Iranian Rehabilitation Journal
The official Journal of the University of Social Welfare and Rehabilitation Sciences

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Manuscripts for *Iranian Rehabilitation Journal* should follow the following instructions:

1. **MANUSCRIPT TYPES ACCEPTED**
   The editorial policy of the *Iranian Rehabilitation Journal* (IRJ) is to encourage the publication of evidence-based research articles related to rehabilitation. IRJ publishes articles within the more basic aspects of rehabilitation in following forms:

   **A-Original Research Articles:** Original Research Articles must describe novel and significant observations and provide sufficient detail so that the findings can be critically evaluated and, if necessary, repeated.

   **B-Reviews:** Reviews are selected for their broad general interest; all are refereed by experts in the field who are asked to comment on issues such as timeliness, general interest and balanced treatment of controversies, as well as on scientific accuracy.

   **C-Case Reports/Case series:** Authors are invited to submit case reports on clinical topics of relevance to the aim and scope of the *Iranian Rehabilitation Journal*. The reports should not be more than 2000 words.

   **D-Commentaries:** Are opinion pieces on topics of general interest to the rehabilitation community.

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3. **MANUSCRIPT FORMAT AND STRUCTURE**

   **3.1. Format**

   Language: The language of publication is English.

   Abbreviations, Symbols and Nomenclature: *Iranian Rehabilitation Journal* adhere to the conventions outlined in *Units, Symbols and Abbreviations: A Guide for Medical and Scientific Editors and Authors*.

   **3.2. Structure**

   All manuscripts submitted to the *Iranian Rehabilitation Journal* should include: Title page, abstract, main text, acknowledgements, references and tables, figures and figure legends as appropriate.

   **Title:** Title page should include title; name of authors, complete names of institution for each author, and the name, address, telephone number, fax number and e-mail address for the corresponding author.

   **Abstract:** Abstract should include Objectives, Methods, Results, and Discussion (for Original articles) contain at most 250 words with 3 to 5 keywords.

   **Main Text of Original Research Articles:** should include Introduction, Materials and Methods, Results and Discussions.

   **Introduction:** should be focused, outlining the historical or logical origins of the study and not summarize the results; exhaustive literature reviews are not appropriate.

   **Materials and Methods:** must contain sufficient detail such that, in combination with the references cited, all experiments reported can be fully reproduced.

   **Results:** should present the observations with minimal reference to earlier literature or to possible interpretations. Presentation of data with tables, related figures and appropriate graphs is encouraged.

   **Discussion:** may usefully start with a brief summary of the major findings, but repetition of parts of the abstract or of the results section should be avoided.

   **Main Text of Reviews and Case Reports:** need not follow the usual divisions of original research articles, but should contain appropriate headings and subheadings.

   **Acknowledgements:** should proceed by the References.

   **References:** References should be numbered consecutively in the order in which they are first mentioned in the text. Identify references in text, tables, and legends by English numerals in parentheses. Use the style of the examples below, which are based on the formats used by the NLM in Index Medicus. The titles of journals should be abbreviated according to the style used in Index Medicus.


   **Tables, Figures and Figure Legends**

   **Tables:** should be double-spaced with no vertical rulings, with a single bold ruling beneath the column titles. Units of measurements must be included in the column title.

   **Figures:** All figures should be planned to fit within either 1 column width (8.0 cm), 1.5 column widths (13.0 cm) or 2 column widths (17.0 cm).
The Journal of “Iranian Rehabilitation Journal” is a scientific forum for the publication of peer-reviewed original papers on the rehabilitation of the disability issues. The journal offers investigations of clinical and basic research; theoretical formulations; literature reviews; case studies; discussions of public policy issues and book reviews. Papers, both clinical and theoretical, derive from a broad array of fields: rehabilitation medicine, physical and occupational therapy, health psychology, orthopedics, neurology, and social work, ergonomics, biomedical and rehabilitation engineering, disability management, law and more. Submissions covering a wide range of topics on disability and rehabilitation from researchers and practitioners across all disciplines working in the field are encouraged. The journal welcomes both quantitative and qualitative research along with multidisciplinary perspectives to embrace a wide range of professionals.

Regarding *Iranian Rehabilitation Journal*, beginning with this issue, Volume 10, Number 16, two issues will be published each year, one for spring and one for autumn. In this issue, we begin by exploring in more detail the concept of rehabilitation, then use a historical perspective to examine the changing nature and support for rehabilitation as a correctional goal over time.

Iranian Rehabilitation Journal is abstracted and indexed in: IMEMR; IndexCopernicus; ISC; IranMedex; DOAJ; Magiran. We are looking forward to receive articles related to above trends and seek to uncover what they tell us about the future of the rehabilitation.

Asghar Dadkhah, PhD.
Editor-in-Chief
<table>
<thead>
<tr>
<th>CONTENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iranian Rehabilitation Journal, Volume 10, No. 16, October 2012</td>
</tr>
</tbody>
</table>

**Original Articles**

- The Effect of Sensory Room Intervention on Perceptual-Cognitive Performance and the Psychiatric Status of Schizophrenics
  Ara Shahgholi; Ashraf Karbalayi Noori; Seyed Ali Hosseini, PhD; Hossein Sourtigi
  [5]

- Reconstructing, Investigating the Reliability and Validity and Scoring the Stanford Diagnostic Reading Test
  Bahram Saleh Seyedpou; PhD; Sara Daazi
  [16]

- Fine Motor Development of Low Birth Weight Infants at the Corrected Age of 8 to 12 months
  Sepideh Nazi; Faranak Ali Abadi; Bahareh Maghauri
  [22]

- The relationship between Mental Pressure and Job Burnout of nurses working in the centers of mentally disabled adults
  Sedighe Bakhtiar Shahri
  [26]

- Age and Gender Effects on Auditory Brain Stem Response (ABR)
  Yones Lotfi, MD.; Farzaneh Zamiri Abdollahi
  [30]

- Comparison of Early Active and Passive Post-operative Mobilization of Flexor Tendon in Zone 2
  Fereydoon Layeghi, MD.; Maryam Farzad2
  [37]

- Compression of Cognitive Flexibility and Adjustment of Students with Developmental Coordination Disorder and Typically Developing Students
  Hasan Sadeghi; Abbas Abolghasemi, PhD.; Nader Hajlo, PhD.
  [43]

- Body Part Concerns Questionnaire (BPCQ) in an Iranian Population with Special Needs
  Katayoun Khademi; Asghar Dadkhah, PhD.; Vahid Kazemi, MD.
  [50]

- Recourse Allocation in Young and Elderly Adults
  Fatemeh Bazrafkan, Afsoon Hassani Mehraban, PhD.; Mojgan Moghadam, PhD.
  [54]

- The Effects of Unloader Knee Orthosis and Lateral Wedge Insole in Patients with Mild and Moderate Knee Osteoarthritis (OA)
  Mokhtar Arazpour, PhD.; Fatemeh Zarezadeh; Monireh Ahmadi Bani
  [60]

- Attentional Demands of Balance under Dual Task Conditions in Young Adults
  Monire NobaharAhari; Seyed Ali Hosseini, PhD.; Vahid Nejati, Ph.D.
  [66]

**Reviews/Short communication**

- Exercise as a Treatment to Improve Quality Of Life in Patients with Cancer
  (A Review of the Literature)
  Kasra Mirhosseini; Abbas Rahimi, PhD.; Hessam Soutakbar
  [72]

- Treatment of Depression in the Elderly: A systematic review
  Arash Mirabzadeh, MD.; Mohammad Reza Khodaei, MD.
  [76]

**Case Report**

- Apert syndrome: a case report
  Masoud Gharib; Nazila Akbar Fahimi
  [92]
Objective: Individuals with schizophrenia show perceptual-cognitive abnormalities. Moreover, depression and anxiety are integral components of the disease most of the times. Psychiatric patients under institutional care experience lack of control and choice-making in their daily lives. Sensory room is an environment in which individuals can choose, control and explore the stimuli around them. So, they can organize their responses to their environment and restore and develop their skills, interacting through it.

Method: 48 people met the study’s inclusion criteria. They were evaluated with Lowenstein Occupational Therapy Cognitive Assessment, Mini Mental State examination, and Positive and Negative Syndrome Scale. Then they were randomly and equally assigned to intervention and comparison groups. The Intervention group received sensory room intervention and the comparison group had its traditional therapies. After 32 treatment sessions, 14 participants in the intervention group and 7 participants in the comparison group were excluded from the study and the tests were repeated for the remaining ones.

Results: Our findings did not show a significant effect of sensory room intervention on perceptual-cognitive performance and psychiatric status of people with schizophrenia (p> 0.05). In the reminding domain, however, results indicated maintenance of the skill in the intervention group (p> 0.05), and its exacerbation in the comparison group (p<0.05).

Conclusions: No significant change in perceptual-cognitive performance and psychiatric status of individuals with schizophrenia was found during the 3 month period of sensory room intervention, except for reminding which did not change significantly in the intervention group, but regressed in the comparison group after the intervention period.

Keywords: Sensory room intervention, schizophrenia disorder, perceptual-cognitive performance, psychiatric status.

Submitted: 04 Aug 2011
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Introduction
Schizophrenia is manifested across a range of symptom categories and perceptual-cognitive deficits. Cognitive-perceptual skills enable humans to function in everyday life: personal, social, and occupational. The ability to absorb sensory inputs and to use them to interact with the surrounding world, to attend to things in a selective and focused way, to concentrate over a period of time, to learn new information and skills, to plan, to determine strategies for actions and to execute them, to comprehend language and to use verbal skills for communication and self-expression, and to retain information and manipulate them in solving complex problems are examples of mental processes that are referred to as cognitive-perceptual functions (1). All these abilities are impaired to some extent in individuals with schizophrenia. Gold suggests that measures of episodic memory, ideational fluency and aspects of complex attention appear to be most impaired; and measures of semantic knowledge and visual-perceptual skills seem to be least affected by the illness (2). Cognitive impairment has emerged as an important new target in schizophrenia therapeutics in light of evidence that cognitive deficits are critically related to the functional disability that is characteristic of the illness.

1- This article is presented as a partial fulfillment of Master Degree Thesis in Occupational therapy.
2- All Correspondences to: Ashraf K. Noori, PhD. candidate in Occupational Therapy; Email: <ashraf1345@yahoo.com>
On the other hand, because of low quality of life, social stigma, expressed emotions in family and many other reasons, people with schizophrenia suffer from other concurrent problems such as stress and depression. In schizophrenia, stress has been predominantly described in terms of the impact of life events and expressed emotions. In several studies, the impact of stressful life-events on psychotic de-compensation and relapse frequency has been well established. Furthermore, once the disease has developed, the degree of expressed emotions within a family has been described to worsen or ameliorate de-compensation in schizophrenic patients, respectively. Even more important may be the observation that in contrast to major life events, relative minor stresses, or the so-called daily hassles, seem to determine by large the subjectively experienced stress in schizophrenic patients. These relative minor stresses may even be predictive of relapse susceptibility (3).

Depression is a frequently occurring symptom in schizophrenia, either as a medication effect or in response to disease consequences. Depressive symptoms are important not only because they significantly contribute to the suffering caused by the illness, but also because they exacerbate deficits in psychosocial functioning and commonly precede attempted and completed suicide (4).

Negative psychological and perceptual-cognitive deficits in people with schizophrenia can, in part, occur because of institutional conditions. In most of the care settings, people with mental diseases, have a limited degree of control and choice in all aspects of their lives. These people spend much of their time in a setting which can be un-stimulating or offer no variation in stimulation. Physical, sensory and cognitive impairments further decrease the amount of significant stimulation that an individual receives. Impaired cognitive ability also restricts the individual’s ability to understand the received stimulation. Such deprivation of meaningful sensations can have negative outcomes like anxiety, stress, depression, disturbed behavior (5), and exacerbation of cognitive deficits, because learning occurs in response to environmental contact (6).

The purpose of this study was to investigate the effect of sensory room intervention on perceptual-cognitive performance (i.e. registration, attention and calculation, reminding, orientation for time, orientation for place, perception, and visuomotor organization) as well as psychiatric status (i.e. anxiety, tension, and depression) of people with schizophrenia.

Sensory room is an environment designed for multisensory treatment, containing a variety of equipments providing input to the tactile, vestibular, proprioceptive, visual, auditory, olfactory, and gustatory systems. There are a variety of therapeutic spaces that may be categorized under the umbrella of sensory room—including sensory modulation rooms, sensory integration rooms and snoezelen rooms. In mental health settings, one or more sensory rooms can be created that is categorized as the sensory modulation room (7).

The main goal of sensory room intervention is facilitating interaction with the world which is perceived by means of sensory modalities. So, an individual’s ability to interact with the environment is influenced by how effectively and efficiently s/he is able to process and use sensory information. There is evidence that many persons with schizophrenia have signs of sensory processing and integration dysfunction (8, 9). They are not able to process and use sensory information well. So, they cannot function properly in their daily lives.

The real goal of occupational therapy is functional improvement. The value of multi-sensory treatment is its ability to influence brain function which in turn facilitates improvement in mental skills and behavior in response to a novel, controlled, and safe stimulation. Specific stimulation of the primary senses in an environment that excludes all extraneous stimulation makes perception and interpretation of those sensations easier for patients and alleviates the effects of sensory deprivation. The stimulation can then be adapted according to the individual’s responses to it, thus making the experience increasingly appropriate and positive. In this way there is no need to express inappropriate behaviors so the adaptive responses develop and pave the way for the participant to interact with and learn from his environment (1). Cognitive-perceptual deficits in schizophrenia have been well documented using broad clinical neuropsychological batteries in dozens of studies in the last two decades. Mohamed et al. (10) administrated a comprehensive clinical and neuropsychological evaluation on a group of ninety-four patients experiencing their first episode of schizophrenic illness and 305 normal comparison subjects. Patients performed significantly worse than the comparison subjects on almost every neuropsychological variable. They concluded that significant cognitive impairment across multiple ability domains is a core characteristic of schizophrenia and is not caused by chronic illness, treatment, or
institutionalization. Doniger et al. (11) examined object recognition in 26 subjects with schizophrenia and 23 non-psychiatric comparison subjects. The results support models of widespread dysfunction in information processing in schizophrenic patients involving both sensory and cognitive regions. They proposed impaired sensory processing as a basis for object-recognition deficits in schizophrenia.

Silver et al (12) studied visuomotor function in 36 schizophrenic patients treated with atypical antipsychotics and in 22 comparison subjects. Patients showed significant disturbances in the ability to trace objects on screen and in keeping pace with a moving target in tracking tests. The impairments were not related to medication dose or to extra-pyramidal side effects. They concluded that visuomotor impairment may be part of illness-related pathology in schizophrenia.

Anxiety can be a manifestation of sensory modulation dysfunction. Pfeiffer and Kinnealey (13) demonstrated a significant correlation between anxiety and sensory defensiveness in fifteen normal adult subjects. Brown et al (9) compared sensory processing deficits of twenty-seven individuals suffering from schizophrenia with thirty patients diagnosed with bipolar disorder and twenty-nine healthy subjects. When compared to the mentally healthy group, both the schizophrenic and bipolar disorder groups had higher scores on sensory avoidance, sensory seeking and poor registration subscales of adult sensory profile.

Since King’s (8) first publication outlining the rationale and application of multi-sensory treatment techniques with the chronic schizophrenic population, there have been several researchers who have attempted to test her hypothesis. In a review of occupational therapy with schizophrenic patients, Reisman and Blakeney (14) involved five schizophrenic patients in daily sessions of sensory integration therapy for a seventeen weeks period and observed changes in the scores of sensory integration measures and psychiatric status. Baillon et al. (5) reviewed studies conducted from 1991 to 1999 and proposed the benefits of using multisensory therapy in different kinds of disorders such as: positive changes in behavior; improved task concentration, an increase in a variety of skills such as awareness of self, social interaction behaviors, communication, exploration and manipulation of stimuli; relaxation; and a reduction in stereotypic self-stimulatory behaviors and an increase in adaptive behaviors such as exploratory behaviors or initiating contact with others.

Sabbare (15) meta-analysis results showed that sensory integration and modulation treatment approaches are not more effective comparing to the other therapeutic interventions in specific outcome areas of psycho-education, motor function, behavior, language, and sensory-perceptual function. In comparison to no treatment alternatives, there are some values for sensory techniques. Other studies reviewed, not critically appraised, mentioned similar results to this meta-analysis but also commented on the significance of group intervention method comparing to improved social behavior whereas it provides a close social context for peer interaction (14).

There are limited studies published from 1990 to 2007 (one was found to date), specifically evaluating the effectiveness of multi-sensory therapy with the early psychosis and schizophrenia population. The majority of studies on this topic were published between 1970’s and 1980’s.

Champagne (7) focused on the effects of the use of sensory room on the level of distress in forty-seven patients with psychiatric diseases including schizophrenia. After ninety-six sessions of treatment, ninety-eight percent of the participants reported a positive change.

Study Purpose - This study sought to determine whether sensory room-based intervention would be successful in improving perceptual-cognitive performance and psychiatric status in the general schizophrenia inpatient population. Such approaches in this population remain in the early stages of implementation and without measurable indications of effectiveness.

Method

Sample and Setting - This study took place at Razi Educational, Clinical, and Psychiatric Center in Shahr-e-Rey, Tehran, Iran. The participants were recruited from six wards of the hospital, designed for long term hospitalization. Seventy-one Subjects met the criteria for inclusion in the study. All subjects had a DSM-VI diagnosis of non-paranoid schizophrenia, characterized by long term admissions. Age of subjects ranged from 40 years to 60 years. None of them could leave the hospital for community living at the time of performing this study because of inability to live independently or psychiatric symptoms. All of the subjects were in 10 to 50 range of Global Assessment of functioning (GAF) at the beginning of the study. GAF was performed by staff who had known subjects for at
least 6 months in order to screen subjects with higher levels of dysfunction. After a brief interview with each subject, 48 (24=m, 24=w) subjects interested in the intervention entered the study as primary participants. They gave informed verbal consent before participating.

The sensory rooms used in this study included two rooms: one in ward number 4 for the women, and one in ward number 6 for men. The first one was approximately 8×12 and the second one was approximately 6×8. Both rooms had almost the same equipments and setting and were in their initial stages of development.

The subjects attended occupational therapy for the sensory room intervention sessions in lieu of the regularly scheduled occupational therapy mainly including exercise therapy, recreational therapy, training activities of daily living, and teaching crafts. Other kinds of therapies such as psychological and medication were available as well.

**Instruments**

*Global Assessment of Functioning (GAF)* - Global assessment of functioning (GAF) is a numeric scale (0 through 100) used by mental health clinicians and physicians to subjectively rate the social, occupational, and psychological functioning of adults, e.g., how well or adaptively one is meeting various problems-in-living. The scale is presented and described in the DSM-IV on page 34. The score is often given as a range.

The examiner must rate the individual according to his global function in the last six months or one year. This Instrument was used to screen patients with higher levels of dysfunction.

*Mini Mental State Examination (MMSE)* - The Mini–Mental State Examination (MMSE) or Folstein test is a brief 30-point questionnaire used for screening cognitive impairments. It estimates the severity of cognitive impairment at a given point in time and is useful to follow the course of cognitive changes in an individual over time, therefore is regarded as an effective way to document an individual’s response to treatment. The Mini-Mental Status Examination offers a quick and simple way to quantify cognitive function and screen for cognitive loss. It is an 11-question measure that tests five areas of cognitive function: orientation, registration, attention and calculation, recall, and language. In this study, areas of registration, attention and calculation, and recall were examined.

The MMSE takes 5-10 minutes to administer. Each section of the test involves a related series of questions or commands. The individual receives one point for each correct answer.

To give the examination, the individual must sit in a quiet, well-lit room. The examiner asks him/her to listen carefully and to answer each question as accurately as s/he can.

To score, the number of correct responses is added. The individual can receive a maximum score of 30 points. A score below 20 usually indicates cognitive impairment.

Since its creation in 1975, the MMSE has been validated and extensively used in both clinical practice and research.

*Positive and Negative Syndrome Scale (PANSS)* - The PANSS or the ‘Positive and Negative Syndrome Scale’ is a medical scale used for measuring symptom severity of patients with schizophrenia. It was published in 1987 by Stanley Kay, Lewis Opler, and Abraham Fiszbein. The name refers to the two types of symptoms in schizophrenia, as defined by the American Psychiatric Association: positive symptoms, which refer to an excess or distortion of normal functions, and negative symptoms, which represent a diminution or loss of normal functions.

To assess a patient using PANSS, an approximately 45-minute clinical interview is conducted. The patient is rated from 1 to 7 on 30 different symptoms based on the interview as well as reports of family members or primary care hospital workers. Each item on the PANSS is accompanied by a complete definition as well as detailed anchoring criteria for all seven rating points, which represent increasing levels of psychopathology: 1 = absent, 2 = minimal, 3 = mild, 4 = moderate, 5 = moderate severe, 6 = severe, and 7 = extreme. In this study three subscales of general psychopathology scale were assessed including anxiety, tension, and depression.

*Loewenstein Occupational Therapy Cognitive Assessment (LOTCA)* - The Loewenstein Occupational Therapy Cognitive Assessment (LOTCA) was developed at Loewenstein Rehabilitation Hospital (LRH) in Israel in 1974. The LOTCA battery is derived from clinical experience, as well as from neuropsychological and developmental theories and evaluation procedures by Luria in 1973 and Inhelder and Piaget in1974.

The LOTCA contains 20 subscales and is divided into four areas: 1) orientation 2) perception 3)
visuomotor organization and 4) thinking operations. In this study the first three areas were assessed. Administration of the battery takes 30 to 45 minutes and it can be divided into two or three sessions of lesser time if necessary. The results of the assessment are recorded on the scoring sheet which provides a profile of the patient's performance.

**Procedure**

Subjects were tested in 3 weeks before treatment. All the assessments were performed by occupational therapists other than the authors, who were trained in administrating and rating the tests. At the beginning of the 4th week, subjects were provided a program that followed a range of un-patterned visual, auditory, olfactory, tactile, gustatory, proprioceptive and vestibular stimuli and activities. In general, the activities were designed to follow some of the principles outlined by Ayres (16) and Champagne (7). Specifically, like the sensory activity they must be 1) pleasurable 2) failure-free 3) under the user’s control 4) non-directive and give the client a feeling of independence and choice.

Primary participants attended intervention sessions individually. During the intervention, 14 participants in the intervention group and 7 participants in the comparison group were excluded from the study due to such reasons as physical illness, relapse, short term recovery and loss of interest in the intervention. In the first sessions, the occupational therapist led participants around the sensory room, while naming each stimulus and briefly modeling its appropriate use, and introducing and modeling motor acts. The therapist manually guided the participant to activate or use the equipment (e.g. to turn on electrically operated stimuli, manipulate non-electrical stimuli) or do motor acts. After a few sessions, according to each individual’s ability and interest, participants were free to either manipulate or look at each item and to do motor acts, move around the room and interact with the sensory equipment at their own pace. The therapist gave no direction to participants unless requested by them or to those who were so passive that they could not act independently. If the latter was the case, the therapist offered him/her an activity or stimulus and adapted its intensity or pace according to the participant’s preference.

The time and equipments used was different for each subject, based on his/her tolerance and preferences. In general, the intervention included: 1) greeting 2) reviewing what has been done in the previous session 3) interacting with the sensory equipments or doing sensory activities and 4) expressing the feeling about the activities in brief.

Some examples of the types of treatment used in the sensory room includes the following: general exploration and use of the environment and equipment in the room, deep breathing, sensorimotor activities, stretching, isotonic and isometric exercises, application of various touch activities including deep pressure or vibration, doing simple crafts, collage, painting either with instruments or fingers. The equipment and the type of sensory input provided are listed in Table 1.

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Sensory properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Therapy ball</td>
<td>Proprioception and vestibular</td>
</tr>
<tr>
<td>Rocking chair</td>
<td>Vestibular</td>
</tr>
<tr>
<td>Spinning chair</td>
<td>Vestibular</td>
</tr>
<tr>
<td>Brush</td>
<td>Deep pressure touch</td>
</tr>
<tr>
<td>Trampoline</td>
<td>Proprioception and vestibular</td>
</tr>
<tr>
<td>Tilt board</td>
<td>Proprioception and vestibular</td>
</tr>
<tr>
<td>Vibrator</td>
<td>Deep pressure touch and Vibration</td>
</tr>
<tr>
<td>Floor mat</td>
<td>Deep pressure touch</td>
</tr>
<tr>
<td>Putty hand exerciser</td>
<td>Proprioception and deep pressure</td>
</tr>
<tr>
<td>Thera Bands</td>
<td>touch</td>
</tr>
<tr>
<td>Hand exerciser balls</td>
<td>Proprioception</td>
</tr>
<tr>
<td>Collage items</td>
<td>Proprioception and deep pressure</td>
</tr>
<tr>
<td>Art supplies: paint by number, watercolor paints, crayons, markers, colored pencils, pastels, colored papers</td>
<td>Tactile, proprioceptive, visual, olfactory</td>
</tr>
<tr>
<td>DVD Player</td>
<td>Auditory</td>
</tr>
<tr>
<td>Aroma therapy candles and sprays</td>
<td>Olfactory</td>
</tr>
<tr>
<td>Chocolates and candies with</td>
<td>Gustatory</td>
</tr>
<tr>
<td>different tastes</td>
<td></td>
</tr>
<tr>
<td>Mirror</td>
<td></td>
</tr>
<tr>
<td>Systems for light effects</td>
<td></td>
</tr>
<tr>
<td>Sprays of happy snow</td>
<td></td>
</tr>
</tbody>
</table>

All of the 32 intervention sessions (in 3 months) were conducted by the second author of this study. Each session lasted for 15 to 40 seconds, three days per week. After the last treatment session, the tests were administered for the remaining participants: 10 (including 6 men and 4 women) in the treatment group and 17 (including 8 men and 9 women) in the comparison group.

**Data Analysis**

SPSS version 16.0 was used to analyze the data in this study. The researchers entered data as they were collected. The one-sample Kolmogorov-Smirnov test was used to test whether the variables were normally distributed. The data was analyzed using
paired t-test to determine if there were differences between pre- and post-test scores on the MMSE, LOTCA, and PANSS from pretest to post-test for each group. Independent $t$ test compared the changes in scores of the comparison group with the score changes of the intervention group.

**Results**

No significant difference was observed in changes in scores of the comparison group relative to the intervention group, in any of the LOTCA subtests; orientation for time ($p = 0.856$), orientation for place ($p = 0.253$), perception ($p = 0.459$), and visuomotor organization ($p = 0.609$). After treatment, neither the comparison nor the intervention group had made significant changes in the scores on the LOTCA subtests including orientation for time (intervention subjects: $p = 0.798$; comparison subjects: $p = 0.455$), orientation for place (intervention subjects: $p = 0.104$; comparison subjects: $p = 1.000$), perception (intervention subjects: $p = 0.269$; comparison subjects: $p = 0.555$), and visuomotor organization (intervention subjects: $p = 0.306$; comparison subjects: $p = 0.846$).

No significant difference was found upon comparing the two groups in items of registration ($p = 1.000$) and attention & calculation ($p = 0.778$) in MMSE score changes. However, there was a significant difference between the two groups in reminding ($p < 0.05$).

Comparing pre- and post-MMSE scores of registration (intervention subjects: $p = 1.000$; comparison subjects: $p = 1.000$) and attention & calculation (intervention subjects: $p = 0.645$; comparison subjects: $p = 0.557$) in each group, there was no significant change in either group. In reminding, however, a significant change was found in the comparison group, but not in intervention group (intervention subjects: $p = 0.168$; comparison subjects: $p = 0.014$); indicating maintenance of the skill in the intervention group and its exacerbation in the comparison group.

Where the PANSS subscales scores were concerned, anxiety ($p = 0.200$), tension ($p = 0.950$), and depression ($p = 0.549$) showed no significant difference between the intervention and comparison groups. There was no significant difference between pre- and post-PANSS scores in either group, including anxiety (intervention subjects: $p = 0.1.000$; comparison subjects: $p = 0.165$), tension (intervention subjects: $p = 0.662$; comparison subjects: $p = 0.387$), and depression (intervention subjects: $p = 0.591$; comparison subjects: $p = 1.000$).

After 3 months of sensory room intervention, except for reminding, the scores of perceptual-cognitive performance and psychiatric status in schizophrenic patients had not changed in the LOTCA, MMSE, and PANSS with respect to the comparison group (table 2 & table 3).

**Table 2.** Independent $t$-test for comparison of Pre- and Post-Therapy on LOTCA, MMSE, and PANSS in two groups

<table>
<thead>
<tr>
<th>Test</th>
<th>Mean</th>
<th>SD</th>
<th>t</th>
<th>p</th>
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<td><strong>LOTCA</strong></td>
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</tr>
<tr>
<td>Orientation</td>
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<tr>
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<td></td>
</tr>
<tr>
<td>Orientation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>for place G1</td>
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<tr>
<td>Perception</td>
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</tr>
<tr>
<td>G1</td>
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<td>0.342</td>
<td>0.752</td>
<td>0.459</td>
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<tr>
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<tr>
<td>organization</td>
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<tr>
<td>G1</td>
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<td>0.379</td>
<td>0.517</td>
<td>0.609</td>
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<tr>
<td>G2</td>
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<td>0.443</td>
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</tr>
<tr>
<td>MMSE</td>
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<tr>
<td>Registration</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>G1</td>
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<td>0.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G2</td>
<td>0.000</td>
<td>0.000</td>
<td></td>
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</tr>
<tr>
<td>Attention</td>
<td></td>
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</tr>
<tr>
<td>and calculation G1</td>
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<td>0.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reminding</td>
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<td>Test Mean</td>
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<td>-----------</td>
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<td>1.307</td>
<td>-0.200</td>
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G1 = Comparison group, G2 = Intervention group

**Table 3.** Paired T-test for comparison of pre-test and post-test means of the LOTCA, MMSE, and PANSS in each group

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<tr>
<th></th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
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<th>Sig. (2-tailed)</th>
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<td>.0000</td>
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### Tension

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### Depression

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<th>Std. Error Mean</th>
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<th>Sig. (2-tailed)</th>
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### Discussion

Based on our study results, except for reminding, 3 months of sensory room intervention produced no significant effect on perceptual-cognitive performance in the intervention group compared to itself in the pre-intervention period, or, to the control group.

Some of the reasons are as follows. First, we must point out the fact that in this study, registration domain was intact in all of the participants. Therefore, we did expect it to be affected by the intervention.

In the attention & calculation domain, there was no significant difference between the two groups. Besides, none of the groups had had a significant change after treatment, compared to their previous statuses. A probable reason behind this could be the way this domain was assessed. In this study attention was assessed, using calculation abilities. Maybe mathematical skills were regressed due to years and years of hospitalization in the participants of this study. Because the intervention was not focused on specifically restoring these skills it did not affect it either.

However, in the reminding domain, a significant difference between the two groups was found, such that, the intervention group saw no significant change after treatment, compared to before. On the other hand, the comparison group had observed
regression. This may be due to the way the intervention was done. In every session the participant was asked to remember what had been done in the previous session; how the activities were done, how the equipments worked, and how s/he felt about them. This way the subject was encouraged to remember what had been learned or experienced before. On the other hand, a multi sensory environment induces self-initiated manipulations (15). Therefore, feelings of control and choice develop which encourage the subject to remember past information and experiences, and to use them to interact with the environment. One of the goals of occupational therapy is maintenance of abilities (17); facilitating meaningful interaction with the environment and helping the subject use his/her skills and abilities. Therefore, the process of regression slows down as a result of the disorder or institutional conditions (18).

Probably, the lack of significant change in time orientation and place orientation in the groups is related to the institutional conditions. All of the participants had been hospitalized for at least 2 years in Razi hospital or other care settings which they had left rarely, accompanied by staff or family members. As a result, they did not know where the hospital was located exactly. Besides, they stated that due to stable conditions and their reliance on staff or family members in doing daily activities, knowing the exact date or time seemed unnecessary to them. 

As demonstrated in table 3, after treatment, neither the control nor the intervention group had exhibited significant changes in scores of perception and visuomotor organization subtests. Moreover, no significant difference was observed upon comparing the two groups with each other. A possible explanation for the lack of improvement of individuals in most of the items evaluated may be the length and frequency of the study. Enriched environmental conditions facilitate neural changes, or neuro-plasticity, defined as the nervous system’s ability to change in response to environmental input and demands (16). Lane and Shaaf (18) indicated that the period of exposure required is at least 1 hr per day over a few weeks to induce these neural changes, followed by behavioral changes. Reisman and Blakeney (14) supported the hypothesis that amount of treatment time is directly related to improvement. Unfortunately, disease-related problems and the participants’ low tolerance prevented the study group from increasing the length and frequency of the intervention. Another explanation is that the intervention was not generalized to the real environment. Lane and Shaaf (18) stated that sensory enriched environments which offer the participants control over activity, novelty, and lifelike context, enhance the brain's processing of information and provide a foundation for learning. In this study the sensory room was rich in novel sensory inputs and was designed to induce feelings of choice and control in the subject. However, first because of the limited length of intervention, and second, due to institutional conditions, the participants spent much of their time in their real environment, an almost unstimulating and unchanging environment which offered them less opportunity to make choices and exert control.

Another explanation is motivational factors. Rosenzweig and colleagues found that active exploration of the environment was crucial for neuroplastic changes in the brain. In other words, the subjects needed to explore for themselves; simply being exposed to the environment without exploring it was not sufficient to result in neuroplastic changes (18). One of schizophrenia’s symptoms is amotivation (19). So, the schizophrenic participants in the intervention group needed increased levels of encouragement and prompting to engage in sensory activities. During the first sessions, specifically, most of them were often not interested in novel activities and were dependent, more or less on the therapist for selecting the stimuli. This changed, after some weeks, however, to some extent, but did not reach the level of independency expected to be necessary for change.

Many clinicians believe that the feeling of independence and choice is an important factor of how multi-sensory therapy works (5). Finally, it must be stated that according to what Hubel and Wiesel showed, function did not necessarily return after a period of deprivation or lesion. Thus, there appear to be limits to the degree of plasticity in organization and function (18). Sabarre (15) reviewed 4 studies published from 1990 to 2007 and concluded that sensory integration treatment approaches are no more effective than other treatment interventions in specific outcome areas such as sensory- perceptual function for psychotic patients. Sabarre (16) proposed that due to limited number of studies, more research is needed to assess the value of sensory treatments in this group. Our research was done in favor of this commitment.

We found that 3 months of sensory room intervention produced no significant effect on the psychiatric status of the intervention group.
compared to either the pre-intervention period or the control group. One reason to explain this lack of improvement is the limited number, period, and frequency of intervention. Another is the major clinical benefit of sensory interventions which is the notion of choice and control (7). People with severe and multiple handicaps often experience very limited psychological and sensory stimulation, particularly in institutional care, and have a limited degree of control and choice in all aspects of their real lives (5). We believe that because of this fact and because of the limited period of intervention, it was not possible to fully give the participants feelings of choice and control. Perhaps this could be done by increasing the duration and numbers of therapy sessions.

Another factor must be considered here as well. In people with mental illness, there are many factors other than sensory deprivation that can cause depression and anxiety. Examples include expressed emotions, life events, and poor social adjustment (3-4). The authors of this study feel that if sensory room intervention was accompanied with approaches like family therapy and social skills training, it would yield more change in the intervention group.

Furthermore, we wished to offer a treatment protocol which included providing insight into the effects of sensory deprivation on daily life and, how the intervention would work. However, impaired cognitive ability restricted the participants’ ability to make sense of the treatment that was to be received. Perhaps if this was not the case the therapy would have become more meaningful to and the participants and effective too.

Conclusion
To sum up, the findings of this research study demonstrate no clear pattern of improved perceptual-cognitive performance and psychiatric status in schizophrenic patients after 3 months of sensory room intervention. The only domain affected was reminding which did not change significantly in the intervention group, but which regressed in the control group after the intervention period.

Lack of change in most of the domains could be due to the small number of sessions and short duration of intervention, lack of motivation in participants and institutional conditions. Findings on the reminding domain support the idea that multi-sensory interventions could prevent the disease regression process.

Therefore, recommendations include a longer period of intervention to allow patterns of behavior to be established. Also, a standardized assessment specific to schizophrenic individuals with high validity and reliability is recommended to minimize any variability in documentation. Experienced therapists, blind to the study purpose and not knowing the participants, rather than multiple staff, should complete the data collection.

Finally, we recommend this study as a pilot study for future research with greater sample size and increased number of sessions and period of intervention.

Limitations- The length of intervention was not extensive enough to note a significant change in cognitive and psychiatric domains. In particular, individuals with mental illnesses who are hospitalized for years require a daily routine of sensory-enriched activities such as cooking, gardening and walking in open places. Moreover, certain changes in the ergonomic designs of the care settings such as seating variations, flowers and plants, floorboards and wallpapers which offer particular tactile or visual sensations to the patient, and colored lights, can be helpful in producing variation in the stimuli. Multiple staff completion of data led to inconsistency in documentation of the areas in question. In addition, due to institutional policies, we had to make the staff aware of the purpose of the study and how the participants were assigned to the intervention or control groups.

Acknowledgements:
We would like to thank Samaneh Hosseinzadeh for her assistance with organizing the research project; S. K Malakouti, associate professor of psychiatry for providing the PANSS evaluation instrument for this study, and the hospital staff for taking the time to complete data collection.

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Reconstructing, Investigating the Reliability and Validity and Scoring the Stanford Diagnostic Reading Test

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### Aim
The aim of the present study was to reconstruct determining validity, and score The Stanford Diagnostic Reading Test fourth edition (SDRT4) in the sixth grade students.

### Methods
The population of the study was all sixth grades of the 19 educational districts from Tehran, 571 students (255 boys and 316 girls) were selected by using a random multi-cluster sampling. The data were analyzed. The techniques were item analysis (difficulty index, discriminative index, and loop techniques). Validity, translation validity, content validity, and construct validity (factorial analysis), and reliability (Kuder-Richardson)

### Results
the exploratory factor analysis determined five factors: declarative knowledge, inferential knowledge, procedural knowledge and visualization knowledge. The reliability of the Stanford diagnostic Reading Test’s subtests by computing the Kuder-Richardson coefficient were 0.778, 0.732 and 0.748 for comprehension subtest, vocabulary subtest and scanning subtest in order.

### Conclusion
By considering the results of present study, SDRT4 has good reliability and validity and can appropriately diagnose the reading disabled students in the sixth grade.

### Keywords
diagnostic reading test, reading disability, reconstruction, scoring, validity, reliability

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**Introduction**

Reading skill is necessary both to success in school and for the economic survival in the technological world. (1) The ability to read is combined to cognitive skills (mental skill involved in learning, thinking and information processing) to a large extent which requires decoding the words and understanding printed materials that mean the capability of understanding what has been read. (2) For many people reading is successful but this is not the same for 15 to 20% of the entire population. (3) This group of people who have difficulties in the speed and accuracy of word decoding and understanding are diagnosed as people with reading disorders. (4) Reading disorder is the most common type of learning disorders that is common in 80% of those whose learning disorders are diagnosed.(5) In DSM-IV-TR (American Psychiatry Association, 2000) reading disorder defined as:

Reading progress, that is measured by standard individual reading tests of fluency or understanding. Basically the measured level of intelligence is lower than the chronological age and the age-appropriate education.

This skill deficiency should be considerably interfered with the academic achievement or activities of daily living requiring reading skills. If a Sensory defect is present, there should be more reading problems than the expected reading problems due to that single defect.

Many researchers and scientists agreed on the etiology of reading disorder to be considered as a neuro-cognitive disorder with a genetic origin. (6)The results of Wilkins et al (2001) investigation about the role of deficiencies in temporal and visual processing (7), Austin (2008) work on the role of deficiencies in Magnocellular Visual System(8), and Fawcett and Nicolson (2008) investigation about the role of the Procedural timing defects (9) show the above agreement. On the other hand, different studies have confirmed the disorder is hereditary; for example Shaywitz and his colleagues’ studies (2001) showed that 23% to 65% children, whose one parent has reading disorder, will

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be affected with this disorder. The association of reading disorder in identical twins (84-100%) is considerably higher than non identical ones (20-35%).(11) Almost 30 to 50 percent of all the children that one of their parents has reading disorder, will have this disorder. Relative risk of this occurrence is almost four to eight times more than what is seen in the control group. (12) Unfortunately, reading disorder will not disappear over time. The longitudinal studies showed that this is a consistent disorder and cannot be considered as a transient developmental lag. This means that all the children diagnosed with reading disorder will probably have difficulties in reading as adults, too.(4)

Shaywitz (2003) has concluded that all group of readers including good and/or bad readers will develop their reading skills over time, but their skill gap still remains and will not disappear.(13) Previous studies on reading skills showed that children with reading disorder are confronting so many problems such as: self hesitancy, low self confidence, loneliness, humiliated by peers, emotional disorders like anxiety, depression, lack of self-esteem, Social Incompatibility, self-contradictory and Inappropriate Social behavior and cognition.(16)

Considering the negative consequences of weakness in reading skill, It is very important to distinguish the children with this disorder and provide them adequate treatment on time. There are many studies about the advantages of timely diagnosis and treatment. Denton and Mathes (2003) said that early intervention can make a strong base for successful academic achievements of the student in future (17) Torgesen (2002a,b and 2004) has confirmed the positive effect of early intervention.(18-20) It has been estimated that appropriate interventions in the class can decrease the risk of reading disorder from 25% to 6% in student population. Meanwhile studies suggested that brain functioning, appeared in the MRI studies of different people with reading disorder, will improve in the individuals who receive and follow treatments to the extent that their brain functioning would be similar to the normal readers.(21)

Regarding to the considerable number of Iranian students with learning disorders especially reading disorder (4-12%) (22), There is an obvious need for a sufficient tool to diagnose the reading disorder in students. Because prompt identification of this group of students can provide enough time and space for their administration, teachers and education professionals to develop appropriate educational programs and/or change in the existing education plan when necessary.

One of the worldwide most common tests to identify the children with reading disorder is Stanford Diagnostic Reading Test. The main aim of the present study was to reconstruct, investigate the reliability and validity and scoring this test for the sixth grade Iranian students. So the main questions of the study are:

1- How will the Stanford Diagnostic Reading Test questions be analyzed?
2- Is Stanford Diagnostic Reading Test reliable enough to identify the students with reading disorder studying in sixth grade?
3- Is Stanford Diagnostic Reading Test valid to identify the students with reading disorder studying in sixth grade?
4- How is the scoring of Stanford Diagnostic Reading Test?

**Method**

This is a descriptive study aimed to describe the characteristics of a situation or a subject in a subjective, real and systematic way. On the other hand, this implementation will be only useful for a better understanding of the current situation or to facilitate the decision making process.(23)

The research population consists of all the students studying in sixth grade of normal guidance schools in Tehran province during school year 2010-2011. The sampling method was multistage randomized clustering so that 4 regions were selected randomly among 22 regions of Tehran, 3 schools randomly in each region and 2 classes randomly in each school. 26 students in the chosen classes were selected randomly to be tested.(table 1)

<table>
<thead>
<tr>
<th>School region</th>
<th>1&lt;sup&gt;st&lt;/sup&gt; school</th>
<th>2&lt;sup&gt;nd&lt;/sup&gt; school</th>
<th>3&lt;sup&gt;rd&lt;/sup&gt; school</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Class 1</td>
<td>Class 2</td>
<td>Class 1</td>
</tr>
<tr>
<td>1</td>
<td>26</td>
<td>26</td>
<td>26</td>
</tr>
<tr>
<td>3</td>
<td>26</td>
<td>26</td>
<td>26</td>
</tr>
<tr>
<td>8</td>
<td>26</td>
<td>26</td>
<td>26</td>
</tr>
<tr>
<td>14</td>
<td>26</td>
<td>26</td>
<td>26</td>
</tr>
</tbody>
</table>

Sample size were calculated using the formula \( n = \left( \frac{s^2 \times z^2}{d^2} \right) \) to estimate the sample size from the population in 95% confidence interval to be 624 students. (24) In the end 571 questionnaires have
been analyzed and 53 incomplete ones were excluded. Stanford Diagnostic Reading Test has been used in this study. This test has three subscales; Comprehension, Vocabulary and scanning that respectively has 34, 24 and 22 questions. The participants should choose the right answer among four options for each question. There are nine fun, practical and informative texts in the Comprehension subscale that the students should mark the right answer of the multiple choice questions related to those texts. The item scoring will be 0 for the wrong and 1 to the right answers. So the highest score in this subscale is 34 and the lowest is 0. In the Vocabulary subscale, the participants should find the synonym to the underlined word among 4 given options. This subscale scoring is similar to the previous one so the score range of this subscale will be between 24 and 0. There are two texts in the Scanning subscale that have some questions proceeding to it. The participants must determine which question belongs to which paragraph then read that paragraph and find the right answer. In this part all of the text will not be read and the scoring is exactly the same as previous and ranged between 22 and 0.

Results
The aim of test question analysis is evaluating all the questions and determining the amount of their accuracy and shortcomings that shows their strong and weak points.(25) To respond to the first research question, all the test questions were analyzed using difficulty index, coefficient of determination and Loop method. The difficulty index (DI) is the percent of all students that marked the correct answer to the questions. The DIs between 0.3-0.7 are the most informative ones about the participants’ differences. Coefficient of Determination (CD) shows the question potential of distinguishing between strong and weak participants. It is obvious that the greater the CD is, the potential determination is more and vice versa.(25) Loop method will measure the total reliability of the test and the internal coordination of the questions. To do this, first the total reliability has to be determined and then its changes will be measured in case of excluding each question. If excluding a question will increase the reliability coefficient, this question is not coordinated with the others. But if excluding a question does not change the reliability coefficient, shows that although this question is not significant in coordination to the other questions but it can be considered as an item for practicing of the respondents.

Based on the analysis of the Comprehension subscale questions, items 54, 52, 51, 50, 49, 43, 42, 41, 37, 36, 35, 32, 31, 28, 21, 19, 18, 10 ,9 were excluded, In Vocabulary subscale the items 29,21, 19, 18, 14, 11 were excluded and in the Scanning subscale, questions 19, 18, 17, 16, 15, 9, 8, 1 were excluded because the omitted items increased the reliability coefficient of the other questions in their subscale.

To respond to the second research question, the construct, content, translation and face validity were determined.

Translation validity: In order to assess the translation accuracy of the tool, we asked some professional translators for back translation the tool we have translated to Persian, into English. Then we have asked some other professionals to compare and determine if the back translation and original text are concordant.

Face validity: We have asked some professionals to confirm the face validity and the form of the questions to be adequate for evaluating the reading skill of the students in sixth grade.

Content validity: Some professional opinions were asked to confirm the content validity and determine the adequacy and goodness of the test content regarding the subject matter.

We have used explorative factor analysis to identify the number of important and significant factors in the comprehension subscale. Varimax and Oblimin Rotations were used to determine if the factors are correlated of dependent to each other. In Oblimin method there was no rotation but the Varimax rotation existed so the explorative factor analysis were done using the the original items and the Varimax rotation. Kaiser-Meyer-Olkin (KMO) Measure was used to verify the sampling adequacy and Bartlett’s test of sphericity has confirmed that there is a correlation among the test items in the population. The measured Kaiser-Meyer-Olkin in

1- Qasem zadeh, Dordi negad and Nejati, all PhD and faculty members of Foreign Language department in Shahid Rajayee University
this research was 0.828 that in comparison to the accepted amount (0.6) shows that the research sample was adequate to do the factor analysis (Table 2). The Bartlett’s test results was significant in 0.99 confidence interval that confirms the enough correlation among the questions of Comprehension Subscale of Stanford Diagnostic Reading Test and it can be analyzed by factor analysis method.

Table 2. KMO and Bartlett’s test of sphericity of the comprehension subscale of SDRT

<table>
<thead>
<tr>
<th>Sig</th>
<th>df</th>
<th>χ² Bartlett’s test of sphericity</th>
<th>KMO</th>
</tr>
</thead>
<tbody>
<tr>
<td>P&lt;0.001</td>
<td>561</td>
<td>2078</td>
<td>0.828</td>
</tr>
</tbody>
</table>

The first item called “Real Knowledge” which means the Knowledge about the world that can be represented as a true conscious knowing and encompasses questions 6, 8, 12, 2, 22, 1, 4, 20. The other factor “Deductive Knowledge” that is the knowledge related to the logical judgment based on the evidences, previous judgments and results is formed by questions 23, 30, 32, 27, 25, 13, 31, 17. Questions 9, 29 and 16 formed the third factor “Processing Knowledge” which is about how to do things and questions 5, 3, 7 are the components of the “Applied Knowledge” factor that is the knowledge to apply the principles, discoveries and theories in their related practical fields. The “Imaginary Knowledge” where a visual imagination will appear conformed of questions 34, 14 and 26. (Table 3).

Table 3. Factorial Loads of Comprehension Subscale of SDRT

<table>
<thead>
<tr>
<th>Questions</th>
<th>Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>RK</td>
<td>DK</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>6. Earthworms breath through….</td>
<td>0.649</td>
</tr>
<tr>
<td>8. Why did Arman’s father need a spider?</td>
<td>0.646</td>
</tr>
<tr>
<td>12. At first, Arman thought that his father brought a …</td>
<td>0.605</td>
</tr>
<tr>
<td>2. This article says that……</td>
<td>0.571</td>
</tr>
<tr>
<td>22. The word “Raid” in this story means……</td>
<td>0.490</td>
</tr>
<tr>
<td>1. When it rains, earthworms come out of the soil so that they can …</td>
<td>0.479</td>
</tr>
<tr>
<td>4. Regarding to the article what do earthworms eat?</td>
<td>0.473</td>
</tr>
<tr>
<td>20. This article has been written because…..</td>
<td>0.356</td>
</tr>
<tr>
<td>30. What did Roman do to sweeten the snow flavor?</td>
<td>0.627</td>
</tr>
<tr>
<td>32. Which of these choices is an opinion in the article?</td>
<td>0.607</td>
</tr>
<tr>
<td>27. Why the teacher was worried about Farzad?</td>
<td>0.596</td>
</tr>
<tr>
<td>25. You need the tape to……</td>
<td>0.592</td>
</tr>
<tr>
<td>13. Which of these choices were not present at the Poster?</td>
<td>0.480</td>
</tr>
<tr>
<td>31. The other good title for this article is……</td>
<td>0.461</td>
</tr>
<tr>
<td>17. The graphite is cooked to ……</td>
<td>0.449</td>
</tr>
<tr>
<td>23. Dingo went because……</td>
<td>0.390</td>
</tr>
<tr>
<td>9. When this story happened?</td>
<td>0.748</td>
</tr>
<tr>
<td>29. These boxes show the important events of the story, mark the correct choice for the empty box?</td>
<td>-0.561</td>
</tr>
<tr>
<td>16. Which one is not an opinion?</td>
<td>0.493</td>
</tr>
<tr>
<td>3. Earthworms are probably helpful more in…..</td>
<td>0.722</td>
</tr>
<tr>
<td>5. You can say earthworms are more skilled in ……</td>
<td>0.471</td>
</tr>
<tr>
<td>7. Perhaps the best way to know more about the earthworms is…..</td>
<td>0.456</td>
</tr>
<tr>
<td>14. If you want to know more about riding you must ….</td>
<td>0.712</td>
</tr>
<tr>
<td>26. The wood numbers help when someone…..</td>
<td>0.486</td>
</tr>
<tr>
<td>34. You can say from this commercial that….</td>
<td>0.365</td>
</tr>
</tbody>
</table>
The confirmative factor analysis was used to evaluate the goodness of fit of the Comprehension subscale factor structure model by means of Amos software version 18. There were factorial confirmations based on both the type of the text and the comprehension method. The findings of the accepted model of the text were: $\chi^2$ df (1.082), mean of estimated error squares (0.01), Goodness of fit index (0.949), comparative fit index (0.984), adaptive goodness of fit index (0.937), Normative goodness of fit index (0.825); and the findings acceptable for all kinds of comprehension were: $\chi^2$/df (1.084), mean of estimated error squares (0.01), Goodness of fit index (0.95), comparative fit index (0.984), adaptive goodness of fit index (0.95), Normative goodness of fit index (0.829).

Reliability
The reliability of this test was examined through the Kuder-Richardson Method of calculation which represented in table (4). This calculation was in response to the third research question.

<table>
<thead>
<tr>
<th>subscales</th>
<th>reliability coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comprehension Subscale</td>
<td>0.778</td>
</tr>
<tr>
<td>Vocabulary Subscale</td>
<td>0.732</td>
</tr>
<tr>
<td>Scanning Subscale</td>
<td>0.748</td>
</tr>
</tbody>
</table>

Discussion
The main aim of this study was to reconstruct and to investigate the Reliability and Validity and Scoring the Stanford Diagnostic Reading Test for the sixth grade students. This test has three subscales that each has 24, 34 and 22 questions respectively. The test is applicable both individually and in the groups. The time required to implement each of the three subscales is 60, 30 and 25 minutes respectively that takes less for most of the students. The important timing issue is that this time table is restricted and must not be extended because it is a significant factor to diagnose the students who have reading disorder and is not able to answer all the questions in this time line.

Participants should answer to the multiple choice questions about nine fun, practical and informative texts in the comprehension subscale and should choose the right answer among four options for each question. The item scoring will be 0 for the wrong and 1 to the right answers. So the highest score in this subscale is 34 and the lowest is 0. In the Vocabulary subscale, the participants should find the synonym to the underlined word among 4 given options. This subscale scoring is similar to the previous one so the score range of this subscale will be between 24 and 0. There are two texts in the Scanning subscale that have some questions proceeding to it. The participants must determine which question belongs to which paragraph then read that paragraph and find the right answer. In this part all of the text will not be read and the scoring is exactly the same as previous and ranged between 22 and 0.
After scoring, the students’ raw scores will be transformed to the T scores (Chart1).
Students with reading disorders can be categorized based on their raw scores to these three categories:

1- Students with reading disorder: This group of students got 13 or less in Comprehension, 12 or less in vocabulary and 5 or less in Scanning.

2- Students to be considered: The group of students that must undergo the preventive interventions and procedures. The raw scores of this group are between 13-15 in comprehension, 12-14 in vocabulary and 5-7 in scanning.

3- Students to be controlled: The group of students that should periodically be studied and controlled. The raw scores of this group are between 15-20 in comprehension, 14-19 in vocabulary and 7-12 in scanning.

Overall, we can conclude that this test has adequate reliability and validity and its subscale are capable of distinguishing the students who have reading disorders.

References


Original Article

Fine Motor Development of Low Birth Weight Infants at the Corrected Age of 8 to 12 months

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Aliasghar Hospital, Occupational Therapy ward, Tehran, Iran
Faranak Ali Abadi, Bahareh Maghfuri
Tehran University of Medical Sciences, Tehran, Iran

Objectives: The aim of this study was to compare fine motor development between low birth weight (LBW) infants and normal birth weight infants (NBW) at the age of 8-12 months by using the Peabody Developmental Motor Scales-2 (PDMS-2).

Method: This was a non-experimental cross sectional study which was conducted on 18 LBW and 14 normal infants. By looking up infant profiles in ‘ Aliasghar Hospital’s NICU, those with the defined inclusion criteria were identified (case group). Normal birth weight infants were randomly selected from the same hospital’s Health Center. They were then matched with the case group for their dates of birth. After completing the questionnaire on demographic variables, their gross motor development was assessed with PDMS-2. Finally, the scores of the motor quotient were analyzed with independent T-test.

Results: There was a significant difference between the groups’ fine motor quotients (p= 0.007).

Conclusion: This study showed that LBW infants are significantly lower than normal weight infants in acquiring fine motor skills. Meaning, LBW infants are more prone to developmental difficulties.

Key words: LBW infants, Motor development, Peabody Developmental Motor Scales

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Accepted: 04 Jun 2012

Introduction
Despite advances in medical care and neonatal medicine and changes in survival patterns of high-risk infants, the developmental outcomes and follow-up assessments of these infants remain a serious concern (1). One of the complications found in these high-risk infants is the birth of LBW infants (< 2500 grams or <37 weeks for gestational age). According to the World Health Organization’s (WHO) statistics, the worldwide rate of LBW is 17% (6% in industrialized countries and 21% in developing countries). The results of two studies in Iran showed that the rate of LBW is 10% in the Islamic Republic of Iran (2) and 8.4 % in Yazd (a central city in Iran) (3). Recent studies have shown that LBW infants are prone to abnormal neurological signs in tone, coordination and reflexes, due to neonatal complications which lead to development of motor deficits and delays at the age of 6 months or later (4). Generally speaking, the shorter the gestational period or the lower the birth weight the greater the risk for motor deficits in the premature infant (1). It has been reported that approximately 10% of extremely LBW (ELBW) preterm infants (< 1,000 grams) will develop cerebral palsy (CP). A 32% rate of CP has also been observed in infants weighing less than 1,500 grams (1). Furthermore, infants who demonstrate early motor impairments that resolve may also have mild fine motor difficulties that persist and later affect their hand function and school performance (4). Hence, concise assessments and follow up of these children is of utmost importance in enabling early interventions and prevention of subsequent abnormal outcomes.

Unfortunately, although several studies have been conducted to evaluate and examine the developmental outcomes of prematurity in motor and cognitive skills elsewhere, sufficient numbers of studies have not been conducted in this regard in our country. Bearing in mind the significance of developmental difficulties in hand function based on other studies, in this study we decided to prospectively and specifically investigate the...
development of fine motor skills. The aim of this study was to compare Fine Motor Development in LBW and NBW infants at the corrected age of 8-12 months by using the Peabody Developmental Motor Scales.

Method
This research was a descriptive and prospective cohort study which was carried out between January and July 2008 in ‘Aliasghar Hospital’s Occupational therapy clinic in Tehran, Iran. It was conducted on two groups of infants aged 8-12 months: the LBW group (<2500g), and the NBW group. The sample size was based on the Z formula and a confidence interval of 95% with 80% power to detect a significant difference between the two groups. With a level of 0.05 was calculated to be 14 children included 18 premature infants with the history of low birth weight [11 (LBW) and 7 (VLBW)] and 14 NBW infants with the history of normal birth weight.

All LBW infants at 8-12 months corrected age (CA) that had been admitted at Aliasghar Hospital’s NICU for 14 days or more, and all NBW infants aged 8-12 months -that had been referred to the hospital’s Health Center for vaccination were screened for eligibility for inclusion in the study. The inclusion criteria were: 1- being in Aliasghar’s NICU for 14 days or more between 20/1/2008 and 20/7/2008, 2- infant birth weight lower than 2500 grams, and 3- singleton infant. The exclusion criteria were: 1- any brain injury, degenerative disease and/or other acquired problems affecting development upon NICU discharge, 2- any congenital abnormalities affecting development, and 3- any sensory problem (deafness, blindness, …). All infants who fulfilled the above criteria were included in the study.

After screening and selecting both groups randomly, informed consent forms were given to their families. Then, all infants underwent a routine clinical examination by a pediatrician and the questions concerning medical history, development and demographic information were completed by the pediatrician. Finally, an occupational therapist conducted PDMS on each infant.

The PDMS-2 is one of the most commonly used assessments for measuring infants and toddlers’ motor skills from birth through 5 years. The ‘Peabody Development Motor Scales’ is one of the most reliable testing instruments used by many professionals as a diagnostic tool to assess gross and fine motor skills in children with special needs. Most motor skills dysfunctions are identified with the PDMS-2. By using the results of the PDMS-2, we can develop a more responsive learning and rehabilitation program for the child with special needs. The test is composed of six subtests that assess related motor abilities that develop early in life: Reflexes, Stationary (body control and equilibrium), Locomotion, Object Manipulation, Grasping, and Visual-Motor Integration. Results from these subtests are used to generate the three composite scores: Gross Motor Quotient, Fine Motor Quotient, and Total Motor Quotient.

After collecting prenatal variables and fine motor scores, the motor quotients were determined and data were analyzed and compared using the SPSS 17 software. Mean motor quotient scores were compared using independent T-tests. Differences were considered significant at P values smaller than 0.05. This study was approved by the Ethical Board of Tehran University of Medical Sciences (TUMS).

Results
The study population consisted of 18 children with a history of LBW (10 boys & 8 girls) and 14 children with a history of NBW (9 boys & 5 girls). Mean birth weight for LBW and NBW was 1670g and 3130g, respectively. In this study there were no ELBW infants (micro-preemies). Mean gestational age for LBW was 34 weeks and for VLWB was 32.5 weeks.

Comparison of the two groups [NBW and total LBW (LBW, VLBW)] based on mean fine motor quotients is shown in table (1). The results showed that mean fine developmental motor quotients (DMQ) were significantly different in both groups.

Table 1. Mean gestational age and comparison of the two groups

<table>
<thead>
<tr>
<th>Groups</th>
<th>N</th>
<th>Mean fine DMQ</th>
<th>Std. Deviation fine DMQ</th>
<th>Mean std. error</th>
<th>T- test sig (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NBW infants</td>
<td>14</td>
<td>103.00</td>
<td>6.22</td>
<td>3.35</td>
<td></td>
</tr>
<tr>
<td>Total LBW</td>
<td>18</td>
<td>91.27</td>
<td>14.22</td>
<td>1.66</td>
<td>0.007</td>
</tr>
<tr>
<td>LBW infants</td>
<td>14</td>
<td>85.71</td>
<td>18.90</td>
<td>7.14</td>
<td>0.0052</td>
</tr>
<tr>
<td>VLBW infants</td>
<td>11</td>
<td>94.81</td>
<td>9.68</td>
<td>2.91</td>
<td>0.0017</td>
</tr>
</tbody>
</table>

1- A birth weight between 1500 and 2500 grams is considered a LBW.
2- The birth weight between 1000 and 1500 grams is considered a VLBW.
**Discussion**

In a study by Grantham et al in 1998, mental and psychomotor development of term LBW and NBW infants was assessed with the Bayley Scale at 6 and 12 months of age. LBW infants had significantly lower scores in mental and psychomotor development indices at 6 months of age. At 12 months of age the differences between these scores had increased (5). In the Goyen and Lui's study, 58 infants born in less than 29 weeks and/or with 1000 g and without disabilities detected at 12 months. Their gross and fine motor skills were evaluated at 18 months, 3 and 5 years by Peabody Developmental Motor Scales. The information of the home environment as a stimulus for development was provided by HOME scale. Results showed that a large proportion (54% at 18 months, 47% at 3 years and 64% at 5 years) of children continuously had fine motor deficits from 18 months to 5 years. The number of infants who had gross motor deficits significantly increased over this period (14%, 33% and 81%, p < 0.001), particularly for the ‘Micropreemies’ (born < 750 g). Multivariate analyses showed that the quality of the home environment had a positive influence on development of gross motor skills. A large proportion of high-risk infants ongoingly had fine motor deficits that reflect an underlying problem with those skills. In addition, the development of gross and fine motor skills appears to be under a different influence by the home environment (6).

Zhang et al. in 2007 studied preterm infants discharged from NICU at the age of one year and reported critical and abnormal neurological developments respectively seen in 29.0% and 12.4% of them. Moreover, prematurity, low level of education in parents, multiple pregnancies, severe intracranial hemorrhage and apnea were the mentioned risk factors of developmental delay (7). In a Spanish study in 2008, developmental outcomes of 116 ELBW infants during the first three years of life were assessed. Cerebral palsy was present in 50%, while psychomotor and speech development was normal in most of these children (8).

In a study by Datar in 2009 mental and motor development of VLBW and MLBW babies during the first two years of life was compared with those of normal birth weight ones. LBW had a small adverse effect on mental and motor development in the first two years of life (9). In this study, although we evaluated only fine motor skills in infants aged 8 – 12 months , the results showed fine motor deficits at those ages which indicates earlier occurrence of fine motor difficulties in these infants. Moreover, according to the PDMS–2 manual, scores between 90 and 10 are assumed as moderate deficits. The mean fine motor DMQ score of the present study was located in this range, meaning the motor difficulties of the infants in this study were less than others in similar studies.

In a follow up study in Iran in 2011, fifty LBW preterm neonates admitted to Shahid Sadoughi Hospital’s NICU in 2008 were evaluated for developmental statuses at 6 and 12 months of age using the Ages & Stages Questionnaires (ASQ). LBW and preterm infants admitted to the NICU showed degrees of developmental delay at the ages of 6 and 12 months, especially in the gross motor and personal-social developmental domains of the ASQ (10). This study too showed that there was delay in fine motor development of premature infants.

Another study was performed in Zanjan (Iran) in 2011 on 130 six-year-old children. Sixty five children with a history of LBW and 65 with NBW were selected randomly to be assessed for IQ. The Wechsler Intelligence Scale for Children-Revised (WISC-R) and physical growth indices, including weight and height were applied. Verbal, non-verbal and total IQ were all significantly different between LBW and NBW groups. Mean total IQ was 93.66±8.27 and 99.32±11.05, respectively. Weight and height showed significant differences between the case and control groups too (11).

In our study there were limitations such as low parental cooperation and refusal to attend the hospital for tests. The children’s fatigue and need to rest frequently, and the small sample size interfered with our study.

**Conclusion**

In conformity with other studies, the result of this study too indicate the importance of paying special attention to developmental follow up of high risk and LBW infants. Earlier detection and early developmental intervention for these infants is recommended. Finally, it is suggested that more diagnostic evaluations be conducted on LBW infants for all aspects of development. We hope that this study will encourage further studies in the field of developmental assessment and early rehabilitation of high-risk infants and subsequently improve and prevent motor and developmental disabilities is these children.

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1- MLBW: Moderately Low Birth Weight
References
2. World Health Organization(WHO) and United Nation Children’s fund(UNICEF). Low Birth Weight: country, regional and global estimates, Geneva, December 2004
11. Mahram M, Mousavinasab N, Gooran Urimei A. Intelligence Quotient (IQ) and Growth Indices in Children with the History of Low Birth Weight. Iran J Pediatr. 2009. 19 (4); 387-392
The relationship between Mental Pressure and Job Burnout of nurses working in the centers of mentally disabled adults

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Objective:
Nurses of mentally disabled adults’ centers are encountered with high pressures and stresses and the objective of this study is the investigation of the relationship between the mental pressure of the nurses of mentally disabled adults’ centers and their job burnout.

Method:
This study was done on 180 nurses of different shifts of Nurses of mentally disabled adults’ centers of Mashhad in different shifts and the data were analyzed by job stress questionnaires based on likert scale and job burnout in Guttman scale and by Pearson correlation coefficient and SPSS software.

Results:
The results showed that in all nurses of mentally disabled adults’ centers, there was a significant relationship between the stress of job roles and burnout and the stress of personal pressures and burnout and the amount of using the resources to cope with their job stress and burnout.

Conclusion:
Based on the results of this study we can conclude that as nursing job in mentally disabled adults’ centers is of high mental pressure jobs, the stress of this job causes different burnouts including job burnout.

Keywords:
Mentally disabled adults’ nurses; Stress; Job burnout; mentally disabled people.

Introduction
Caring disabled adults is a high-pressure job (1). These people should work a lot under stringent rules and they cannot spend more time on their own. Some duties as continuous changing of the diaper in people with poor control of sphincter and urine, caring about the physical condition of the mental patients and reporting to the related staff, supervision and caring about sleeping and wakening the patient, changing his/her clothes and sheets and providing the environment similar to the family environment and creating emotional relationship like a mother with metal patients cause that the nurses are encountered with high mental pressure and stress. The outcomes of stress can be a serious threat for the health and reduce enjoyment and productivity of a person from the life. Burnout is a psychological process that results in emotional exhaustion, depersonalization, and feelings of decreased accomplishment (2). Nervous and mental pressure in daily life is observed abundantly. The industrial and trans-industrial world inflicted many problems. The concern about job, family, children, the concerns of the employed mothers to the condition of their children and feeling guilty of not taking after their children, social problems, economical conditions and various demands, the expectations of the organizations from the staffs and technology progress and the concern about old knowledge and information all cause that a person from the morning until the night is encountered with emotions, concerns, various fears and hopes that are consistent sometimes with physical, nervous and mental capacity and sometimes they are not consistent with them (3). Maslach (4) proposed 6 organizational factors in job burnout as workload, low control on the work, low reward, the lack of social contact, discrimination in working environment, value discrepancy between the personal values and working environment values. The jobs in which the expectations are high or the jobs in which a person is encountered with working pressures in contact with their colleagues or clients or even the jobs that a person feels that he is not respectable before others all cause job burnout (4). Various studies investigated about mental pressure

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and burnout. For example, Filian, Emad (5) in his study on nursing staffs reported that special leadership of the chiefs of the organization reduced job burnout among the staffs. The people with close relationship with their chiefs are less exposed to job burnout than the staffs working with less considerate chiefs.

Soleimani et al (6) in their study on the burnout of psychiatric health staffs of Ruzbeh hospital found that 20.7% of all the staffs were suffering from strong emotional exhaustion, 9.3% were having strong depersonalization and 55% had insufficiency feeling (6).

Kilfedder et al (7) selected sample of 510 psychiatric nurses from one Scottish Trust about job burnout and found that the sample accounted for, 33% of personal accomplishment, 7% of depersonalization and 22% of emotional exhaustion, that was more in men, in the study sample. The study showed that there is negatively significant correlation between depersonalization and age.

Yasayi et al (2002) by investigating the prevalence of psychiatric disorders and job burnout in pilots found that general index of disease symptoms among the investigated group is more than the common society and 8.5% of people are suffering from mental disorders. In addition, there is a significant relationship between the job burnout and the symptoms of psychology and the relationship between job burnout and paranoid disorders, somatization, anxiety and depression was more than other disorders. As there are various researches on the job burnout of the nurses decreases the quality, caring and education of the mentally retarded adults all over the world and in each of them the effects of stress are investigated in different ranges but there are fewer researches on humanistic and emotional environments such as rehabilitation of mentally disabled people centers. Therefore, in this study the relationship between the stress and job burnout is observed in nurses working in mentally disabled centers under the supervision of well-being organization of Mashhad (8).

**Method**

This study was a research-inference method. The study population of this research was 42 nurses among 180 nurses working in rehabilitation and education of mentally disabled adults’ centers of Shahid Beheshti, Fatholmobin, Poya, Imam Javad and Eram of Mashhad and by random relative stratified sampling method, they were selected. Data collection was done by two questionnaires and the questionnaires were distributed among the selected population. These questionnaires were including job stress and job burnout questionnaires. Job stress questionnaire was including 29 questions based on Likert scale. By this questionnaire, we investigated job stress in three domains of job roles, personal pressures and coping responses. The job roles in this questionnaire were including role overload, underload and load ambiguity, role boundary, responsibility and materialistic environment. Role boundary means that a person is to what extent encountered with opposite requirements of the role. The second domain is personal pressures including job pressure, mental pressure, interpersonal pressure, physical pressure, negative attitudes of a person toward his job. The third domain is including a set of four measures by which coping resources are evaluated: Recreation, self-care, social support and logical and cognitive coping. By these measures, some tools are investigated by which stressful factors of life. Job burnout questionnaire was including 10 questions and it was designed based on Guttman scalogram. To calculate the validity of the questionnaire, at first 20 mental health nurses were selected by simple random method to answer the questions. Then, the questionnaire was given to the same group after one week (re-test method) and after data analysis, correlation coefficient of two stages of the test was analyzed and the validity coefficient of job stress questionnaire was 0.77. 20 questionnaires were evaluated by Cronbach’s alpha test and its validity was 0.75 and it was close to the previous validity of this test. The data analysis was done by Pearson correlation coefficient. SPSS software was used for data analysis.

**Results**

The analysis of the questionnaires was done by 42 nurses working in mental health centers were selected by random relative stratified sampling method. The correlation coefficient between the stress of job roles and job burnout (r=0.5069) at confidence level 99% showed that there is a positive association between the stress of job roles and job burnout variables. It means that the more the amount of the stress of job roles, the more the amount of job burnout (table 1).

<table>
<thead>
<tr>
<th></th>
<th>Job roles stress</th>
<th>Job burnout</th>
</tr>
</thead>
<tbody>
<tr>
<td>Job roles stress</td>
<td>1</td>
<td>0.5069</td>
</tr>
<tr>
<td>Job burnout</td>
<td>0.5069</td>
<td>1</td>
</tr>
</tbody>
</table>
The data showed that there is a relationship between the stress of personal pressures of mental health nurses and their job burnout. Their processing results showed that the correlation coefficient between two variables is positive and significant and at confidence level 99% was determined as 47%. It means that the more the stress of personal pressures of mental health nurses, the more the amount of job burnout (table 2).

**Table 2.** Pearson correlation coefficient between the stress of personal pressures and job burnout

<table>
<thead>
<tr>
<th>stress of personal pressures</th>
<th>job burnout</th>
</tr>
</thead>
<tbody>
<tr>
<td>job burnout</td>
<td>4709</td>
</tr>
<tr>
<td>job burnout</td>
<td>1</td>
</tr>
</tbody>
</table>

There is a relationship between the coping resources with the stress of mental health nurses and their job burnout. The Pearson correlation coefficient between two variables is positive and significant and at confidence level 99% was determined as 48%. It means that the more the stress of personal pressures of mental health nurses, the more the amount of job burnout. It means that the less the amount of coping resources, the more the amount of job burnout (table 3).

**Table 3.** Pearson correlation coefficient between the coping resources and job burnout

<table>
<thead>
<tr>
<th>coping resources</th>
<th>job burnout</th>
</tr>
</thead>
<tbody>
<tr>
<td>job burnout</td>
<td>1</td>
</tr>
<tr>
<td>coping resources</td>
<td>0.4782</td>
</tr>
</tbody>
</table>

There is a relationship between the stress of mental health nurses and their job burnout. The Pearson correlation coefficient between two variables is positive and significant $r=0.49$ at confidence level 99% It means that the more the stress of mental health nurses, the more the amount of job burnout (table 4).

**Table 4.** Pearson correlation coefficient between the stress of job roles and job burnout

<table>
<thead>
<tr>
<th>Stress of job roles</th>
<th>Job burnout</th>
</tr>
</thead>
<tbody>
<tr>
<td>job burnout</td>
<td>1</td>
</tr>
<tr>
<td>Stress of job roles</td>
<td>0.49</td>
</tr>
</tbody>
</table>

**Discussion**

One of the research results showed that there a positive and significant relationship between the stress of job roles of mental health nurses and their job burnout. The current study showed that the continuous caring and contact of the nurses with the patients and encountering with their physical and mental problems are the main resources of stress. Other results of this research were the significant relationship between the stress of personal pressure and job burnout of the nurses of mental health centers. This study showed that personality and personal characteristics such as hastiness were effective in increasing the stress of the nurses and this result is consistent with the results of the study of Allen and Mellor (2002) that showed neuroticism had significant relationship with emotional analysis, depersonalization and the reduction of personal success in cross section researches in a group of nurses (9). Other personal factors that were effective in increasing stress were social and family communications. The other result of this research showed that the less the coping resources are used, the more the job burnout of mental health nurses. These results showed the important role of coping resources as social and psychological preventive measurements to avoid the damages of job burnout.

Soltani and Ruhani (2000) showed that there are various ways to cope with burnout syndrome including the reduction and elimination of the existing stresses in work environment, emotional supports of the family, friends and colleagues, consulting services to change the attitude of the patients and instilling self-esteem and self-respect in them, changing bad working conditions that is consistent with the results of this research (10). The researches of Kurman that were done to support the hypothesis of adjustment of coping mechanism, concluded that the people using control mechanism to cope with job stresses in work environment are not exposed to job burnout and their job performance is not reduced while the effect of adjustment of coping methods on avoidance is very little on the negative results of stress (11, 12) that is consistent with the result of the current study.

**Conclusion**

The current study is done to investigate the effect of mental pressure on job burnout of mental health nurses of Mashhad city and the determination of the relationship between these variables. Based on the results of this study, it can be concluded that stress resources among mental health nurses and they are responsible for rehabilitation of the mentally disabled people and create different reactions and one of the most important cases is job burnout and its outcomes is the low quality y of rehabilitation and caring about the disabled people. Thus, to cope with this problem, mental stresses and job burnout should be solved. As working with mentally disabled people is a humanistic...
and emotional relationship, the managers should have a true understanding of job stress by recognizing psychological factors of work place and by recognizing the stressful factors in these centers and using its reduction ways, to maintain and use human resources more than before.

Acknowledgment:
My gratitude goes to the collaboration of the nurses and managers of mentally disabled rehabilitation centers of Mashhad and all people who helped me to perform this study.

References
Age and Gender Effects on Auditory Brain Stem Response (ABR)

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University of Social Welfare and Rehabilitation Sciences, Tehran, Iran

Objectives: Auditory Brain Stem Response (ABR) is a result of eight nerve and brain stem nuclei stimulation. Several factors may affect the latencies, inter-peak latencies and amplitudes in ABR especially sex and age. In this study, the effects of age and sex on ABR were studied.

Method: This study was performed on 120 cases (60 males and 60 females) at a Rehabilitation Center in Tehran, Iran. Cases were divided into three age groups: 18-30, 31-50 and 51-70 years old. Each age group consists of 20 males and 20 females. Age and sex influences on absolute latency of wave I and V, and IPL of I-V were examined.

Results: Independent t test showed that females have significantly shorter latency of wave I, V, and IPL I-V latency (P-value <0.001) than males. Two way ANOVA showed that latency of wave I, V and IPL I-V in the 51-70 year old group was significantly higher than the 18-30 and 31-50 year old groups (P-value<0.001).

Conclusions: According to the results of the present study and similar studies, in clinical practice, different norms for older adults and both genders should be established.

Keywords: ABR, gender, presbycusis, central auditory pathway, brain stem time

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Accepted: 12 Sep 2011

Introduction
Auditory Brain Stem Response (ABR) is an onset response (1, 2) and is a set of waves that occur in about 10 milliseconds (ms) after delivering a transient stimulus, mainly a click. This response is a result of eight nerve and brain stem nuclei (up to midbrain) stimulations (1, 3). This objective response is widely used for detecting auditory thresholds in infants and patients who have difficulty in behavioral auditory tasks like mentally retarded patients (4). In addition, ABR is one of the non-invasive and inexpensive diagnostic tests for eight nerve and brain stem pathologies, especially acoustic schwannoma (4, 5). In humans ABR generally has seven waves, I through VII. Each one is originated from different parts of the auditory pathway (3). The most important components of ABR are waves I, III and V. Other components are highly variable and may not present even in normal cases (1, 3).

Generators of wave I to V are: distal part of the eighth nerve, proximal part of eighth nerve, cochlear nucleus, superior Olivary complex, and lateral leminiscus near the inferior colliculus (1, 5).

In humans, ABR can be recorded from about 26 weeks of gestational age (GA). After that, waves develop rapidly until term birth. From birth ABR continues development more slowly and in 18-24 month children, all the components are completely mature and adult-like (1, 5).

ABR is an early auditory evoked potential (AEP) and is not affected by sedatives (6, 7), and general anesthetics (8) so this test is a useful tool for assessing non-cooperative populations such as infants, young children and severe mentally retarded patients (1, 4, 5).

In general the ABR changes can be seen with neurological maturation and functional integrity of the brainstem (5). In particular, wave V is the most constant and most prominent of the ABR, and is widely used for objective audiometry. The analysis of this wave can identify pathological processes in the brainstem (1, 5). In diagnostic audiology, inter-peak latency interval (IPL) or inter-wave interval (IWI) of main ABR components especially I-V are very important because IPL I-V reflect the central conduction time (CCT) or brain stem conduction...
time (BCT). CCT reveals the functional state of brain stem and its deficit indicates neurological pathologies (5, 9, 10). Several factors may affect the peak latencies, IPL and wave amplitudes in ABR. These factors are classified as recording variables (electrodes, reference, filters), stimulus variables (stimulus intensity, stimulus rate, stimulus mode and stimulus phase) and subject variables (age, sex, body temperature, and cochlear hearing loss). Subject variables especially ‘age’ and ‘gender’ have powerful influences on ABR (11). It has been shown that females may have shorter ABR latencies and IPL latencies than males. Also, in the elderly ABR waves have delayed latencies in comparison to young adults (12-15).

In interpretation of ABR in individual patients, it is important to consider subject variables affecting ABR waves, especially IPLs. Otherwise, our findings would be misleading. In this study, age and sex effects on ABR were studied. The Aim of this research was to determining age and sex influences on absolute latency of wave I and V, and IPL of I-V in four age groups from 18 to 70 years old. Most previous studies have not considered hearing loss in the elderly as a confounding variable so their findings are uncertain, but in this study only normal-hearing cases with hearing thresholds ≤30 dBHL were used. This study was performed on 120 participants at the ‘University of Social Welfare & Rehabilitation Sciences’ Akhavan Rehabilitation Center in Tehran, Iran. SPSS software version 13 was used for statistic data analysis. Independent t test and two-way ANOVA were applied.

Method
This study was performed on 120 cases (60 males and 60 females) at the ‘University of Social Welfare & Rehabilitation Sciences’ Akhavan Rehabilitation Center in Tehran (Iran) between 2010 and 2012. Participants were selected from patients with tinnitus, dizziness, or vertigo symptoms, and the Akhavan Rehabilitation Center (ARC) staff. All the participants signed a written consent and were volunteers. Cases were divided into three equal age groups: 18-30 years old, 31-50 years old and 51-70 years old. Each age group consisted of 20 males and 20 females.

Inclusion criteria were as follows: Normal otoscopy (Riesterotoscope), tympanogram A (Zodiac 901 of Madsen), acoustic reflex being present (Zodiac 901 of Madsen), hearing threshold ≤30dBHL (Clinical Audiometer AC 33 and headphone TDH-39p of Telephonics) and good ABR morphology at 80 dBNHL (ICS Charter EP 2000, Madsen-Aurical and Insert phone ER-3A). Cases did not have any significant neurologic and audiologic problems.

For recording ABR, click stimulus at 80 dBnHL, with rarefaction polarity, the presentation rate of 11.1/s, 100-3000 HZ filtration was used. Response was average of 1024 accepted sweep and time window of recording was 15 msec. Stimuli were presented through Insert phone ER-3A. Disc gold electrodes with conductive gel were applied on the forehead (ground electrode), ipsi-lateral mastoid (active electrode) and contra-lateral mastoid (reference electrode). Before applying electrodes, mastoids and forehead were cleaned by using abrasive material. Impedance of electrodes was below 5 KOhms and inter-electrodes impedance was below 2 KOhms.

Results
The SPSS version 13 was used for statistic analysis. There were 60 males and 60 females aged 18 to 70 years old. Each gender group had three age groups: 18-30 years old (20 males and 20 females), 31-50 years old (20 males and 20 females), and 51-70 years old (20 males and 20 females). The right ears of all cases were selected to neutralize ear effect. Descriptive information about latencies in sex and in three age groups is summarized in table (1) and (2) respectively.

| Table 1: Descriptive analysis of ABR latencies in males and females |
|---|---|---|---|---|
| | Males | Females |
| | Means | Sd | Means | Sd |
| Absolute latency of I (in ms) | 1.51 | 0.07 | 1.40 | 0.07 |
| Absolute latency of V (in ms) | 5.90 | 0.09 | 5.6 | 0.12 |
| Interpeak latency of I-V (in ms) | 4.39 | 0.09 | 4.19 | 0.09 |

| Table 2: Descriptive analysis of ABR latencies in three age groups |
|---|---|---|---|---|
| | 18-30 Years Old | 31-50 Years Old | 51-70 Years Old |
| | Means | Sd | Means | Sd | Means | Sd |
| Absolute latency of I (in ms) | 1.41 | 0.09 | 1.44 | 0.06 | 1.52 | 0.06 |
| Absolute latency of V (in ms) | 5.65 | 0.17 | 5.73 | 0.18 | 5.88 | 0.14 |
| Interpeak latency of I-V (in ms) | 4.23 | 0.11 | 4.29 | 0.16 | 4.35 | 0.10 |
Charts (1), (2) and (3) show mean latency of wave I, V and I-V IPL for different gender and age groups.

**Chart 1. Mean latency of wave I**

<table>
<thead>
<tr>
<th>Age group</th>
<th>18-30 years old</th>
<th>30-50 years old</th>
<th>50-70 years old</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean latency of wave I in milliseconds</strong></td>
<td>7.0</td>
<td>6.0</td>
<td>5.0</td>
</tr>
</tbody>
</table>

**Chart 2. Mean latency of wave V**

<table>
<thead>
<tr>
<th>Age group</th>
<th>18-30 years old</th>
<th>30-50 years old</th>
<th>50-70 years old</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean latency of wave V in milliseconds</strong></td>
<td>1.5</td>
<td>1.0</td>
<td>0.5</td>
</tr>
</tbody>
</table>
Independent t test was done to compare ABR latencies between the two sexes. This analysis showed that females have significantly shorter wave I latency (male mean value=1.51, female mean value=1.40, with P-value<0.001), shorter wave V latency (male mean value=5.90, female mean value=5.60, with P-value<0.001), and shorter IPL I-V latency (male mean value=4.39, female mean value=4.19, with P-value<0.001) than males.

Then two-way ANOVA was done to compare ABR latencies between three age groups in both sexes. Homogeneity of variances showed variances were equal for latency of wave I (P-value=0.08), wave V (P-value=0.10) and IPL I-V (P-value=0.14) in all age groups. There was an interaction between sex and age groups (P-value=0.003). Two-way ANOVA showed that latency of wave I in the 51-70 years old age group (mean=1.52 ms) was significantly higher than 18-30 (mean=1.41 ms) and 31-50 years old (mean=1.44 ms) age groups (P-value<0.001); latency of wave V in 51-70 age group (mean=5.88 ms) was significantly higher than 18-30 (mean=5.65 ms) and 31-50 years old (mean=5.73 ms) age groups (P-value<0.001), and latency of wave V in 31-50 years old age group was significantly higher than 18-30 years old age group (P-value<0.001).

Moreover, it was shown that IPL I-V in the 51-70 year-old age group (mean=4.35 ms) was significantly higher than 18-30 (mean=4.23 ms) and 31-50 years old (mean=4.29) age groups (P-value<0.001), and that IPL I-V in 31-50 year olds was significantly higher than the 18-30 year-old age group (P-value<0.001).

**Discussion**

The results indicate that there is a significant difference between males and females in absolute latencies and IPLs of ABR, irrespective of age. Females have shorter absolute latencies and IPLs in ABR. Furthermore, this study shows that absolute latencies and IPLs of ABR increase with aging especially in the 51-70 year-old interval. These findings are in agreement with other studies (e.g. 5, 12, 13, 28, 29, 39).

It has been reported that females have shorter conduction times and ABR latencies than age-matched males (5, 12, 13), and that gender has more powerful effects on ABR than aging (14-16). Allison et al. (1983) explained this result by difference of body size in males and females (5,17). Head size and consequently the length of the auditory neural pathway is different between the sexes and can lead to ABR waves latency and amplitude discrepancies. Stockard et al. (1978) suggested that the anatomical distance of auditory pathway in females (CCT) might be shorter than males (12) because generators
of ABR components are closer to each other and to the surface electrodes (1). On the other hand, some researchers insist that head size cannot be the only factor for gender difference in ABR latencies (12, 18, and 19).

Indeed, cochlear duct is longer in males than in females, resulting in longer cochlear traveling times in males. In addition, shorter cochlear duct in females results in greater stiffness of the female basilar membrane and may cause earlier ABR latencies relative to males. When velocity of the traveling wave increases it leads to increments of neural synchrony (20). With frequency-specific ABR and high-pass masking, it has been revealed that cochlear response time in females is 13 percent shorter than males (21). Males and females are different in cochlear processes. It has been shown that SOAEs are more prevalent and stronger in females than males and TEOAEs have larger amplitude in females (22). Moreover, the activity of the olivo-cochlear bundle (OCB) which is a part of the efferent auditory system is different between males and females. Researches show that the auditory efferent system is more active in males and this could affect peripheral mechanisms (23). Additionally, behavioral and imaging studies have shown that in males and females the auditory cortex has different ways for processing acoustic stimuli. For example, fMRI studies have identified that in females, language areas of cortex show stronger activation (20). These differences are under the influence of hormones especially estrogen (19, 20, 24). Gender difference of hearing is reduced during menopause and in females who have a male twin. In support of this hormonal explanation, females with Turner syndrome, a chromosomal abnormality resulting in estrogen deficiency, demonstrate longer click-ABR latencies and earlier presbycusis, similar to males. Auditory thresholds show variations with the menstrual cycle in females (20). Electroencephalography (EEG) and ABR show fluctuations during menstrual cycle (25-27). In Menière’s disease, auditory symptoms are exacerbated during the premenstrual phase because estrogen levels are in their lowest state during this phase (20).

Many authors have reported increments of ABR latencies with advancing age and decrement of neural conduction velocity (increment CCT) in older people. As mentioned in earlier studies, advancing age will directly affect the peak latencies and IPLs of ABR waveform components (28-31). Most studies have shown that in the age range of 25 to at least 55 years old, ABR latencies increase 0.2 ms (32). Between 60 and 86 years old, IPL I-V increases significantly (33-35). Allison et al. (1984) and Dorfman and Bosley (1979) explained this as an age-related decrease in the peripheral (cochlear) and central conduction velocity. Other explanations are axonal dystrophy especially in myelinated fibers, demyelination, neurotransmitter alterations, or vascular and biochemical changes (5). Moreover, central nervous system dysfunctions are common in patients with essential hypertension (36, 37). Dysfunction of brain in hypertension is a result of arterial and arteriolar spasm in cerebral blood vessels and micro-infarctions. A variety of clinical sensory and motor signs and symptoms along with dizziness, vertigo, tinnitus and occipital headache in patients of essential hypertension suggest the micro-vascular insufficiency of the brain. Such type of micro-vascular damage may alter ABRs. Essential hypertension may also be due to micro-vascular damage in the peripheral nervous system like peripheral neuropathy. Given the high prevalence of hypertension in older subjects, it could lead to reduction of neural conduction velocity and increase in ABR wave latencies and IPLs (37).

In many studies of presbycusis, the hearing thresholds of young and older participants are not matched and there is hearing loss in older people especially in high frequencies. This hearing loss is a confounding factor and makes it difficult to separate aging effects from threshold effects (1, 13, 38). Oku and Hasegawa (1997) compared the ABR and ECOG in young and older participants (50–89 years old). The old group had normal hearing thresholds at 0.5–2 kHz, but their thresholds were between 35 to 72 dB HL at 4–8 kHz. The latencies of Waves I, III, and V showed a progressive delay in the older group, but it was attributed to high frequency hearing loss and it was difficult to rule out hearing loss effects on the ABR latency (30, 39). Martini et al. (1991) reported that normal-hearing older adults in the frequency range of 0.25–2 kHz who had mild high frequency loss at 4 kHz and above, had delayed latencies for Waves I, III, and V compared to normal-hearing young adults. These differences were considered to be due to the mild hearing loss at 4 kHz and were not exclusively due to aging (39). But the present study showed that increase in ABR latencies is independent of hearing thresholds because all the participants had normal hearing thresholds.
Conclusion
The results of this study among others show that subject variables (age and sex) have statistically significant influence on ABR latencies. Therefore age and sex can affect ABR interpretation and clinicians should consider them in clinical settings. It is recommended that in clinical practice, different norms be established for different age groups and genders.
We conclude that if female norms be used for both sexes, then all males may fall into abnormal (late) ABR criteria and if male norms be applied to both sexes, neurological pathologies in females may not be detected. Furthermore, our study shows that irrespective of the hearing threshold, in the elderly, ABR latencies are longer than young adults and misinterpretations may take place if their norms are used interchangeably.

Acknowledgment:
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References
Comparison of Early Active and Passive Post-operative Mobilization of Flexor Tendon in Zone 2

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Objectives: Despite numerous studies, achieving the best outcome is challenging after flexor tendon repairs in zone 2. This study was done to test the hypothesis that immediate postoperative active mobilization will achieve similar outcomes to passive mobilization.

Method: Fifty fingers in 38 patients with flexor tendon repair in zone 2 were enrolled in this trial. The patients were randomly assigned to two groups: Early active mobilization and Passive mobilization. They were assessed eight weeks post-operatively. Outcomes were defined using ‘Strickland’ and ‘Buck-Gramcko’ criteria. The analysis was done according to intention-to-treat principles, using imputation for missing data.

Results: There were significant differences between the two groups (p<0.001). According to Strickland criteria, the results were 80% ‘excellent and good’ and 20% ‘fair’ and ‘poor’ in the early active mobilization group. In the passive mobilization control group results were: 40% ‘excellent and good’ and 44% fair and 16% poor. Mean of total active mobilization was significantly greater in the early active mobilization group.

Conclusion: The actively mobilized tendon underwent intrinsic healing without large gap formation. Increased ultimate range of motion confirmed that early active mobilization can be used after strong repair in zone two.

Keywords: flexor tendon, zone 2, early active mobilization, passive mobilization

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Introduction
Hand injuries form an important part of hospitals’ accident and emergency services, and among them flexor tendons are more commonly affected (1). Despite numerous advances in our understanding of the anatomy, biomechanics, nutrition and healing of flexor tendons, repair techniques and post-operative care improvement, the results following flexor tendon repairs show relatively high rates of failure (2).

Adhesion formation that prevents tendon gliding is the most frequent cause of failure after flexor tendon repairs (3). Since the surgical management of acute flexor tendon injuries is well understood, the real problem is how to decrease or eliminate the formation of the peritendinous scarring that inhibits a freely gliding tendon. A wide range of rehabilitation approaches have been based upon this principle (4, 5). Early active mobilization of repaired tendons has been recognized as an important treatment after flexor tendon repairs for more than two decades (2). Strong repairs are needed to tolerate the tension of active mobilization (6). Current flexor tendon repair techniques consist of a multiple strand core suture to withstand the stress produced by early and in particular, active mobilization. Active mobilization generates tension and motion and offers several advantages over passive mobilization (6, 7).

Several investigations have been designed with new four-strand core suture techniques that are easy to perform. These sutures possess adequate strength to allow active mobilization (8-10).

Attempts have been made to strengthen the repairs by increasing the strands but more time is needed, an expert surgeon is required; and there is risk of adhesion formation. In spite of all the benefits of active motion, due to difficulties in performing multiple strands, passive motion is routine therapy.

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after flexor tendon repairs in zone 2. We hypothesised that by using epitenon the first four strands can withstand the load of active motion and is therefore suitable to use in active mobilization. The purpose of this study was to compare the result of active versus passive mobilization after four-strand repairs in zone 2.

Method
The study protocol was approved by the Human Research Committee of our Institution. Between 2003 & 2004 sixty-one patients with flexor tendon repairs (four-strands) in zone 2 were identified. Inclusion criteria were being ten years or older, beginning mobilization in the first week after repair and no concomitant injuries. Thirty eight patients met the inclusion criteria. After informed consent, 50 fingers from these 38 patients were equally randomized to either receive early active mobilization or controlled passive mobilization according to a computerized random-number generator.

Surgical method
Intervention - Post operatively, the repairs were protected in a dorsal blocking splint; the wrist was positioned in 0-30 degree flexion; metacarpophalangeal (MP) joints were protected in 60-70 degree flexion and interphalangeal (IP) joints were kept in full extension in both groups. In the passive mobilization group an elastic band was attached to the finger nail for modified kleinert exercises and the patient was asked to do passive flexion with a rubber band and active extension ten times in every waking hour. For flexor digitorum profundus gliding we added a palmar pulley to the splint. The patients were asked to take off the rubber band at nights. We performed Duran mobilization in the therapy session too. This protocol was done for 3 weeks after surgery (11, 12). In early active mobilization groups, we used Belfast and Sheffield protocols. Exercises were performed every 4 hours within the orthosis, included all digits and consisted of two repetitions each of full passive flexion, active flexion, and active extension. The first week's goal was full passive flexion, full active extension, and active flexion to 30 degrees at the Proximal Interphalangeal PIP joint and 5 to 10 degrees at the Distal Interphalangeal DIP joint. Active flexion was expected to gradually increase over the following weeks, reaching 80 to 90 degrees at the PIP joint and 50 to 60 degrees at the DIP joint by the fourth week. Tenodesis exercise was done 25 times a day under supervision of a therapist (7, 12).

After three weeks the splints were changed to neutral wrists and in the 4th week they were taken off in both groups. Tendon gliding and blocking exercises were started in the 4th and 5th weeks respectively. From the 6th week we started progressive resistive exercises and if needed we used correction splints for flexion contracture in PIP joints this time onward (12).

Evaluation - At the end of the 8th week all the patients were evaluated by an independent therapist not involved in the care of the patients. Prior to the intervention, demographic information and injury-related medical history were recorded. After eight weeks finger motion was measured with a handheld goniometer. Many systems for evaluating the range of motion following flexor tendon repair have been described, but the most commonly used systems are the ‘Strickland’ and ‘Buck-Gramcko’ system. They are the most rigorous classification systems and relatively easy to apply. The Strickland system sums the degrees of active flexion at the distal interphalangeal joint and the proximal interphalangeal joint and subtracts the degrees of extension deficit. The result is compared with an ideal of 175 degrees (total active motion) (13).

Statistical Analysis - Prior to the study, it was calculated that 23 patients per group would provide 90% power to detect a 30 degree difference in the arc of flexion and extension between cohorts to reach significance with alpha set at 0.05. The target enrolment was 60 patients to cover an expected 15% to 20% rate of patient loss. Comparison of baseline characteristics and outcome variables was done using a two-tailed independent Student t-test for continuous variables and the chi-square test for categorical variables. Significant and nearly significant variables (p < 0.10) were then introduced in a backward multiple linear regression analysis to account for any confounding.

Results
Recruitment and Participant Flow - Between 2003 and 2004 fifty fingers from 38 patients met the inclusion criteria from among 61 patients and were enrolled in the trial. They were then randomly assigned to either the active or passive mobilization groups. All the patients attended two months in the sessions.

Baseline Data - In the passive mobilization group there were 17 patients with 25 injured fingers. 88%
were male with a mean age of 29.52 years (SD=15.57). 36% of injured fingers were the ring finger. All the patients were right handed and 56% of injuries were in the right hand.

In the active mobilization group there were 21 patients with 25 injured fingers. 80% were male with a mean age of 21.6 years (SD = 44.5). 48% of injuries were in the right hand. 96% had right hand dominancy. The most commonly injured finger was the middle finger (36%).

**Outcomes** - Based on Buck-Gramcko’s criteria in the passive group: 4% were excellent, 12% were good, 24% were fair and 60% were poor. However, in the active group 12% were excellent, 40% were good, 32% were fair and 16% were poor Chart 1).

![Chart 1](image1)

**Chart 1:** Frequency of total active motion in groups according to Buck-Gramenko criteria

Based on Strickland’s criteria in the passive motion group; 8% were excellent, 32% were good, 44% were fair and 16% were poor. In the active group 44% were excellent, 36% were good and 20% were poor; with no fair cases.

We had no rupture in either group (2).

![Chart 2](image2)

**Chart 2:** Frequency of total active motion in groups according to Strickland’s criteria

The mean of total active motion in the passive and active groups were 116.4 and 150.2 respectively. The latter is the result of better gliding of the repaired tendon in. The confounding variables were: age (p=0.132), sex (p=0.366), number of injured fingers (p=0.79), kind of injured finger (p=0.746).

The dominant hand (p=0.131) had no effect on the results. Only the type of mobilization had a significant effect on the results (p<0.001). There were significant differences between the means of total active motion in the two groups (p<0.001) (3).
Discussion

In this study, there were significant differences in total active motion between active and passive mobilization groups. This is consistent with previous studies addressing rehabilitation methods after zone two flexor tendon repairs (5).

In 1989 Small et al documented a series of patients who were managed with the ‘Belfast regime’ of early active motion which allowed protected active flexion of repaired tendons and stated that it is a safe approach to manage injurers in zone 2 (7). But it needed strength repairs. Current flexor tendon repair techniques consist of a multiple strand core suture to withstand the stress produced by early and in particular, active mobilization. Active mobilization generates tension and motion and offers several advantages over passive mobilization (4). Several investigations have designed new four-strand core suture techniques that are easy to perform and possess adequate strength to allow active mobilization (14-16). The epitenon first technique, was first described by Sanders (17). There are four advantages of using this technique: the forceful handling of tendon is minimized, enlargement of the tenorrhaphy is minimized, sutures are buried in the tendon and the repair provides more strength than the popular Kessler suture.

Early active motion can shorten healing time and reduce the weakness occurring ten days postoperatively that is due to contracture of the repaired site versus the only folding of repaired tendon seen in passive motion (18). Many investigations showed that at least a four-strand repair is necessary for active motion (8, 10, 19). Small et al treated 98 patients with early active mobilization with modified Kessler repair and a running peripheral suture; 77% had excellent and good results and 9% experienced rupture (20).

With the early passive mobilization method, Singer and Malloon (1988) (1) achieved 80% excellent or good results. Mclean (21) reported 66% excellent and good and Strickland (1987) (22) also achieved 83% excellent and good results with the early active motion program.

Savage and Risitano (1989) (23) achieved 69% excellent and good results in zone 2 tendon laceration. Cullen et al (1989) (7), Small et al (1989) (20) and Elliot (1994) (16) have also reported 78%, 77% and 79% excellent and good results after flexor tendon repair with active motion.

In our study we observed a clear difference between the results achieved in the two groups. The passive groups had 40% excellent and good outputs while the active group had 80% such cases.

Early active motion prevents extrinsic healing that restricts gliding (24). In contrast it facilitates intrinsic healing that creates more power in the suture area.

Active motion, with activates contraction of the repaired sites provides synovial fluid release in the repaired area, thus resulting in better nutrition and less adhesion formation (12).

The immobilized tendon showed significant reduction in both gap formation and ultimate strength during the first seven days, which was probably caused by softening of the tendons’ ends. The immobilized tendon healed by an inflammatory response from the tendon sheath. This caused a large tendon callus and extrinsic adhesion which interfered with restoration of the smooth gliding surface.

Previous studies of repair processes of mobilized tendons have observed that epitenon cells migrate into the depth of the repair site and produce new collagen fibres (25).
So use of early active motion can change the result of flexor tendon repairs but it generates more tension than passive motion in repair sites. Passive motion generated 1-9 N where as active motion provided 1-29 N against no resistance, 15-50 N against moderate resistance. Considering the oedema in repair sites, the strength of the sutures should be increased. The ultimate strength of the traditional Kessler core suture plus running peripheral stitch was only 28 N, that cannot withdraw tension generated in active motion (26, 27).

Increasing the number of suture strands or locking during surgery increase the tensile strength of sutures (28, 29). Several recent studies have demonstrated that epitenon suture gives additional strength to the repair (30). The epitenon first technique was found to be 22% stronger than the modified Kessler technique (31) and can tolerate tension of active motion.

Conclusions
In our study with no rupture and mean of total active motion, we showed that it can be a safe method for performing active motion to have better results in no man’s land than passive. Taking into account the mean total active motion and that rupture did not take place, so we may recommend early postoperative active mobilization as a safe tendon rehabilitation method, and also conclude that it yields better results than passive mobilization.

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Original Article

Compression of Cognitive Flexibility and Adjustment of Students with Developmental Coordination Disorder and Typically Developing Students

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Objectives: The aim of this research was to compare cognitive flexibility and adjustment between two groups of students with Developmental Coordination Disorder (DCD) and typically developing students (TDS).

Method: Fifty students with DCD and 50 TDS were chosen from 12 primary schools. The Developmental Coordination Disorder Questionnaire (DCD-Q), Adjustment Inventory for School Students (AISS) and Wisconsin Card Sorting Test (WCST) were used to measure the research variables.

Results: The results of the multivariate analysis of variance (M-ANOVA) showed that the mean scores of cognitive flexibility, emotional, educational and social adjustment were significantly higher in the students with DCD (P<001). The results of multivariate regression analysis also showed that a 25% variance in cognitive flexibility and adjustment that can explain the variance of DCD in people with such a disorder (p<.001).

Conclusions: The results of the present study provide further evidence on low cognitive flexibility and adjustment observed in students with DCD.

Keywords: Developmental Coordination Disorder (DCD), Cognitive Flexibility, Adjustment

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Introduction
In the Diagnostic and Statistical Manual (DSM-IV-TR), developmental coordination disorder (DCD) is considered a motor skills disorder, which is characterized by malfunction in developing motor coordination abilities in 6 percent of children. These problems are not in accordance with children’s intellectual abilities and/or a developmental prevailing disorder or general medical condition (1). It has a considerable effect on daily life and educational performance of children (2) that might persist until adolescence (3) and be accompanied with increased problems in executive functions (4), neurological disorders (5, 6) and psychosocial maladjustments (7, 8, 3, 9, 10).

Among executive functions, lack of attention and distraction toward external stimuli has been extensively reported in children with DCD (11, 12). However, other executive functions, such as cognitive flexibility are variables that have not been sufficiently studied (4). Cognitive flexibility is an individual’s ability to use cognitive processing strategies to adapt to new and unexpected environmental conditions (13). This definition includes three important conceptual features. Firstly, cognitive flexibility is an ability which might indicate a learning process, as it can be acquired by experience. Secondly, cognitive flexibility includes the strategies of adaptation with cognitive processing. In this definition, strategy is the order and sequence of operations working to find a response to a problematic environment (an attempt to find a solution) (14). Therefore, flexibility indicates a change in complex behaviors, not discrete responses. Finally, cognitive flexibility refers to adjustment to new environmental changes. On the other hand, based on the international framework of classification for

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children and youth (15), health and function come under the influence of their activities and participations (16). Improvement of functional abilities, which may increase participatory activities, has always been the main goal of occupational therapists who work with children with DCD (17). Nevertheless, most therapists merely concentrate on these children’s motor function rather than their abilities, such as executive functions 18).

Adjustment is one of the variables that have not been studied sufficiently in children with DCD (11). It was discovered in a research that children with DCD had lower scores in attention and learning as compared to typically developing children. This factor leads to social problems of a higher level in these children. These findings indicate that children with DCD are more likely to have adjustment problems (12). On the other hand, they experience more anxiety resulting from emotional problems. Such anxiety leads to negative emotions, depression, isolation and low self-esteem (19, 20, 21). Therefore, these children experience more social and psychological maladjustments (22).

To our knowledge, earlier studies have emphasized the identification of characteristics in DCD children, and have not sufficiently discussed the psychological factors involved. Thus, attempts were made in the present study to compare cognitive flexibility and adjustment in DCD and typically developing children. Also, the role of cognitive flexibility and adjustment in predicting DCD has not been examined in any research, until now.

**Method**

**Participants** - The population under study included all secondary school first and second graders in Ardabil city in 2012 (n=990). Before beginning the study, a meeting was held with school managers and members of the parent-teacher association to achieve their informed consent and to make necessary arrangements with the schools, teachers and parents for the research process. The children with DCD were in the form of heterogeneous groups. Therefore, it was likely that different evaluations would not provide identical outcomes on identifying children with DCD. Hence, in order to better identify the children with DCD, sampling was done in two steps: the participants were chosen from students aged 10-14 from 12 primary schools in three districts of Ardabil city. A letter describing the research objectives, a letter containing the parental informed consent form, a developmental coordination disorder questionnaire (23) and a Persian guideline used for the DCDQ (24) were sent to the parents. 800 out of 990 questionnaires were completed and returned by the parents. 80 students were randomly selected among the students who received scores lower than 57 in the DCD questionnaire (DCD-Q) (23). In the second stage, in order to identify the children with DCD accurately, the ‘Children’s Self-Perceptions of Adequacy in and Predilection for Physical Activity’ questionnaire (CSAPPA) (25) was completed for the selected students. Also, clinical interviews were carried out with them. Finally, 50 students with DCD were selected. As the research method was the causal-comparative type, 50 people were selected as the control group (the selection conditions were the same, that is to say, the number of students selected with DCD in a class was the same as the number of the typically developing individuals in that class).

**Measures** - The *Wisconsin Card Sorting Test (WCST)* (26) was revised by Heaton and his colleagues in 1993. A short form of the WCST (27) contains images in different colors (red, yellow, blue and/or green), shapes (cross, circle, triangle and/or star) and numbers (one to four numbers). WCST is one of the most famous neuropsychological tests used to measure abstract thinking, cognitive flexibility, perseveration, problem solving, concept development, modification, and sustenance of attention reasoning (28).

The *Developmental Coordination Disorder Questionnaire’s (DCD-Q)* (29) first version included 17 items. The revised version was composed of 15 questions and was suitable for 1 to 5 range of age. Overall, these items evaluate three factors; motor control, elegant movements/handwriting, and...
general coordination (29). Regarding the basic acceptance of this coefficient (0.07) the amount of the result indicates the acceptance and high reliability of this tool.

The Adjustment Inventory for School Students (AISS) (30) contains 60 items measuring three main fields of emotional, social and educational adjustment (20 questions for each field). The answers are either “Yes” or “No”. A high score shows maladjustment and a low score indicates adjustment. Validity of the main form of the inventory was reported to be 0.51. It was assessed through integration of its total scores by ranking the data related to 60 students at five levels of adjustment. Reliability coefficient in the main inventory form for the total adjustment through the test-retest method was 0.93 and for all the above-mentioned fields were 0.96, 0.90, 0.93, respectively (30).

Results

The percentages of typically developing boys and girls respectively were 62% and 38%. (Boys) 62 and (girls) 33 percent of the parents of typically developing student (TDS) had primary school degrees, and (boys) 44 and (girls) 56 percent of them had high school Diploma or higher degrees. In addition, the mean (standard deviation) ages of the students with DCD and TDS aged 12-14 were 12.94 (0.74) and 1.84 (0.79), respectively.

The mean (standard deviation) scores of the students with DCD and TDS was 16.88 (5.20) and 12.27 (5.46), respectively. Moreover, the mean (SD) of the scores for cognitive flexibility of students with DCD and TDS was 56.50 (16.01) and 69.69 (19.51), respectively (Table 1).

| Table 1. Mean and standard deviation of cognitive flexibility and adjustment |
|-----------------------------|-----------------------------|
| Variables                   | DCD                        | Non DCD                    |
|                             | M±SD                       | M±SD                       |
| CF                          | 56.50±16.01                | 69.69±19.51                |
| AA                          | 7.68±3.31                  | 5.42±2.87                  |
| EA                          | 4.76±1.98                  | 3.58±2.70                  |
| SA                          | 4.44±1.80                  | 3.27±2.31                  |
| Total                       | 16.88±5.20                 | 12.27±5.46                 |

Before applying parametric multivariate analysis of variance, Box’s and Levene’s tests were used to observe its assumptions. According to Box’s test, which was not meaningful for any of the variables, uniformity condition for variance/covariance matrices was observed correctly (P>0.05). According to Levene’s test, which was not meaningful for all the variables, equality condition for the group variances was observed.

The results of Wilk’s Lambda Test showed that the effect of the group on the combination of cognitive flexibility and adjustment components is significant [Wilks=.568, F=17.59]. The test mentioned above permitted the usability of multivariate analysis of variance (M-ANOVA). The results showed that there is a significant difference between at least one of the variables of the study in the two groups. Eta-square (which is, in fact, the correlation coefficient square between dependent variables and group membership) shows that the difference among the two groups -with respect to cognitive flexibility and adjustment- is significant and the rate of difference is approximately 43 percent. That is to say, 43% of the variance related to the difference between the three groups is due to the influence of interaction of dependent variables.

The results obtained from the analysis of multivariate variance showed that the means of emotional adjustment (F(1,96)=13.02), educational adjustment (F(1,96)=6.09), and social adjustment (F(1,96)=7.84) scores were significantly higher in the students with developmental coordination disorder (P<0.001) (Table 2).

| Table 2. Results of the analysis of multivariate variance on mean cognitive flexibility and adjustment in students with DCD and TDS |
|-----------------------------|-----------------------------|
| Variables                   | DF  | MS  | F   | P   | Partial Eta Squared |
|                             |     |     |     |     |                   |
| CF                          | 1   | 4259.02 | 13.43 | .000 | .123 |
| AA                          | 1   | 125.45 | 13.02 | .000 | .119 |
| EA                          | 1   | 33.91  | 6.09  | .015 | .060 |
| SA                          | 1   | 33.48  | 7.84  | .006 | .076 |

The mean cognitive flexibility score (F(1,96)=13.43) in the students with developmental coordination disorder was significantly less than in the TDS.
The t-test was used for the two independent groups to compare the total mean scores of adjustment. The results showed that the mean scores of the students with DCD were significantly higher than the ones in the typically developing group ($t=4.241, df=96, p<0.001$).

In order to determine the influence of each variable, cognitive adjustment and flexibility — as the predictor variables, and DCD — as the criterion variable — they were analyzed by multivariate regression. The results showed that 25% of the variance is explained by cognitive adjustment and flexibility. With respect to beta values, cognitive flexibility (Beta=.337) and emotional adjustment (Beta=0.352) can explain variance of developmental coordination disorder in people suffering from it ($P<0.001$) (Table 3).

### Table 3. Results of the analysis of multivariate regression of cognitive flexibility and adjustment in two groups of students with DCD and TDS

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** $P<.001$

### Discussion

The results of the present research showed that children with DCD have lower cognitive flexibility and adjustment than typically developing children. They also showed that children with DCD have lower cognitive flexibility than typically developing children.

Typically, in growing children, performance in complex cognitive tasks and performance in motor coordination are related to each other (30, 31, 32). In research conducted on children with DCD, Roebers & Cover (31) concluded that the two functions of complex cognitive tasks and motor coordination (even by controlling age of participants) are significantly related to each other. These results indicate that there are common processes in cognitive and motor functions. It might also indicate that there are high-level cognitive processes in both factors and this is responsible for simultaneity of cognitive and motor deficits in the children with DCD. The results of the studies specified that there is a close relationship between developmental coordination disorder and executive functions, for when the duties are in the high-level executive functions such as cognitive flexibility, accuracy and quick action in tasks, working memory and self-regulation and performance of children aged 6-15 with DCD decrease extensively (33, 12, 34, 35). Michel et al. (37) concluded that children with lower motor coordination in controlling avoidance responses (Stroop Test) and distraction (cognitive flexibility) showed weaker performances. Stating that the problem of children with DCD in cognitive tasks is due to a disorder in motor coordination does not seem to be entirely true.

A test on two groups of children with developmental coordination disorder and typically development using Reaction Time Test showed that the motor function of the two groups was similar whereas in the next stage, performance of children with DCD was considerably lower (37). In explaining the findings of the present research, it can be stated that dysfunction of children with DCD might be due to the complex motor responses caused by complexity of tasks (the necessity of quick action which is as correct as possible). Therefore, children with DCD have problems in shifting accuracy and correctness in doing complex responsibilities. As a result, when these children are unable to perform the tasks that require high cognitive flexibility, they encounter
problems in learning skills, because cognitive flexibility is extremely important in acquiring new skills and cognitive processes and facilitating motor functions (38).

Another finding of this research was adjusting problems in the students with DCD. We observed that students with DCD had less adjustment as compared to the TDS. Because of weakness and lack of motor activities, these students also have communication problems at school, while playing and being among their peers. Perpetuation of such conditions for prolonged periods of time will result in reduction of adjustment in these children (39). In another research, Stephenson & Chesson (10) showed that developmental coordination disorder causes problems in psychosocial and emotional adjustments, isolation, educational problems, anxiety, obsessive-compulsive disorder and some other disorders. Moreover, children with DCD enjoy insufficient social support, have low self-esteem, and possibly have a higher level of self-perception in proportion to their isolation (40). Therefore, the feedback of this level of self-perception in proportion to interaction and performance makes a child pay more attention to his/her weaknesses, insufficiencies and failures. Finally, a child will be isolated and will experience considerable social problems. Educational maladjustment of the students with DCD starts when these students enter school while having motor problems and weak social skills. It seems that these children are kept away from school activities from the very beginning, and on the other hand, are not supported by their own peers; nor are they allowed participation in school activities. Therefore, these conditions remain as a constant feature in educational performance. Since children with DCD have problems in shifting accuracy in doing complex and common tasks in the educational atmosphere of school (such as dictation or doing class exercises in a limited time), these factors cause educational adjustment problems for these students and finally lead to their academic failure (41). Our findings confirmed earlier studies on cognitive flexibility problems and emotional, educational and social adaptabilities in children with DCD. These variables are related to one another at a deep level. Therefore, existence of each of them predicts the prevalence of the other.

The results of the multivariate regression analysis showed that cognitive flexibility and adjustment explain 25% of variance of developmental coordination disorder. Meanwhile, cognitive flexibility and emotional adjustment have significant predictive power for DCD. This result shows that 75% of variance and the remaining factors are explained by other variables affecting DCD. With respect to the lack of corresponding findings in the record, this finding can be used to prove that cognitive flexibility and adjustment have considerable effects on the symptoms of developmental coordination disorder. Therefore further studies are required in this field.

Limitation- One of the limitations of this research is lack of control of co-morbid disorders with developmental coordination disorder in the participants; the co-morbidity of certain movement neurological disorders such as attention deficit/hyperactivity disorder (ADHD) / or learning disorders might have affected the research findings. This should be kept in mind by other researchers. Another limitation is that the present research was conducted at a certain time span. Therefore, it is recommended that cognitive flexibility and adjustment in different groups of neurodevelopment disorders be studied in a follow-up manner to gain a better understanding of the possible damages in this regard.

Acknowledgements:
The researchers appreciate all the managers and schoolteachers’ efforts who helped conduct the current study, especially the parents and students who took time to contribute to this research.

Authors’ Contributions - All authors had equal roles in design, work, statistical analysis and manuscript writing.

Conflict of Interest: None declared.
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Body Part Concerns Questionnaire (BPCQ) in an Iranian Population with Special Needs

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*Islamic Azad University (Tehran Medical branch)*

**Objective:** Cosmetic surgery has become increasingly popular in the past decades. The purpose of this study was to design a questionnaire for screening ‘negative body image’ in special needs populations referring to cosmetic clinics.

**Method:** One hundred and fifty special needs individuals in cosmetic clinics were randomly selected and assigned to fill questionnaires to assess their body part concerns.

**Results:** Results of reliability analysis and validity have shown the effectiveness of this questionnaire for recognizing individuals with negative body image. These preliminary results suggest that body dysmorphic disorder may be relatively common among patients seeking cosmetic surgery.

**Conclusions:** A high proportion of patients in cosmetic clinics have demonstrated significant body image concerns. These relatively common body image concerns deserve more study in adolescents and people with special needs.

**Keywords:** body image, body part, body dysmorphic disorder, body part concerns questionnaire, cosmetic clinics

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Accepted: 05 Aug 2012

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**Introduction**

Body image is a person’s perception of his/her physical appearance. There is little relation between the actual appearance and sense of attractiveness. Great physical appearance doesn’t guarantee a positive body image, or does lacking natural beauty lead to a negative body image. In fact, beauty doesn’t properly reflect one’s feelings of body image; it depends on one’s appearance. There are relations between body image and feeling, thinking and acting in particular conditions (1). One of the key features of the ‘Body Dysmorphic Disorder’ (BDD) definition is excessive preoccupation with slight or imagined defect in body appearance (2). BDD has the worst outcome of all the body image disorders (3). Since BDD has a negative impact on quality of life (4) screening BDD patients in clinical settings seems important (5). Sense of body image may put an adolescent’s physical health at risk (6). However, physical concerns don’t necessarily reflect body dysmorphic disorder (7). In addition, there are high numbers of BDD patients that have extreme body image dissatisfaction (8). The main feature of BDD is excessive attention to negative body image. Subsequently, negative evaluation of images can lead to rumination, mood changes and compulsive behaviors (3). Self-worth based upon appearance (9) and poor body image is important in BDD (10). The feeling of attractiveness (11) and body image can influence BDD symptoms (12). BDD patients have high rates of suicidal ideation and attempts and also completed suicide attempts (13). Since this disorder can have a devastating effect on the quality of a person’s life, it seems necessary to identify it at an early stage (14).

Compared to men, women are more likely to undergo cosmetic surgery. Lack of body satisfaction can predict cosmetic surgery. Experience of cosmetic surgery among family or friends can increase the rate of cosmetic surgery in women. Media has no effect on the rate of cosmetic surgery.
in either gender (15). Some bodily concerns about weight and breast augmentation have the potential of developing body image disorders like BDD (16, 17).

Method
The Body Part Concern Questionnaire (BPCQ) has been prepared as a screening tool for patients with negative body image in cosmetic clinics. This study has been conducted on 150 female special needs patients in cosmetic clinics in Tehran, Iran. All of them wanted to have cosmetic surgery. Their average age was 29.8 years and 65% of them were single. Participants completed the questionnaires and were administered clinical interviews to evaluate body image concerns. All statistical procedures were accomplished with SPSS 18 statistical software.

Results

This 33-Item questionnaire evaluates body image satisfaction in terms of positive and negative items. The BPCQ is graded by a Likert scale, and the score is achieved by summing the scores of questions 1 to 33. The total score ranges from 33 to 165 with a higher score reflecting greater agreement. The answering options are: strongly agree, agree, undecided, disagree and strongly disagree.

Pearson correlation of the BPCQ with the Physical Appearance Concern Questionnaire (PACQ) was 0.259 (P=0.002) (18). The validity of the questionnaire has been checked by a number of university professors. The reliability of the questionnaire was evaluated by Cronbach’s Alpha (α=0.883), suggesting that the items have relatively high internal consistency with corrected item total ranging from 0.011 to 0.535. Mean variance and Cronbach’s Alpha for each item deleted has been shown in table (1).

<table>
<thead>
<tr>
<th>Item</th>
<th>Scale Mean if Item deleted</th>
<th>Scale Variance if Item deleted</th>
<th>Corrected Item-Total Correlation</th>
<th>Cronbach’s Alpha if Item deleted</th>
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<td>33</td>
<td>69.6069</td>
<td>191.726</td>
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</tbody>
</table>
Results of reliability and validity of the BPCQ have demonstrated that using this questionnaire can help screen patients for negative body image in cosmetic clinics.

Discussion

This questionnaire consists of questions on several body parts and the general feeling about skin color, weight and body proportion. This questionnaire therefore identified the undesirable parts of body. In this study 141 out of 150 patients had a negative body image.

According to the BPCQ, 60.5% of participants were diagnosed with BDD after the clinical interview. Approximately 90% of patients in cosmetic clinics have demonstrated dissatisfaction with their body image.

Based on 150 filled BPCQs, the top 10 common locations of perceived flaws in order were: abdomen, waist, weight, body hair, hips, body proportion, height, thighs, skin, and breasts. The most satisfactory parts of body are: hair color, eye size, eye color, mouth shape, face shape, neck, chin & jaw, hand & wrist, shoulders and skin color. In a sample from Turkey, 43.8% of the 420 female college students studied had body image dysfunction. The most common areas of concern were head, face and hips (19). Out of the 156 medical students in Karachi University, 78.8% of the students reported dissatisfaction with some aspect of their appearance (22).

Body dissatisfaction is notably one of the most important features of BDD (23), anorexia and bulimia nervosa. Thus, evaluation of body image satisfaction is a necessary element for those treating eating disorders and BDD. In fact, having a negative body image is not a good reason for having cosmetic surgery. Conversely, those supposed to have normal body image had better be screened. In our opinion, some patients who have no insight of a poor body image will understand how they feel about their physical appearance upon filling this questionnaire.

Some of the BDD patients have continual plastic surgeries with hopes of finding personal satisfaction and a perfect body. However the perfect body is almost unachievable (1); nearly all of them have a negative body image. BDD sufferers are often concerned with more than one part of their body (10, 20).

This questionnaire helps physicians understand that patients have concerns in specific parts or that they have a totally negative body image. In case of having poor body image, surveying BDD seems necessary. Body image dissatisfaction can be used as a predictor for certain disorders in which it can play a role as a risk factor, such as eating disorders (21, 24). 20.7% of patients seeking rhinoplasty had a potential diagnosis of BDD (20), so it would be useful to screen them for BDD symptoms in cosmetic clinics. Moreover, there are several patients who have no BDD symptoms, but who have negative body image. Informing such individuals of such feelings could help them avoid cosmetic surgery and turn their negative body image into a positive one.

To our knowledge, this is the first time this tool has ever been used for identifying patients with negative body image in cosmetic clinics in Tehran, Iran.

We acknowledge a number of limitations in the present study. First, all participants were female because male patients weren't interested in taking part in the study. This may limit the ability to generalize our findings. Second, if we could have worked on a larger sample size, our results would be much more reliable. Despite these limitations, this study provides new and insightful information into people’s perception towards physical appearance and how people with special needs are prioritized in Tehran, Iran. More research is required to develop a screening questionnaire or interview for identifying patients with special needs and others seeking cosmetic surgery.

With the increasing prevalence of plastic surgery in Iran, it is useful to consider those factors that may increase the likelihood of undergoing cosmetic surgery in a non-patient population in future studies.

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Recourse Allocation in Young and Elderly Adults

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Iran University of Medical Sciences, Rehabilitation Research Center, Tehran, Iran

Objectives: The role of cognitive processes in postural control was shown in dual task studies. However, there was no definite evidence on how verbal instructions influence the allocation of attention to postural control. This study determined whether young and elderly adults are able to deliberately control the resource allocation when performing a sensorimotor and cognitive task simultaneously and if there are any differences between young and older adults in this regard.

Method: A Cross-sectional study was performed in 16 young adults aged (23.95±3.31) and 20 elderly adults (61±2.21). Participants were selected by non-probable sampling method. Parallel standing and tandem standing on a hard surface were used as postural tasks. Force plate was used for postural performance. Postural sway was measured and the choice reaction time task was conducted as the cognitive task. Dual-task performance was measured under three different instructions including paying attention to the cognitive task, postural task, and equal attention to both tasks.

Results: For postural performance the main effect of instructions and interactions by difficulty and groups were not significant (P ≥ 0.05) for cognitive performance. However, the main effect of group was significant (F = 5.672, P = 0.023), showing that elderly adults have longer reaction times. The interaction of instruction by group effect and also interaction of instruction by postural difficulty on mean reaction time was also significant, (F = 3.710, P = 0.030), (F = 5.242, P = 0.008) respectively.

Discussion: Because of age related changes in the brain, flexibility in elderly adults are less than young adults.

Keywords: attention, resource allocation, instruction, flexibility, dual task

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Accepted: 28 Jul 2012

Introduction
Falls are a serious problem in health care (1). In addition to the cost and financial burden to health system (2), loss of independence in living worsens quality of life and satisfaction in elder adults (3). Therefore, identifying and modifying fall's risk factors are important. Various risk factors such as sensory impairment, visual deficit, muscle weakness, balance control disabilities, impairment have been proposed as the main causes for falling till now (4); although it may be a combination of some of these factors, not all.

Researchers have found that falls often occur in multitasking situations where elderly adults are trying to maintain their balance and do others task such as talking at the same time. The simultaneous occurrence of falling and other tasks recently led to the formation of a hypothesis, that perhaps falling is associated with multitasking. In other words, falling is the consequence of multiple tasking (5-7). Henceforth a huge flood of studies began to investigate the impact of multitasking, the impact of simultaneous tasks on each other, the effect of concurrent tasks on equilibrium, and so on (7-10). Now the results of researches done in this area have confirmed this hypothesis, in which the concurrent performance of cognitive tasks increases spontaneous postural sway (11-13), and that increased postural sway in elderly adults enhances the probability of falling (14).

Cognitive processes are a part of the postural control system. Hence the simultaneous performance of a cognitive task influences postural performance (12). In other words, cognitive processing is required for
integrating assembled sensory information to produce appropriate motor responses to maintain balance. Therefore demands of two simultaneous tasks to a limited processing capacity lead to an interference between them and deteriorates performance efficiency of one or both (15, 16).

The aging process reduces cognitive capacity on one hand and increases the attention demand of postural control on the other (because of the effect of the aging process on various aspects of postural control system) (17). Therefore, elderly adults show slower performance of postural and/or cognitive tasks compared to young adults in dual task situations. Here is an unanswered question: how do cognitive deficits resulting from the aging process affect the performance of dual tasks in elderly adults? Does the ability of the brain to flexible allocation of attention to concurrent tasks reduce as result of the aging process? And does this point prevent flexible allocation of attention in multiple tasking? There are many clinical and laboratory evidences that show structural and functional changes of the brain's frontal lobe with the aging process (18,19). The frontal lobe is responsible for the executive function which is a cognitive process that regulates, controls, and manages other cognitive processes such as planning, working memory, attention, problem solving, verbal reasoning, inhibition, mental flexibility, and task switching (20). Although there are many studies have been conducted on dual tasking till now, but the answer of this question cannot be found in earlier studies. So the aim of the present study was to determine if a decline in mental flexibility and task switching is a cause of more pronounced dual task effects in elderly adults.

Method

Participants - Twenty elderly community dwellers aged 60-73 (5 females and 15 males, age=62.87±4.57 years, height=168.75±9.00cm, weight=71.30±11.87kg, mean±SD) and 16 young adults aged 20-30 (3 females and 13 males, mean age=23.95±3.22 years, height=170.18±6.75cm, weight=71.43±13.13.44 kg) participated in the experiment. Participants signed the informed consent form prior to participation in the study. The testing protocol was approved by the ethics committee of Tehran University. Upon self-report, participants with known neurological, musculoskeletal or balance disorders were excluded. Each participant had normal hearing and ability to perform postural tasks desired in the present study. Performance in the MMSE (Mini Mental State Examination) test was used to determine mental status and a cut off≥24 (21) was used as an inclusion criteria. The BBS (Balance Berg Scale) was used as a clinical test to evaluate functional balance with a cut off ≥50 (22). Two groups of young and elderly adults were matched for gender, weight and height to remove the possible effects of these factors on postural performance.

Postural task - Postural sway was assessed in two different positions, including: (1) parallel standing on a force plate, (2) tandem standing on a force plate. Subjects stood barefoot with their arms hanging at their sides. They were not permitted to move their limbs and head or speak during the data collection period. Subjects looked at a wall 3 meters away from their faces.

Center of Pressure (COP) data were captured using strain gauge; Bertec 4060-10 force platform and Bertec AM-6701 amplifier (Bertec Crop, Columbus, OH). Data were collected at 100 Hz, stored on a Pentium-based PC and then transferred to MATLAB and computed COP parameters were measured.

Cognitive task - The cognitive task used in this experiment was choice reaction time task (Odd ball task) (23), in which two different voices, one of high frequency (1000Hz) and one of low frequency (500Hz) were played by a laptop (Model of Sony VGN-SZ640). The numbers of high and low frequency voices and intervals between the stimuli were random. Each subject had to respond to low frequency voices by pressing the hand-held probe as fast as possible during 32 seconds. Mean reaction time was recorded as an indicator of performance in the cognitive task. The study session started by performing the odd ball task alone and in a seated position to familiarize the subjects with the cognitive task. It was then followed by performing cognitive and postural tasks simultaneously.

Procedure - Quiet standing postural sway was recorded at three levels of postural difficulty: (1) parallel standing on force plate, (2) tandem standing on force plate. The aim of manipulating base of support inputs was to change the difficulty of the postural task. Subjects were required to perform each postural standing task concurrently with the cognitive task while following one of three different priority instructions; cognitive task priority, postural task priority, equal priority. In sum, participants were exposed to 6 (two different postural tasks ×
three different instructions= permutations) experimental conditions. For each condition, three trials were performed. The two postural conditions were presented randomly. Rest was given to subjects after each five trials or upon their request, lasting for a minute. Postural performance was captured for 32 seconds for each experiment.

**Data analysis** - Residual analysis on COP data showed a cut-off frequency of 10 Hz (24). Therefore COP signals were filtered with sixth order Butterworth, zero-phase low-pass filter at 10 Hz. Parameters calculated from COP data were mean total velocity, phase plane portrait, and standard deviation (SD) of velocity in AP and ML directions. The rationale for choosing multiple COP parameters was their ability to measure different aspects of postural behavior and their respective high reliability. For example, phase plane portrait provides information on static and dynamic dimensions of postural control by considering both position and velocity of COP. Previous studies have shown high test-retest reliability of these parameters (21, 25).

On the other hand, mean reaction time during the Oddball was calculated for cognitive tasks, and only trials with correct responses were included for analysis. Three percent of trials were discarded because of errors in response to low frequency stimuli.

**Statistical analysis** - To evaluate normal distribution of data, values of COP parameters and cognitive scores were submitted to the Kolmogorov-Smirnov test and the results confirmed use of parametric tests. The average values of dependent variables for three trials of each experimental condition were used for statistical analysis. To examine postural performance in quiet stance conditions, 2×2×3 mixed model analysis of variance was used to determine the interaction and main effects of 3 factors (two groups; two levels of postural×three instructions) for each of the COP measures. Mauchly test of sphericity assumption and Levene's test of equality of variances assumption were considered for within-subject and between-subject effects. Multiple comparisons were made using Bonferroni method. All effects were considered as significant at (P≤0.05).

**Results**

**Postural performance**

Table (1) shows the mean and SD of COP parameters in different conditions of postural control and instructional sets for both groups. Also, the ANOVA results have been reported for main effects and interactions of independent variables in Table (2).

<table>
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<th>Instructional Sets</th>
<th>Levels of postural difficulty</th>
<th>Variable Priority-Cognition</th>
<th>Variable Priority-Posture</th>
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<tbody>
<tr>
<td></td>
<td>Parallel standing</td>
<td>Young</td>
<td>Old</td>
<td>Young</td>
<td>Old</td>
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<tr>
<td>Mean total velocity</td>
<td>1.425 (0.141)</td>
<td>1.611 (0.249)</td>
<td>1.513 (0.379)</td>
<td>1.560 (0.211)</td>
<td>1.626 (0.380)</td>
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<td>Phase plane portrait</td>
<td>1.952 (0.576)</td>
<td>1.807 (0.314)</td>
<td>2.021 (0.512)</td>
<td>1.902 (0.478)</td>
<td>1.866 (0.266)</td>
</tr>
<tr>
<td>SD of velocity (AP)</td>
<td>1.301 (0.117)</td>
<td>1.282 (0.122)</td>
<td>1.404 (0.283)</td>
<td>1.297 (0.092)</td>
<td>1.314 (0.150)</td>
</tr>
<tr>
<td>SD of velocity (ML)</td>
<td>1.013 (0.132)</td>
<td>1.001 (0.085)</td>
<td>1.170 (0.165)</td>
<td>1.049 (0.216)</td>
<td>1.172 (0.203)</td>
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<tr>
<td>Tandem standing</td>
<td>4.066 (1.375)</td>
<td>4.115 (1.743)</td>
<td>3.937 (1.096)</td>
<td>4.230 (1.339)</td>
<td>3.897 (0.973)</td>
</tr>
<tr>
<td>Mean total velocity</td>
<td>4.907 (1.653)</td>
<td>4.962 (2.098)</td>
<td>4.758 (1.27)</td>
<td>5.126 (1.593)</td>
<td>1.663 (1.553)</td>
</tr>
<tr>
<td>Phase plane portrait</td>
<td>4.253 (1.857)</td>
<td>4.474 (2.182)</td>
<td>3.652 (1.381)</td>
<td>4.508 (1.813)</td>
<td>3.520 (1.301)</td>
</tr>
<tr>
<td>SD of velocity (AP)</td>
<td>2.069 (0.346)</td>
<td>2.653 (0.572)</td>
<td>1.851 (0.667)</td>
<td>2.720 (0.319)</td>
<td>2.741 (0.769)</td>
</tr>
<tr>
<td>SD of velocity (ML)</td>
<td>2.989 (0.742)</td>
<td>3.807 (0.572)</td>
<td>3.807 (0.667)</td>
<td>3.807 (0.319)</td>
<td>3.807 (0.769)</td>
</tr>
</tbody>
</table>

Table 1. Mean/SD of COP Parameters in Different Conditions of Postural Control and Instructional Sets.
Main effects of group, postural difficulty and cognitive difficulty were not significant for either of the parameters with the exception of phase plane portrait, SD of velocity (AP) and (ML) for which the main effect of postural difficulty was significant; SD of velocity (ML) for main effect of group was also significant. Interactions of groups by postural difficulty, group by instruction, postural difficulty by instruction were not significant for any of the dependent variables with the exception of SD of velocity (AP) and (ML) for which main effect of group was significant; F=3.902, P=0.05 and F=9.031, P=0.003 respectively.

Cognitive performance
The mean and SD of mean reaction times in different conditions of postural difficulty and instructional sets for both groups have been demonstrated in table (3) and (4).

Table 3. Mean (SD) of mean reaction time in Different Conditions of Postural Control and Instructional Sets.

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Mean Total Velocity</th>
<th>Phase Plane Portrait</th>
<th>SD of Velocity (AP)</th>
<th>SD of Velocity (ML)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main effect</td>
<td>F Ratio</td>
<td>P</td>
<td>F Ratio</td>
<td>P</td>
</tr>
<tr>
<td>Group</td>
<td>0.360</td>
<td>0.553</td>
<td>0.482</td>
<td>0.492</td>
</tr>
<tr>
<td>Instruction</td>
<td>1.002</td>
<td>0.372</td>
<td>0.550</td>
<td>0.579</td>
</tr>
<tr>
<td>Postural difficulty</td>
<td>165.999</td>
<td>0.999</td>
<td>167.279</td>
<td>0.000</td>
</tr>
<tr>
<td>Group × Instruction</td>
<td>0.245</td>
<td>0.783</td>
<td>0.151</td>
<td>0.860</td>
</tr>
<tr>
<td>Group × Postural difficulty</td>
<td>1.025</td>
<td>0.319</td>
<td>0.872</td>
<td>0.357</td>
</tr>
<tr>
<td>Instruction × postural difficulty</td>
<td>0.274</td>
<td>0.761</td>
<td>0.294</td>
<td>0.746</td>
</tr>
<tr>
<td>Group × Instruction × Postural difficulty</td>
<td>0.267</td>
<td>0.746</td>
<td>0.507</td>
<td>0.604</td>
</tr>
</tbody>
</table>

Table 4. Summery of Analysis for Mean Reaction Time: F Ratio and P Value by Variable.

<table>
<thead>
<tr>
<th>Cognitive Performance</th>
<th>Main Effect</th>
<th>F Ratio</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>5.672</td>
<td>0.023</td>
<td></td>
</tr>
<tr>
<td>Instruction</td>
<td>1.057</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>Posture</td>
<td>0.237</td>
<td>0.630</td>
<td></td>
</tr>
<tr>
<td>Group × Instruction</td>
<td>3.710</td>
<td>0.030</td>
<td></td>
</tr>
<tr>
<td>Group × Posture</td>
<td>1.330</td>
<td>0.257</td>
<td></td>
</tr>
<tr>
<td>Instruction × Posture</td>
<td>5.242</td>
<td>0.008</td>
<td></td>
</tr>
<tr>
<td>Instruction × Posture × Group</td>
<td>0.213</td>
<td>0.808</td>
<td></td>
</tr>
</tbody>
</table>

Main effect of group was significant F=5.672, P=0.023, showing that elderly adults have longer reaction times.

The interaction of instruction by group effect and interaction of instruction by postural difficulty on mean reaction time was significant; F=3.710, P=0.030, F=5.242, P=0.008 respectively. Other main effects and interactions were not significant.

Discussion
The aim of the present study was to compare the flexibility of resource allocation in young and elderly adults. Results from the present study showed that the young group can adopt instruction and reduce reaction time by following cognitive priority instruction, but focus of attention on postural task did not change postural performance. Our results match the results of ka-Chun Siu et al’s findings (26). In their study shifting attention toward a secondary cognitive task was identified by reduction in verbal reaction time and also postural performance was stable under different instructional sets. Stable postural performance under different priority instructions may be due to the automatic allocation of attention to postural tasks. It has been demonstrated that postural control is to some extent automatic and to some extent cognitively accessible (27). Hence it is conceivable that cognitive performance is influenced greater by instructions. Instruction to minimize sway cannot increase the load of the postural component because the postural control system ordinarily does it, if left alone.

Our results showed that in the elderly adults group, different instructions did not change cognitive and postural performance. In Brown and Doumas studies (28, 29) elderly adults prioritized sensorimotor over cognitive performance only in challenging task contexts. One explanation for these results is that in elderly adults maintaining stability requires more resources, and because resources cannot be released,
cognitive performance does not improve following instructions. That is, elderly adults protect posture and prioritize it despite instructions to pay more attention to the cognitive task. But it is interesting that postural sway in simple and difficult postural tasks were similar to dual mode in our study. It may indicate that despite sufficient resources, inadequate flexibility of resource allocation causes greater dual task cost in elderly adults. Less flexibility might be due to age related changes in different parts of the central nervous system especially prefrontal cortex which has an important role in following instructions (30,26). Given that central processing resources are limited; preservation of somebody's safety and at the same time accuracy of their cognitive performance requires flexible shifting of attention. Since changes related to age influence brain's higher functions such as executive functions it is possible that shifting attention is impaired in elderly adults and dual task performance reduction occurs as a result. Some studies suggest that postural threat modifies postural control; as increased postural threat is associated with a shift to more conscious control over behavior. For instance, changing postural behavior in highly threatening conditions, reduction of attention is impaired in elderly adults and dual task performance reduction occurs as a result. Actually we know that in young adults resource allocation has an adaptive nature, i.e. according to instruction, postural threat and importance of secondary task, the facilitating effect (i.e. reduced sway to aid supra postural task with high precision demand) or resource competition (i.e. when precision demand and cognitive load of supra-postural task is high, but postural task is also demanding) may be accrued (32). But the pattern of adaptive resource allocation in elderly adults does not adopt it because of differences in postural control system.

Conclusion
The processes of lifelong learning and gradual adaptation to biological changes prevent elderly adults from following instructions in spite of sufficient resources.

References


The Effects of Unloader Knee Orthosis and Lateral Wedge Insole in Patients with Mild and Moderate Knee Osteoarthritis (OA)

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\textbf{Objective:} Patients suffering from mild to moderate knee osteoarthritis may be treated with unloader knee orthoses or laterally wedged insoles. This study aimed to identify and compare the effects of two orthoses in these patients.

\textbf{Methods:} 56 patients with medial compartment knee OA were evaluated when wearing an unloader knee orthosis and insoles with a 6° lateral wedge which were randomly assigned. Testing was performed at baseline and after 6 months of use with the two types of orthoses. The KOOS score was used to assess outcomes in this study. A paired T test was used for comparing base line and the 6th month post interventions KOOS sub scale score. An independent T test was used for analyzing the efficacy between the two orthoses.

\textbf{Results:} Each of the interventions improved all the parameters comparing to the baseline condition (P=0.000). However, in comparing the effect between these orthoses, we did not find significant differences in activities of daily living (P=0.871), or sports and recreational activities (P=0.351). The pain and symptoms (P=0.000) were, however, significantly different between the two interventions.

\textbf{Conclusion:} The unloader knee orthoses were more effective than lateral wedge insoles in reducing pain and symptoms.

\textbf{Keywords:} knee osteoarthritis, conservative treatment, knee unloader orthoses, lateral wedges

\textbf{Submitted:} 18 Jan 2012
\textbf{Accepted:} 22 Aug 2012

\textbf{Introduction}
Knee osteoarthritis (OA) is the most common type of arthritis, especially in the elderly population (1, 2). Pain and reduced activity in OA causes functional defects, disabilities and reduction in the quality of life (3, 4). Long term disabilities lead to decreased mobility and reduced independence of the individual, plus difficulty in both daily living activities and recreational and sports activities (3). The prevalence of medial compartment osteoarthritis is 10% higher than that of lateral compartment osteoarthritis, because 62% of the weight line passes through the medial side (5). Initially there is a tendency to a varus deformity, followed by an increase in the adduction moment in the knee during gait and reduced joint space in the medial compartment (4, 6, 7). The incidence of this complication in the United States of America population was reported in 2003 to be approximately 20 million people and was predicted to reach 40 million in 2020 (8). The potential consequences of medial compartment knee OA is therefore a considerable burden for individuals and society; because of the costs of the related interventions and treatments (9).

The overall goals of conservative treatment in osteoarthritis are to reduce pain, improve function and reduce disease progression rates (10). Application of knee unloader orthoses and the use of lateral wedges to inlays are current conservative procedures used in the treatment of this complication (10). These approaches aim to create corrective forces to reduce the varus forces acting on the medial side of the knee (11).

Cross over studies have previously demonstrated that valgus braces improve confidence during walking and also aid in the ability to push off (11), and that custom made patient-adjustable knee braces improve function, stiffness, varus angulation and reduce medial compartment loading of knee (12).
One cross-sectional study suggested that valgus braces immediately improved the function of the patient with unicompartmental osteoarthritis of the knee (13). A randomized clinical trial by Kirkley et al also showed that unloader knee orthoses were effective in improving quality of life and function in knee OA patients (7).

In comparison with another types of knee orthoses, knee unloader orthoses have been shown to provide a more successful effect (12, 14, 15). However, knee orthoses have many disadvantages, because using them requires upper limb strength, they are more expensive than insoles, they may cause skin sensitivity, and also reduce knee flexion and foot clearance during walking in patients with knee OA (7, 16).

Another alternative method in realignment of weight bearing load through the knee is the use of footwear modifications. The lateral wedge insole has been suggested for conservative treatment of mild knee OA. Kerrigan et al (17), in a cross over study, reported that lateral wedged insoles with 5° and 10° inclines were effective in reducing the varus torque at the knee during walking. A prospective quasi-experimental study for the effectiveness of lateral wedge insoles has also shown that this approach is effective in improving symptoms in medial compartment knee OA (18). Shimada et al (19), and Hinman et al both reported positive effects of lateral wedge insole use in reduction of the adduction moment in knee OA subjects. An added advantage of this type of orthotic intervention is that it is more economical than a sophisticated knee or thesis (18, 20).

However, few objective comparative studies exist which have compared knee or those to lateral wedged insoles by studying their effect on clinical parameters such as pain, daily living activities, recreational and sport functions and quality of life. One randomized controlled trial has shown that both orthoses decreased clinical parameters when compared to baseline, but did not report any differences between them in effecting pain, stiffness and function as measured by WOMAC (21). Due to their low cost and user-friendly design, laterally wedged insoles are thought to be a alternative option for the treatment of symptoms with medial compartment knee OA (18, 20). The aim of this study was therefore to identify and compare the effects of lateral wedge insoles to that of custom moulded unloader knee orthoses on the pain, daily living activities, recreational and sport function and quality of life in symptomatic individuals with medial compartment knee osteoarthritis.

**Method**

**Subjects** - Fifty six individuals (mean age 60.10 years, body mass index 27.74 kg/m²) participated in this quasi-experimental study. Eighty three subjects were referred to the orthotics & prosthetics clinic of University of Social Welfare and Rehabilitation Sciences. The sample selection was based on non-probability judgment sampling. Referred subjects were assigned to participate in this study according to the following inclusion and exclusion criteria.

Inclusion criteria included: pain in one or both knees, grade 1 or 2 of knee osteoarthritis according to the Kellgren/Lawrence Scale (range 0-4) (22). Subjects who had received knee arthroscopic surgery in the past 6 months, suffered from knee trauma or amputation of a lower limb, neurological disease, a symptomatic spine, hip, ankle or foot disease, any intra-articular steroid injections in the past 3 months, hyaluronic acid injection in the last 9 months, any previous tibial fractures, skin disease, peripheral vascular disease, blindness, any severe cardio vascular defect or an inability to apply a brace (e.g. due to arthritis in the hand or difficulty in bending) were excluded from study. Selected patients were assigned randomly to two groups of intervention (lateral wedge insoles or unloader knee orthoses). Subjects wore lateral wedge insoles or knee orthoses on the affected side. The subjects with bilateral knee pain wore lateral wedge insoles or knee orthoses bilaterally. Subject characteristics are reported in table 1. The Ethical committee of University of Social Welfare and Rehabilitation Sciences approved the performance of this study.

**Description of insoles and knee unloader orthoses -**

Lateral wedge insoles were prepared from cork composite (Thermocork™) (Etrex Worldwide, Inc, Teaneck, New Jersey) with a density of 60 durometers which have high resistance to compressive deformation. The insoles were constructed with a medio-lateral elevation of 10 mm along the entire lateral length of the foot, which produced a 6° lateral wedge. A previous investigation has demonstrated that elevations greater than this are uncomfortable when worn (17). The lateral wedge insoles were cut to fit to subjects’ shoes and were placed under the removable insert of the shoes. In subjects with unilateral knee osteoarthritis, a lateral wedge insole was used for affected side and a neutral –wedge insole with 0 medio-lateral incline was used on non-affected side. To control the effect of the lateral wedge insole and knee orthosis, subjects were fitted with a comfortable,
A lightweight pair of shoes (Iran melli shoe) with a 1 inch heel height. The other group of subjects used knee unloader braces, which comprised of a bilateral side bar design. The knee unloader orthoses were custom moulded and individually constructed from a cast of each subject’s lower extremity. All orthoses construction was performed by an experienced orthotist. This orthoses included thigh and calf polypropylene shells connected by orthotic knee joints to apply the three-point pressure principle for correction, and which extended proximally and distally to the knee so as to cover 2/3 of the femur and tibia length. This was done to provide suitable long lever arms for varus control within the orthoses in preference to off-the-shelf devices. At the beginning of the intervention, the brace adjustment was tailored for each subject according to his or her individual requirements. The valgus angle was set at a position which was both comfortable and acceptable for the patient (21,23). Patients subsequently attended on a monthly basis to adjust the orthosis fit.

Procedures - The baseline assessment included the KOOS, (Persian version (24)), which is a validated and disease-specific questionnaire that separately evaluates the severity of pain (9 questions), symptoms of the disease (7 questions), daily living activities (17 questions), sports and recreational activities (5 questions), quality of life associated with knee problems (4 questions) plus assessment of joint pain and symptoms of the affected knee/s. Scores are transformed to a 0-100 scale, with zero representing extreme knee problems and 100 representing no knee problems as commonly seen in orthopaedic scales and generic measures. Scores between 0 and 100 show the percentage of total possible score achieved. In assessing daily living activities, sports and recreational activities and quality of life, all subjects were asked to consider both knees. They also were asked to use orthosis while they were awake for activities that had been troublesome to them in the past. The assessment performed at the end of 6 month included use of the intervention and the KOOS assessment.

Data analysis - The differences between the 6 month post-intervention and the baseline KOOS sub-scale and total score were calculated. Changes were considered for subjects by calculating the means and SDs for each KOOS sub scale at baseline and at 6 months post- intervention. Due to the normality of data, a paired T test was used for comparing baseline and the 6th month post intervention KOOS sub scale scores. An Independent T test was used for analyzing the efficacy between two orthoses. SPSS statistical software was used for analysis of data. The level of significance was set at 0.05.

Results

There were no significant differences in mean of age, sex, BMI, and knee osteoarthritis grade between groups in baseline (table 1). All parameters were uniform among groups.

| Table 1. Subject characteristics at baseline (N=56) |
|---------------------------------|---------------------------------|------|
|                                | Insole with lateral wedge Group | Unloader Knee brace Group | P-value |
| Number of subject              | 28                              | 28   | 0.543 |
| Age                            | 60.66+/-2.8725                  | 59.55+/-3.0135             | 0.043 |
| Sex (Female)                   | 46.4%                           | 57.1%                        | 0.422 |
| Body Mass Index (kg/m^2)       | 27.82+/-3.0547                  | 27.67+/-3.409               | 0.621 |
| Index knee                     |                                 |                               | 0.369 |
| Right                          | 46.4%                           | 35.7%                        | 0.034 |
| Left                           | 25.0%                           | 42.9%                        | 0.214 |
| Bilateral                      | 28.6%                           | 21.4%                        | 0.034 |
| Kellgren/Lawrence Grade (22)   |                                 |                               | 0.342 |
| 1                              | 39.3%                           | 46.4%                        | 0.034 |
| 2                              | 60.7%                           | 53.6%                        | 0.034 |

When comparing the change between baseline and 6th months post intervention, we found the KOOS sub-scale score significantly improved (p=0.000) for both test conditions. When comparing knee orthoses and lateral wedge insoles in the sub-scales, there were no significant differences in the activity of daily living (P=0.871), or sports and recreational activities (P=0.351) noted. However, in the pain, symptoms and quality of life sub-scales the differences were significant (p=0.000). The knee orthoses had a greater effect on the pain and symptoms sub- scales than the lateral wedges, but in the quality of life sub-scale the lateral wedge insoles were more effective than the knee orthosis (table 2).
knee unloader orthoses, enhanced proprioception that (7, 12, 15, 16). Lateral wedge conservative approaches in reported that resting pain, they reported that the adduction moment was acting on the knee joint may be due to decreased (26) reported that a reduced adduction moment with medial compartment knee OA causes knee observed that the adduction moment in individuals Schmalz et al (23) and Harrington et al (25) interventions when treating mild to moderate medial compartment knee OA. One other considerat insoles are more effective than lateral wedge insoles, when compared to knee unloader orthoses. One other consideration is that patients with knee osteoarthritis have previously found knee brace treatment difficult to tolerate, because of skin irritation and poor orthosis fit (7, 12, 15, 16). Lateral wedge insoles are safe and more cost-effective than knee orthoses and also easier to use (18, 20). The results of this study therefore demonstrated that clinicians can choose with confidence between these two orthotic interventions when treating mild to moderate medial compartment knee OA.

Schmalz et al (23) and Harrington et al (25) observed that the adduction moment in individuals with medial compartment knee OA causes knee loading pattern changes during walking. Pollo et al (26) reported that a reduced adduction moment acting on the knee joint may be due to decreased pain. They reported that the adduction moment was reduced by 20% to 25% when subjects suffering from medial compartment knee OA used knee unloader orthoses. It therefore supposes that the knee orthoses used in this study applied a corrective force to the knee joint. Enhanced proprioception that can occur when wearing a knee orthosis is another factor in the improvement of knee pain (27). Birmingham et al reported proprioception was significantly improved following application of a custom-fitted knee valgus brace on patients who had varus alignment and OA of the medial knee compartment (28). Ramsey et al (15) suggested that increasing the co-contraction of vastus medialis-medial hamstring and vastus lateralis which occurred when wearing knee unloader orthoses, could improve pain in the medial compartment knee OA. Kirkley et al (7) reported that when comparing use of knee unloader orthoses to a non-braced control group, the WOMAC pain sub-scale score improved with an unloader knee brace.

Barnes et al announced that the application of a knee orthosis reduced pain and an improvement in performing activities of daily living and quality of life (29). Lindenfeld and colleagues also demonstrated a reduction in pain scores, with functional scores during activities of daily living and sport activity increasing when patients wore a brace (30). Finger and Paulos reported that resting pain, night pain and pain during activities of daily living reduced after 3 months of brace use (31). In a crossover study, Draganich et al, reported subjects experienced improvement in function and a decrease in stiffness and pain when using a custom made adjustable knee brace (12). Conversely, Brouwer et al announced no significant differences in quality of life when patients used a knee brace (32). Richards et al (16) reported that reducing varus force using a knee unloader orthoses increased the knee joint space on the medial side and improved symptoms. Ramsey et al (15) suggested that knee orthoses increased knee joint stability and improved function.

Table 2: Mean (SD) of variables in OA patients in baseline and post intervention according to the Knee injury and osteoarthritis outcome score (KOOS)

<table>
<thead>
<tr>
<th></th>
<th>Insole with lateral wedge Group</th>
<th>Unloader Knee brace Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
<td>Post intervention</td>
</tr>
<tr>
<td>Pain</td>
<td>39.66</td>
<td>69.41</td>
</tr>
<tr>
<td>(3.47970)</td>
<td>(3.09006)</td>
<td></td>
</tr>
<tr>
<td>Symptoms &amp; Stiffness</td>
<td>29.44</td>
<td>58.24</td>
</tr>
<tr>
<td>(2.21290)</td>
<td>(6.06714)</td>
<td></td>
</tr>
<tr>
<td>Daily living activities</td>
<td>59.49</td>
<td>80.66</td>
</tr>
<tr>
<td>(5.57685)</td>
<td>(4.54927)</td>
<td></td>
</tr>
<tr>
<td>Sports and recreational activities</td>
<td>21.46</td>
<td>56.00</td>
</tr>
<tr>
<td>(2.365)</td>
<td>(5.670)</td>
<td></td>
</tr>
<tr>
<td>Quality of Life</td>
<td>58.21</td>
<td>82.18</td>
</tr>
<tr>
<td>(5.86292)</td>
<td>(4.16423)</td>
<td></td>
</tr>
</tbody>
</table>

P1 comparison of the means between baseline and post intervention in the Insole with lateral wedge group; P2 comparison of the means between baseline and post intervention in the unloader Knee brace group; P3 comparison of the means between Insole with lateral wedge group and unloader Knee brace group.

Discussion
The question we asked was whether lateral wedged insoles, when compared to knee unloader orthoses, would have the same result in improvement of KOOS sub-scales. Lateral wedged insoles and knee unloader orthoses are both current conservative approaches in treating symptomatic medial compartment knee OA. The results of our study showed significant decreases in pain, and increases in daily living activities, recreational and sport function and quality of life as compared to baseline when using either intervention. However, the knee unloader orthoses were more effective than lateral wedge insoles in reducing pain levels. When considering symptoms and the value of the quality of life KOOS sub-scales, the lateral wedge insoles were more effective than the knee unloader orthoses. One other consideration is that patients with knee osteoarthritis have previously found knee brace treatment difficult to tolerate, because of skin irritation and poor orthosis fit (7, 12, 15, 16). Lateral wedge insoles are safe and more cost-effective than knee orthoses and also easier to use (18, 20). The results of this study therefore demonstrated that clinicians can choose with confidence between these two orthotic interventions when treating mild to moderate medial compartment knee OA.
Whilst we found significant differences between both interventions in pain, symptoms and quality of life KOOS sub-scales, Van raaij et al (21) conversely found no significant differences in pain and function WOMAC sub-scales between lateral wedged insoles and knee braces in patients with medial compartment knee OA. Backer et al (20) found no statistically significant and clinically important differences on WOMAC pain sub scale in 5 subjects who wore lateral wedged insoles in a cross-over trial. There is therefore variance in the literature.

The knee orthoses used in this study were custom made, and extended 2/3 of the length of the upper and lower leg; so giving an optimum fit and theoretically effective application of corrective forces using longer lever arms than most off-the-shelf devices. This paper therefore demonstrated that such orthoses are effective in providing symptom reduction as well as the other beneficial effects demonstrated in this paper, and similarly designed orthoses are therefore recommended for use by patients with medial compartment knee OA. The authors are not aware of previous evidence of comparing use of this design of custom orthosis to laterally-wedged insoles.

A limitation of this study was that the thickness of the lateral wedged insoles was not checked during the study period. However, the lateral wedge insoles was not deemed necessary.

Conclusion

This study demonstrated that use of lateral wedge insoles and knee unloader orthoses improved pain (P=0.000), symptoms (P= 0.000), daily living activities (P=0.000), recreational and sport function (P=0.000) and quality of life (P=0.000) in subjects as compared to baseline with symptomatic medial compartment knee OA. In comparing both interventions, we did not find significant differences in activity of daily living, sports and recreational activities between them. Reduction of pain and symptoms occurred when subjects worn knee unloader orthoses. However, in improving quality of life, lateral wedges showed that they were a suitable alternative to knee unloader orthoses for conservative treatment of the medial compartment knee osteoarthritis patients.

References

Original Article

Attentional Demands of Balance under Dual Task Conditions in Young Adults

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Objectives: The aim of this study was to identify the role of intentional process in postural control using choice reaction time task while changing the visual and proprioceptive cues under a difficult balance task (standing on one-leg).

Methods: This cross-sectional study was conducted on 20 young people (22.75±2.29). Each subject performed one-leg standing as a balance task for each of the following 2 test conditions: free balance position (single task), and balancing while performing a secondary cognitive task (choice reaction time task). Each test was carried out for each of the following 3 sensory conditions: on a hard surface with open eyes, on a hard surface with closed eyes and on a foam surface with closed eyes. One-way ANOVA was used for analysis.

Results: Analyses of the task conditions didn’t show significant differences between single and dual task under two sensory conditions in open and in closed eyes (P>0.05). However, there was a significant difference between single and dual tasks on a soft foam with closed eyes [t (19)=-2.391, P=0.027].

Conclusions: Findings revealed significant differences in the balance performance of individuals under three different sensory conditions caused by reduction in base of support. This effect can be seen in dual task conditions as well. Therefore it can be concluded that the nature of the primary task has the most influence on balance performance and it is not the effect of the dual task condition.

Keywords: Balance, Attentional Process, Dual-Task

Submitted: 13 Sep 2011
Accepted: 18 May 2012

Introduction

According to the system approach, movement arises from the interaction of both perception and action systems, with cognition affecting both systems at many different levels. Current view of balance and postural control is based on this system approach. That is, postural control for stability and orientation requires complex interactions of action, perceptive and cognitive systems (1).

Traditionally, postural control was considered as an automatic task needing reflexive mechanisms but recent studies showed that postural control somewhat changes the attentional process (2-4). Hence, the role of the cognitive process in postural control and balance performance was widely investigated by researchers (3, 5-8).

On one hand, there are two objectives in dual task studies of the postural control-cognitive process: first, investigating attentional demands of postural control which must be limited to the secondary cognitive task with no changes occurring in the primary (postural) task in changes of performance. Thus, results focus on discussing changes in the secondary task, and in this way, attentional demands associated with changes in postural tasks are clearly identified (2, 9). The second objective is to examine performance changes in both primary and secondary tasks under dual task conditions. In these experiments, in addition to evaluating attentional demands of postural control, the effect of performing attentionally-demanding cognitive tasks on the control of posture is examined (1, 4, and 7). The results of these studies are not consistent.
However; the reasons being the types of dual-tasks studies, individual differences, age of participants, nature of cognitive and balance tasks, and the instructions given to participants for performing the experiment. For example, some reported increase in postural sway by increasing the difficulty of both postural and cognitive tasks (3, 7, 10-15), while other investigators stated increase in postural sway only following any enhancement in the difficulty of the secondary or primary task (2, 4, 6, 8, and 16). In contrast, some other studies reported a decrease in postural sway (5, 17-20). Finally, in many studies no changes either in postural or cognitive tasks were observed (21-22).

On the other hand, the hypotheses used as explanations for the results of the dual task data are not consistent. For example, some authors suggest that interference either in cognitive or in postural tasks (reduction in postural stability or decline in cognitive performance) (10) arises from the capacity limitation in those two simultaneous tasks competing for the same processing resource (4). Priority to postural control at the expense of cognitive task is proposed as the reason of the finding that no changes or improvement in balance stability occur. As a matter of fact, in some cases increase in arousal is the illustration for decrements in postural sway during the simultaneous performance of a cognitive and postural task. Additionally, dual-task studies conducted in youth have different results as well, and the level of difficulty in the balance task is proposed as an important reason behind conflicting findings.

A number of studies conducted on youth have shown postural sway decrease while changes in the difficulty level of postural task was made by reducing the base of support (BOS) or by modifying somatosensory cues available for postural control (17, 19). Interestingly, findings revealed no changes in postural sway index even by using more difficult cognitive tasks (23). The possible answer to this result may be the level of the balance task which was so easy that it could not interfere with the secondary cognitive task or create any perturbation in balance under a dual task condition. Therefore this study was performed to identify the role of attentional processes in postural control under the dual task paradigm. For this purpose, visual and proprioceptive inputs necessary for balance stability of single-leg standing were manipulated. Recognizing the extent to which postural control changes attention resources can help therapists use appropriate strategies in interventions for young people suffering from neurological disorders affecting their postural and cognitive abilities.

**Method**

Twenty healthy young students aged 22.75±2.29 (10 males and 10 females) from the ‘University of Social Welfare and Rehabilitation Sciences’ (USWRS) participated in this cross-sectional study. None of the subjects were taking psychoactive medication and did not report any neurological or psychiatric impairment on a general health questionnaire. Nor did they report any orthopedic impairment. They gave their informed consent for the experimental procedure to be carried out.

The secondary cognitive task used in this experiment was choice reaction time task (Odd ball task), in which two different voices, high frequency (1000Hz) and low frequency (500Hz) were presented by a laptop (Model: Dell XPS, M1330). Afterwards each subject had to respond to low frequency voices by pressing the hand-held probe as fast as possible during 100 seconds. Reaction time was recorded as an indicator of performance in the cognitive task. It must be noted that the study session started by performing Odd ball task alone and in seated position and was then followed by balance tasks in single and dual conditions which were assigned randomly.

The balance task was standing on one leg (on their right leg and keeping up their left leg) in three different sensory conditions including: open eye/hard surface (OEHS), which required participants to keep their balance and look straight ahead; Closed eye/hard surface (CEHS), which required them to keep their balance while standing on one leg and close their eyes; and closed eye/foam surface (CEFS), which requested both groups to maintain one-leg standing on foam while they were blindfolded. A 10-cm-thick piece of medium-density foam (45 cm² X 13 cm thick, density 5 60 kg/m³, load deflection 5 80 to 90) was used as the soft surface. All of these balance conditions were performed with and without the cognitive task and the instruction to participants was counterbalanced. In addition, the maximum time that was considered for maintaining single-leg standing was 100 seconds for each condition.

Data were analyzed by using SPSS software version 11.5. For three different sensory conditions, analysis of variance was used for comparing three sensory conditions under dual and single task conditions. Comparisons between single and dual task
conditions were made using paired t-test.

Results
The subjects’ demographic data are shown in Table (1) Table (2) and table (3) present the results of balance and cognitive performance under single and dual tasks in three different sensory conditions.

### Table 1. Demographic data

<table>
<thead>
<tr>
<th>Variables</th>
<th>(n=20)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender (male- female)</td>
<td>M: Male F: Female</td>
</tr>
<tr>
<td>Age</td>
<td>22.75 (2.29)</td>
</tr>
<tr>
<td>Height</td>
<td>170.4 (8.58)</td>
</tr>
<tr>
<td>Weight</td>
<td>62.4 (10.94)</td>
</tr>
<tr>
<td>Education (year)</td>
<td>15.15 (1.56)</td>
</tr>
</tbody>
</table>

Analysis of variance (ANOVA) was used to analyze the mean values of each dependent variable. Tokey was performed to find out the difference between the two groups precisely. The results of this study are divided into two parts including: A) the results related to the cognitive task, B) the results related to balance tasks.

A. The results related to the cognitive task
The analyses of the data gathered from the cognitive task revealed that the mean of reaction time for the auditory stimulus was significant only between single and dual tasks in standing on one-leg under OEHS condition (P<0.05). That is, the mean reaction time in the dual task condition increased as compared with the single task but there were no significant difference of means between single and dual tasks in the other two different sensory conditions (CEHS and CEFS) (P>0.05) (Table. 2 and Fig. 1).

### Table 2. Balance and cognitive performance under dual task condition

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reaction time (open eye/hard surface)</td>
<td>0.408±0.121</td>
</tr>
<tr>
<td>Reaction time (closed eye/hard surface)</td>
<td>0.335±0.125</td>
</tr>
<tr>
<td>Reaction time (closed eye/foam surface)</td>
<td>0.407±0.016</td>
</tr>
<tr>
<td>The time of standing on one- leg (open eye/hard surface)</td>
<td>84.878±24.89</td>
</tr>
<tr>
<td>The time of standing on one (closed eye/hard surface)</td>
<td>36.202±22.72</td>
</tr>
<tr>
<td>The time of standing on one (closed eye/foam surface)</td>
<td>22.68±19.05</td>
</tr>
</tbody>
</table>

There was significant difference in the mean reaction time in three different sensory conditions. Therefore, different sensory conditions (OEHS, CEHS, and CEFS) did not have any influence on reaction time (P=0.05).

B. The results related to balance tasks
Using one-way ANOVA results from efficacy of balance task showed that whenever the difficulty of postural task increased the period of time for standing on one-leg decreased (P<0.05) because of less number
of sensory inputs needed for balance. The greatest difference was observed between OEHS and CEFS/HS (P=0.000). In addition, there was significant difference of means between these two conditions CEHS and CEFS (P=0.02), indicating that changes in proprioceptive inputs using foam surface in the absence of visual cues reduce the time in standing on one-leg position. (Fig. 2)

![Figure 2: Balance task performance under single task condition](image)

To compare the mean differences of single and dual balance tasks the paired t-test was performed. It showed that there was only significant difference of means for the CEFS condition between single and dual tasks. There were significant differences of means in three different balance conditions under simultaneous balance and cognitive tasks. The differences were observed between OEHS and CEHS (P<0.05), and also among CEFS (P<0.05). But there was no significant difference of mean between CEHS and CEFS (P=0.144) (Table3, Fig3)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reaction time</td>
<td>0.325±0.078</td>
</tr>
<tr>
<td>The time of standing on one-leg (open eye/hard surface)</td>
<td>88.66±15.40</td>
</tr>
<tr>
<td>The time of standing on one (closed eye/hard surface)</td>
<td>29.36±24.57</td>
</tr>
<tr>
<td>The time of standing on one (closed eye/foam surface)</td>
<td>13.49±1.95</td>
</tr>
</tbody>
</table>

![Table3. Balance and cognitive performance in single task condition](image)

![Figure 3: Comparing balance task performance under single and dual task conditions](image)
Discussion
This study was performed to identify the role of attentional processes in postural control under the dual task paradigm. For this purpose, visual and proprioceptive inputs necessary for balance stability of single leg standing were manipulated. The theoretical framework most commonly applied to postural-suprapostural dual-task performance can be termed resource-competition. That is, if the total capacity was enough for performing each task, deterioration would not occur in either task. In the other words, the optimal performance of each task can be seen by sharing the capacity between two simultaneous tasks. If two tasks that are performed together necessitate the use of more than the total capacity, the performance of either one or both will deteriorate. The Findings of the present study showed that there was no significant difference between single and dual tasks under two different sensory conditions (open eye and closed eye/hard surface) which is consistent with the capacity processing hypothesis. When two tasks are performed together during standing on one leg with open eyes, there weren't any decrements in either task, suggesting capacity sharing between them. This finding is consistent with those of Nejati's et al (2008) (24). The author suggested that high capacity in youth caused implicit learning under the dual task paradigm. On the other hand, findings revealed that in spite of reducing the BOS or changing the sensory input, the difficulty of both cognitive and a balance task was not to the extent that can cause deterioration in balance performance or challenge resource processing. Apparently, the type of cognitive task modality accounts for the decrement in performance of the cognitive task while standing with open eyes. In that case, interference occurs between visual cues necessary for postural control and auditory signals of the secondary cognitive task; because the secondary task was based on auditory signals. In addition, the best processing of auditory information while standing with closed eyes and no changes in reaction time in this condition confirm these finding. Hence, this choice reaction time task is such a simple task that individuals can execute it in both balance conditions. In other words, the ceiling effect can account for this result. Studies that have examined the role of visual processing in postural control suggest that movements of the head and body influence visual information required for postural control (25). In Dault et al’s study (2001) (21) different levels of difficulty for postural control task had no effect on working memory task and no changes were seen in attentional demand following changes in the type of postural task. Whereas, in Lajoie et al (1993) (8) and Yardley et al’s (2001) (26) studies, changes in difficulty of postural task using static and dynamic positions influenced cognitive performance. The present study’s findings are in conflict with those showing decrements in cognitive task along with increase in stability of postural control tasks (3, 8, 10).
In Shumway-Cook et al’s (2000) study, the effect of sensory context on postural stability while performing attentionally-demanding cognitive tasks in youth and older adults was investigated. The author explained that adding auditory load had no significant influence on postural stability. Barin et al. (1997) (30) showed no significant difference during simultaneous performance of the subtraction task under different sensory conditions.

Changes in sensory conditions appeared to be influenced by the extent of postural control to sensory inputs, especially when reduction in BOS makes the balance task more difficult. The results of the present study confirm this claim. Our findings show that decrements in BOS bring about significant differences in balance performance under different sensory conditions; this influence can be seen during dual task conditions. Therefore, it can be concluded that the nature of the primary task has the most effect on performance of single leg standing and this effect is not due to dual task performance. This study was conducted by using behavioral methods which have certain limitations. Therefore, the precise detection of balance ability may be missed. While using the force plate could be helpful in showing the exact performance of individuals. Moreover, the type of cognitive task- as secondary task may have had important effects on the final results.

References
Exercise as a Treatment to Improve Quality Of Life in Patients with Cancer (A Review of the Literature)

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Introduction: Improvement in cancer care increases life expectancy of cancer patients, most of whom have experienced prolonged episodes of fatigue during and after their treatment. This has been found to reduce the quality of life and increase morbidity and mortality of such patients. Therefore, additional interventions are beneficial to improve overall quality of life as well as longevity. There is growing evidence that exercise is beneficial to cancer patients through improvements in their physical and physiological abilities and functions.

Objectives: The purpose of the present article was to evaluate the current evidence to determine if exercise could be used as a safe and effective method to reduce fatigue and improve quality of life in these patients. The Cochrane Central Register of Controlled Trials, MEDLINE, EMBASE and CINAHL search engines were electronically searched and 21 empirical studies published between 1995 and 2009 were found.

Conclusion: There is accumulative data in the literature supporting the effectiveness of exercise interventions on the physical and psychological wellbeing of patients with cancer. Exercise can improve muscle mass and strength and whole body oxygen uptake which are reduced during bed rest, infection and cancer treatments. Growing evidence is now supporting the effectiveness of exercise on specific populations such as women suffering from breast cancer. However, the effect of exercise on other populations such as children and patients suffering from other types of cancers is vague. Therefore, more research is needed to define scientific evidence-based rehabilitation protocols for patients with different types of cancer.

Keywords: Cancer, Exercise, Quality of life, Fatigue, Rehabilitation

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Accepted: 30 Aug 2012

Introduction
Fatigue is a normal response in the body which any individual can experience. Prolonged and chronic fatigue however could be a symptom of various diseases such as heart failure, HIV/AIDS, multiple sclerosis and cancer (1). Cancer related fatigue is very common. It is suggested that 80% of patients suffering from cancer have experienced episodes of fatigue during and after their treatment (2). The fatigue induced by cancer and/or its treatments not only decreases the quality of life, but also contributes to the morbidity and mortality resulting from the disease (3). There is evidence suggesting that severe and prolonged fatigue in oncology patients might be partly responsible for the poor prognosis and high rates of mortality of the disease (4). The severity of the fatigue could also be related to the type of cancer therapy being used. Moreover, biologic response modifiers including α-interferon and interleukins can cause severe fatigue following treatment (5).

The multi-dimensional nature of fatigue makes its definition difficult due to subjectivity (6). It can be described in terms of its characteristics such as severity, distress, temporal features, or specific impairments like lack of energy, depression, weakness, somnolence and difficulty in concentration. Therefore, it has recently been defined as a “multidimensional phenomenon that develops over time which diminishes the energy, mental capacity, and the psychological

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condition of patients”. These are particularly experienced following treatments such as radiotherapy, chemotherapy and immunotherapy. The symptoms could be due to increased energy requirements due to the disease itself, as a result of the tumour growth, infection, and fever, or due to increased levels of substances that impair the metabolism or normal functioning of muscles such as cytokines or antibodies. However, there is no current evidence suggesting the exact mechanism underlying such conditions (2). An important factor contributing to the weakness and decrease in physical performance is the lack of muscular activity attributable to bed rest in such patients. It is well established that prolonged bed rest could result in loss of muscle mass which in turn could lead to several metabolic abnormalities. This might be accelerated in the presence of cytokines and other inflammatory mediators (7, 8).

Over the past 20 years improvements in treatment protocols have resulted in a substantial number of cancer survivors with an increased life expectancy. Hence, care is directed towards interventions improving the quality of life as well as survival (9). Exercise is widely used in the management and rehabilitation of various chronic diseases such as cardiovascular and pulmonary disorders (10). The positive effects of physical activity on mood, anxiety, and general well-being of patients with chronic fatigue syndrome and depression are also well established (11). Although the exact molecular mechanism of the effect of exercise in such conditions is not well understood, its potential benefits are appreciated. It can help restore cardiopulmonary function, muscle mass, strength, and range of movement. Moreover, it can induce metabolic adaptations by altering body composition and endocrine secretions (12). There is growing evidence that exercise is beneficial to cancer patients through improvements in physical, psychological and physiological abilities and functions, which increase quality of life as well as longevity (13). There are several reviews supporting the beneficial effects of exercise in the literature. However, exercise rehabilitation is still not well integrated into the general cancer care plan as the underlying risks and contraindications are not well outlined (9, 14).

The aim of this study was to examine the strength and weakness of the current evidence to determine if exercise could be used as a safe and effective method to improve quality of life in patients with cancer. The Cochrane Central Register of Controlled Trials, MEDLINE, EMBASE and CINAHL search engines were electronically searched and 21 empirical studies published between 1995 and 2009 were found and reviewed.

Discussion
As mentioned above, fatigue is the most common symptom seen in cancer and in its treatment. Exercise is a potentially useful intervention. However, most oncologists dispute the significance of fatigue with regard to cancer. That is why exercise rehabilitation may not necessarily be included in the treatment program. Several types of exercise interventions have been used in a variety of patient trials to measure differences in cardiopulmonary fitness, strength, weight, body composition, insulin sensitivity, fatigue and quality of life. In a study by Curneya et al. on post-menopausal breast cancer survivors, they found that moderate aerobic exercise on a bicycle thrice a week, for 15 weeks, significantly increased cardiovascular fitness and quality of life in the exercise group compared to controls (15). They also found a correlation between change in peak oxygen consumption and overall change in quality of life. Thus, the results of this study suggest that supervised aerobic exercise is a useful intervention in increasing cardiovascular and psychological fitness of patients.

Other studies that looked at the effects of aerobic exercise in one group and stretching in another control group following radiation therapy found that the exercise group showed significant improvements in cardiopulmonary function and decreases in body mass index (BMI) and fat mass. Fatigue and mood improved in both control and exercise groups with no difference between them (16). Studies have found that Tai chi can also lessen fatigue and improve quality of life. Hence, the improvement in fatigue and mood in this study might be attributed to the stretching exercises done by the control group (17). Therefore, more studies are needed to compare exercise and bed rest especially during the treatment period.

As aerobic exercise alone might not improve muscle mass and power, some studies have used “mixed aerobic and resistance exercises” as their intervention. Wall et al. suggested that by implementing this type of intervention patients could improve strength, power output and BMI as well as aerobic fitness. They also mentioned that as there is a correlation between ‘hope’ and power, increasing power through such interventions could result in increased levels of hope in such patients (18).
However, the positive effects on fatigue were not well explained in their study. Reduction in cancer-related fatigue is reported in several studies following mixed exercise. Nevertheless, it seems that different populations may have different outcomes in response to exercise. Studies that recruited only patients with breast cancer could establish the effect of exercise on fatigue whereas trials that recruited patients with other types of cancer were unable to do the same (14). Flexibility and simplicity of the exercises are very important as well. Exercises which might need special equipment or are difficult to execute might not be suitable for patients with fatigue and depression due to low compliance rates (11). Moreover, as most patients are treated in out-patient clinics, they might not attend the supervised exercise sessions. Therefore it seems that home based programs could be more useful for rehabilitation of these patients. This is in agreement with a study which designed a home based mixed resistance-aerobic exercise program for patients with multiple myeloma and bone lesions who were receiving high-dose chemotherapy and stem cell transplantation. They found that this type of exercise could efficiently improve their symptoms (19). Moreover, a study examining quality of life, psychological well-being, physical fitness and time of hospitalization found that exercise could significantly improve physical fitness and quality of life in those patients.

Elsewhere, Curneya et al. (2003) used exercise following high dose chemotherapy and bone marrow transplantation. Patients had to perform exercises in isolated rooms due to their weak immune system. They concluded that exercise could increase quality of life and reduce the period of hospitalization (15). Findings from this study could be highly beneficial as these patients experienced moderate fatigue symptoms during their treatment. More research in this field is however needed to support their findings as the outcomes of this study cannot be generalized owing to the selection bias of their samples; patients who had experienced more severe medical complications were recruited in their study. The small sample size and bias in data collection were two other limitations of the study.

One common weakness of the aforementioned studies is that they have not used intention-to-treat analysis to interpret their results (14). Only one recent study by Dimeo et al. (1997) used this analysis. During this study patients performed 30 minutes of exercise daily on a bed ergometer with a mean work load of 32 Watts. The results of this study differed from findings of previous data. These authors showed that exercise could not reduce fatigue symptoms after high dose chemotherapy which is in contrast to previous findings. However, due to the specific sample and protocol of the study more studies are needed to disregard the positive effect of exercise on lessening fatigue (8).

There is also very limited data in the literature on the paediatric population. Since children suffer from different types of cancers their complications might be different from adults. Therefore, the data achieved from adult studies cannot be applied to the paediatric population. However, it has been suggested that intra-hospital rehabilitation programs can improve quality of life and physical fitness in children (20). Moreover, as the definition of fatigue is subjective, the results of the studies investigating fatigue in children could be biased because the fatigue questionnaires are usually filled by parents. Children’s commitment to the rehabilitation program is also very important. In a study examining the feasibility and efficacy of a rehabilitation program it was found that less than half of the recruited subjects had completed the program. They therefore suggested that when designing rehabilitation programs for children, not only are age, gender, stage of disease and variety of exercises important, but, parents motivation and education are important too (21).

Conclusions
There is accumulative data in the literature supporting the effectiveness of exercise interventions on the physical and psychological wellbeing of patients with cancer. As mentioned above, oncology patients face multiple difficulties, especially physical weakness and fatigue during treatment, which could decrease their quality of life and increase their morbidity and mortality. Exercise can improve muscle mass and strength and whole body oxygen uptake which are reduced during bed rest, infection and cancer treatments. The psychological effect of exercise is however not well established. This might be related to the confounding factors that affect the results of these studies. Growing evidence is now supporting the effectiveness of exercise on women suffering from breast cancer. It is now well established that rehabilitation can be effective during and after their treatment period. This however, might not be the case with findings from other populations such as children and patients suffering from other types of
cancers. Although the efficiency of exercise in improving physical fitness is shown in these populations, its effect on fatigue and quality of life of these patients is not yet well understood.

While exercise is found to be beneficial, it can increase the risk of several other issues in patients. More research is needed to define the risks and contraindications of exercise in oncology patients, such as, over training which could increase fatigue and exhaustion in these patients. Moreover, exercise should be performed in hygienic areas after specific treatments like bone marrow transplants. This could prevent patients from exercising in public places such as gyms and fitness classes. Exercises are also needed to be specifically well designed for the target population in terms of duration, intensity and type. This is highlighted amongst children, as exercises should be feasible, interesting and well tolerated for this population.

References

Clinical Messages
- Exercise can be considered a type of treatment for chronic diseases.
- Exercise in cancer subjects focuses on treating fatigue.
- More research is needed to clarify the intensity and duration of exercise.

Acknowledgements: The authors declare they have no financial interests in this study. This paper is dedicated to the MAHAK centre, the only specific cancer charity in Iran, where children with different types of cancers are treated free of charge.
Reviews/Short communication

Treatment of Depression in the Elderly: A systematic review

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Introduction: Depression is a common disorder and a major public health problem in the elderly. Despite its prevalence and seriousness, depressive disorder in older people remains under-treated. The optimal treatment of depression in later life is crucial, and requires appreciation of several age-related factors such as comorbidity, polypharmacy, altered drug kinetics, variable treatment responses and increased predisposition to side effects. Discussion: Although sometimes difficult to diagnose because of concurrent stressors, medical illness, or dementia, depression in elderly patients responds readily to appropriate therapy. When untreated, this disorder may result in increased morbidity and mortality or suicide. Effective therapeutic options for late-life depression, as in younger patients, include psychotherapy and pharmacotherapy. Because of their favorable adverse effect profiles and safety in cases of overdose, the selective serotonin reuptake inhibitors have, in most cases, replaced tricyclic antidepressants as first-line therapy when antidepressants are indicated. The SSRIs considered to have the best safety profile in the elderly are citalopram, escitalopram, and sertraline. Finally, electroconvulsive therapy offers a safe and effective alternative for patients refractory to or unable to tolerate antidepressant medication.

Keywords: Polypharmacy, depressive disorder, older people

Submitted: 8 Dec 2011
Accepted: 19 April 2012

Introduction
Depression is common in the elderly and is a major public health problem (1). Major depressive disorder (MDD) is common in the elderly too, with an estimated prevalence of 2% to 3% in the general population and 15% to 25% among nursing home residents (2). Approximately 15% of the community-dwelling elderly have clinically significant depressive symptoms, and such symptoms are present in 25% of elderly patients with a chronic medical illness (3). Despite the high prevalence of depressive illness in this population, it is estimated that clinically significant depression goes untreated in 60% of cases (4,5). Depression in the elderly can be divided into early-life onset, which recurs in old age, and late-life onset, which begins in old age (6). Depression in late life is associated with significant morbidity including deficits in a range of cognitive functions and considerable influence on functional impairment and disability (1,2,7). In elders who have co-existing chronic medical conditions, the presence of depressive symptoms increases role impairment, utilization of medical services and treatment costs, decreasing patients’ compliance with their medical treatments and altering the course of disease that leads to higher mortality and disability (1,4,5,8). Evidence regarding outcome and treatment response in relation to age is even less consistent (9,10). Old age has been associated with a slower improvement during treatment and an overall poorer prognosis (9,11-13). However, opposite findings have also been reported (9,14). Elderly patients with late onset of depressive disorder have been characterized by less personality abnormalities and a low incidence of family history of psychiatric illness (9,16), but severity and symptomatology have been observed to be quite similar in early and late onset elderly patients (9,16). Old age at onset has been linked to both better and poorer outcomes. Thus, the impact of age and age at onset of depressive disorder in symptomatology and outcome is still a debated issue. It has been suggested that potential biases may

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have confounded the above-mentioned study results (17). For example, severity of depression may be influenced by concurrent medical problems and time to remission may be longer. Medical comorbidity more likely occurs in people with late-onset depression without a past psychiatric history (18). The importance of assessing factors related to patient age and not just to age itself in evaluations of risk factors for poor prognosis has been emphasized (9,17).

Obstacles to Treatment

The importance of detecting, diagnosing, treating and following the course of geriatric depression lies in the possibility that, if not recognized, this nosological entity may provoke negative consequences in term of morbidity, potential autonomous life deficits, functional capacities and even death (1). Barriers to proper diagnosis and treatment include attributing depressive symptoms to “normal” aging or physical illness, lack of family support, self-medication (e.g. alcohol use), drug prescription, impoverishment and low socioeconomic status (that confines the accessibility to health care), mourning, social isolation, hypochondriasis, hiding the effects of concomitant medical problems, misdiagnosis of dementia instead of depression, somatization, expense matters, time limitations, and the stigma of mental illness (1,2,4). Clinical experience suggests that physicians who look carefully for symptoms of depression rather than relying on the patient to report mood changes have higher rates of recognition and response to therapy (19). One of the major obstacles to the therapeutic response is the lack of compliance, influenced by several factors such as: cognitive impairment, complexity of dosages, side effects, lack of comprehension of the depressive symptoms, treatment costs, lack of family support, and fear of stigma. On the contrary, factors improving compliance to treatment include: a complete physical and cognitive assessment of the patient, involvement of relatives in the therapeutic program, maintenance of frequent contacts and supply of clear and comprehensible information on diagnosis and therapeutic management, these being, generally, the cardinal points of the so-called good medical practice (1,5,19).

Treatment Modalities

As in younger patients, the goals of treating depression in elderly patients include alleviating depressive symptoms, reducing risk of recurrence and relapse, decreasing morbidity and mortality, and improving quality of life. Because data providing clinical recommendations for depressed elderly patients are limited, treatment recommendations are usually based on data from younger patient populations or from small studies of elderly patients. Treatment options include pharmacotherapy and psychotherapy, in some cases, electroconvulsive therapy (ECT) (20).

Pharmacotherapy

For several reasons, the pharmacologic treatment of depression in elderly patients is particularly challenging. First, reduced ‘lean body mass’ and increased ‘body fat’ result in higher concentrations of drugs that distribute in body fluids. One such example is lithium, which increases the distribution and prolongs the elimination half-life of fat-soluble drugs, such as antidepressants (20,21). Second, hepatic and renal drug and metabolite clearance may decrease with age, resulting in slower drug clearance. Third, the presence of medical illness may result in pharmacodynamic changes. For example, the presence of dementia or other brain diseases may increase sensitivity to the central nervous system effects of psychotropic medications. Finally, because elderly patients are often taking multiple medications, drug-drug interactions are a source of concern. For these reasons, elderly patients should initially receive lower antidepressant doses than those recommended for younger patients (20,22-24). The dose can then be slowly titrated upward based on clinical response and emergence of adverse effects. Older patients may take longer to respond to antidepressants, and should receive a 6- to 12-week antidepressant trial, if possible, before assessing for efficacy. Estimates of drug noncompliance in elderly patients range from 40% to 75% (20,25). Simplification of multidrug treatment regimens and dosing schedules and the use of daily dosing pill boxes may facilitate compliance. Lack of medical literacy may also contribute to noncompliance. Patients and significant others should receive verbal and written information outlining dosing schedules and potential adverse effects. Because many elderly patients receive fixed incomes, physicians must consider drug costs as well as the cost of associated risks, such as falls, and follow-up monitoring, such as office visits and laboratory tests, when selecting an antidepressant (20).
Pharmacological Changes
Treatment of depression in the elderly must take into account pharmacokinetic and pharmacodynamic changes in late-life (26). Beyond recognizing the existing clinical variables in patients with late-life depression, aging patients also have changes in key physiologic factors that can influence the pharmacokinetics of antidepressants. These considerations should be applied to all geriatric patients with late-life depression who are about to receive antidepressant therapy (27). The results of studies in younger adult populations cannot be generalized to the elderly people, since drug pharmacokinetics have changed, as well as chronic medical illnesses that may affect their renal, hepatic, and cardiac function. Drug absorption changes, distribution volume is diminished and mean level of drugs are higher in the older ones, all of which may adversely affect their ability to metabolize or excrete some medications (5,28,29).

Pharmacokinetics
Pharmacokinetic changes include decreased absorption, increased volume of distribution, decreased metabolism, and decreased excretion (26). Normal aging results in a number of pharmacokinetic changes that can influence a drug’s peak plasma levels and duration of action. Age-related gastrointestinal (GI) changes, like pH alterations and intestinal motility reduction, may reduce the absorption of oral medications; however, the extent of these changes varies among individuals and may not always be clinically significant. Aging patients are at risk of reduction in production of gastric acid and GI motility, decreases in serum albumin, decreases in hepatic blood flow and liver mass, and decreases in renal blood flow (27,30). Reductions in gastric acid production and GI motility may result in reduced absorption of antidepressants (27). Changes in levels of drug-binding plasma proteins, particularly albumin, can alter the fraction of drug that is unbound and thus able to cross the blood-brain barrier and bind to receptor sites (31,32). Changes in the activity level of certain liver enzymes can extend the half-life of many drugs, and decrease in the glomerular filtration rate can decrease renal elimination (31-33). The net result of these pharmacokinetic changes is increased peak plasma levels, prolonged half-life, increased bioavailability and lowered therapeutic dose. Inter-individual genetic variability can magnify these effects. For example, Nortriptyline cured older adults with at least cytochrome P-450 (CYP) 2D6 allele encoding reduced or absent metabolism who had mean drug plasma levels nearly two times more than those of patients with the extensive metabolizer genotype (31-34).

Pharmacodynamics
Patients in later life may have age-related changes in drug sensitivity (26). Elderly patients may have pharmacodynamic changes that make them more vulnerable to anticholinergic and noradrenergic side effects of medication, due to age-related receptor sensitivity and age-related changes in cholinergic and mono-aminergic neurotransmission (25,35). Dosing, therefore, should begin with low doses and be gradually titrated. If administration is a challenge, many antidepressants come in liquid form or have soluble tablets. Despite these concerns, clinicians should be attentive not to under-treat these patients and fail to provide adequate trials at therapeutic dosages (25). Age-related changes in receptor sensitivity and concentration can change the effectiveness of a medication and result in increased adverse effects. Changes in function of acetylcholine receptor can increase the severity of CNS and peripheral anti-cholinergic adverse consequences e.g. confusion, blurred vision, constipation, and urinary retention (31,36,37). Aging alters the serotonergic system, including decreasing serotonin-2A receptors and the serotonin transporter (36). Genetic polymorphisms of the latter may influence treatment response and predispose patients to adverse effects. Functional reserve decreases with age and requires more time to reestablish homeostasis after exposure to a stressor (31-38). The overall effect of these pharmacodynamic changes can worsen adverse effects in elderly patients, even at therapeutic doses (31).

Management Principles
More than 20 antidepressants have been approved by the Food and Drug Administration (FDA) for the treatment of depression in older adults (39). The main target of the anti-depressive treatment is that of obtaining and maintaining a complete remission, i.e. achievement of a complete resolution of depressive symptoms, and a return to the previous level of function. Failure to obtain remission implies a higher risk of relapse with successive episodes characterized by excessive depressive severity, shortened inter-episodic pauses, progressive functional impairment, and an increase in the rates...
of suicide and mortality, due to any cause. The pharmacological treatment of geriatric depression is based on the use of anti-depressive drugs, combined with psychotherapy (if needed), antipsychotic drugs in cases of psychotic depression or electroconvulsive therapy in cases of severe depression, non respondent to drug therapy. The duration of treatment depends mainly on the patient anamnesis; generally, the acute treatment of an episode, followed by the continuation and maintenance phases, lasting almost for a year. In patients with two previous episodes, the duration may be prolonged for three years, with successive prolongation beyond three years of treatment in patients with a history of more depressive episodes (1,40).

When selecting an antidepressant it is important to consider the elderly patient’s previous response to treatment, the type of depression, the other medical problems of the patient and medications and the potential risk of overdose (41,42). Psychotic depression will likely not respond to antidepressant monotherapy, while treatment of bipolar depression will require a mood stabilizer. Antidepressants are effective in treating depression in the face of medical illnesses, although caution is necessary to prevent worsening of the medical condition or causing adverse events (41,43). For example, dementia, cardiovascular problems, diabetes and Parkinson’s disease, which are common in older adults, can worsen with highly anti-cholinergic drugs (41,44). Such drugs can cause postural hypotension and cardiac conduction abnormalities. Minimizing the interactions of drugs is also important especially because of the number of medications that old patients are often taking. Tricyclic antidepressants are lethal in overdose and are avoided for this reason (41).

The pharmacological management of depressive disorder is divided into three phases, namely acute treatment, continuation therapy and maintenance treatment (45). These will be discussed in turn.

Acute Phase
Antidepressants are usually the first-line treatment in patients with moderate and severe depressive episode. In general, no antidepressant drug is clearly more effective than another, but rather antidepressants should be tailored to the patient, taking into account the likely side effects and tolerability. Older antidepressants should be avoided in patients at risk of suicide. The acute phase of major depression treatment is provided with one of the antidepressant drugs, with a first assessment of response after 4-8 weeks. Therapeutic response may occur within 2 weeks. Likewise, if there has been no response within 4 weeks recovery is unlikely (45,46). Once recovery has started it may take up to 12 weeks for a full response (i.e. longer than in younger patients) (45). In case of a positive response, the therapy is carried on in the continuation phase, usually with the same drug and at the same dose. The therapeutic alternatives in the respondent patient include: substitution of the antidepressant drug, combination of drug therapy and psychotherapy or the use of electroconvulsive therapy. More alternatives are present in the partial response patient, including change in antidepressant doses, addition of another antidepressant or no antidepressant drug (lithium, thyroid hormone and etc.). Several factors contribute to the antidepressant drug to be used in the acute phase of treatment (1).

Continuation Phase
Continuation drug therapy reduces the risk of relapse after remission. It is not a fixed period, but in older people a 12-month period of continuation with antidepressants is recommended, in contrast to a 6-month period for younger patients. However, patients with recurrent depression can be treated for 2 years. For patients with delusional depression on antipsychotic medication, it is recommended that this be continued for 6 months before being tapered off (45,47).

Maintenance Phase
Major depression often follows a recurrent course, and older people benefit from maintenance therapy even after a first episode of depression. Evidence comes from several studies. Citalopram, an SSRI, prevented recurrence over a period of 1-2 years, suggesting that a protection effect is not confined to tricyclic antidepressants (48). Extrapolating from studies of younger patients, the risk of relapse is increased if there are residual symptoms or if chronic life stresses exist (49). The case for long-term antidepressant treatment needs to be balanced against adverse effects, which for the older antidepressants can include troublesome weight gain, tooth decay and cardiovascular disturbance (45). Thirty to 40% of geriatric depression cases may be chronic, with recurrence rates of up to 38%, 3 to 6 years after resolution of the initial depression.
Maintenance of treatment regimens for an amount of time sufficient to resolve the depression, as well as adequate full-dose maintenance therapy after remission is critical. Maintenance therapy has been recommended for 6 to 9 months to 2 years after remission of the first depression episode. Some data suggest that antidepressant therapy should continue indefinitely in older persons with late-onset or recurrent depression. In practice, antidepressant therapy is often terminated prematurely due to somatic side effects from the medication, a belief that the patient no longer needs treatment, and other reasons (50).

Choosing an Antidepressant

Fortunately there are several antidepressants that have been shown to be efficacious in elderly patients being treated for a major depressive episode without psychotic features. It is recommended that selection of an antidepressant be based on the least expected side effect profile and lowest risk of drug-drug interactions (41).

A recent meta-analysis of antidepressant use in the elderly found no significant difference in efficacy between drug classes (51). Therefore, selection of an antidepressant is often based on targeting specific symptoms while considering an antidepressant’s adverse-effect profile to maximize a patient’s overall health and lifestyle (52). Antidepressants are medications that enhance and stabilize serotonin, norepinephrine, and/or dopamine systems in the brain. Selective serotonin reuptake inhibitors (SSRIs) and serotonin norepinephrine reuptake inhibitors (SNRIs) are first-line antidepressants for most prescribers, although other antidepressants such as bupropion and mirtazapine could also be used for first-line treatment. The best dosing strategy for late-life depression is to begin the patient’s antidepressant at a low starting dose and increase at a rate that is comfortable for the patient. Because it is not possible to predict the antidepressant dose to which a patient will respond to, it is important to assess for tolerability and symptom severity after each dosing increment. The reality of trial and error in antidepressant treatment comes into play when ultimately the patient is either unable to tolerate the medication or does not achieve remission. When patients are already receiving medications that are metabolized through CY P1A2, 2C9, or 2D6, the psychiatrist should recall that there is potential for a drug-drug interaction with certain antidepressants (53). The antidepressants that have a low risk of causing clinically significant CY P450 drug-drug interactions include citalopram, escitalopram, sertraline, venlafaxine, desvenlafaxine and mirtazapine. Fluoxetine, in addition to its CY P450 inhibitory effects, is also noted to have an average half-life of approximately 120 hours. Citalopram and escitalopram have average half-lives of approximately 30 hours. Medications with long elimination half-lives put patients at an increased risk of accumulation, which could manifest as difficulty in tolerating a medication. Given the risk of cognitive decline in elderly patients it is important to avoid the use of antidepressants with anticholinergic properties. Tricyclic antidepressants (TCAs) such as nortriptyline and desipramine are well known to be muscarinic-1 receptor antagonists. Paroxetine also has anticholinergic properties, although many believe that its anticholinergic effects are not as potent as the TCAs. When the psychiatrist is selecting an antidepressant to treat late-life depression, first consideration must be given to the patient for whom it is being prescribed. The patient’s history of depression and its treatment is perhaps the initial issue a psychiatrist should consider. Is the patient’s current episode of depression the first, or have there been previous episodes? Knowing which antidepressant treatment trials the patient has received in the past can help determine which antidepressants should not be used for the current depressive episode. Furthermore, if a patient has recurrent depression and has received several previous antidepressant treatment trials, it is possible that the antidepressant treatment strategy needed for the current episode maybe more aggressive and associated with a higher degree of safety concerns. For example, for some patients with recurrent depression, the use of higher antidepressant doses or antidepressant combinations or the use of TCAs may be considered. Using any of these strategies, however, should indicate to the psychiatrist that the risk of poor tolerability is greater and that monitoring for appropriate adverse effects in the patient is necessary. The psychiatrist should next consider whether the patient has co-occurring medical or psychiatric conditions. As discussed earlier, comorbidities are likely to be treated with concurrently prescribed medications so the risks of drug-drug interactions, poor treatment adherence, and poor treatment outcomes become magnified (27).

SSRIs

Selective serotonin reuptake inhibitors (SSRIs) inhibit the pre-synaptic reuptake of serotonin. Acute
treatment of depression in the elderly frequently begins with a trial of a selective serotonin reuptake inhibitor (SSRI) for four to twelve weeks with the goal of remission. SSRIs are generally well tolerated in the elderly and have limited drug-drug interactions and are less likely to be discontinued. A good trial is one that has achieved a therapeutic dose in at least eight weeks and about 60-70% of patients have responded. Once there is resolution of depressive symptoms, maintenance treatment should be continued for at least four to six months in order to consolidate remission and recovery (26).

SSRIs have lower anticholinergic effects than older antidepressants and are thus well tolerated by patients with cardiovascular disease (41). A recent meta-analysis of antidepressant use in elderly populations found SSRIs to be as effective as TCAs; the SSRIs were associated with a lower rate of discontinuation as a result of adverse effects. However, SSRIs have several potentially serious side effects, including GI bleeding (especially with concurrent use of aspirin or NSAIDs) and hyponatremia (up to 12% of older adults treated with SSRIs may present with clinical symptoms of hyponatremia) (54). Some other common consequences are CNS effects (headache, dizziness and anxiety), high risk of fall and decreased libido. In the elderly, caution should be taken because SSRIs appear both to negatively affect bone marrow density (BMD) and to increase fall risk (55). however, this risk should be considered in context with the decrease in BMD associated with depression itself (31). Owing to renal functioning associated with aging, there is also an increased risk of developing hyponatremia in elderly patients secondary to a syndrome of inappropriate anti-diuretic hormone secretion. This is seen in approximately 10% of patients taking antidepressants and is associated particularly with SSRIs and venlafaxine. It is important to check sodium levels one month after starting treatment on SSRIs, especially in patients on other medications with a propensity to cause hyponatremia, such as diuretics. Of course it is also important to check sodium levels if symptoms of hyponatremia such as fatigue, malaise, and delirium arise. Of the SSRIs, fluoxetine is generally not recommended for use in the elderly because of its long half-life and prolonged side effects. Paroxetine is also typically not recommended for use in the elderly as it has the greatest anticholinergic effect of all the SSRIs, similar to that of tricyclic antidepressants. SSRIs considered to have the best safety profile in the elderly are citalopram, escitalopram, and sertraline (41). It generally is recommended to initiate doses at half the initial dose recommended for younger adults and titrate up slowly to the optimal dose. If adverse effects do occur, one should consider decreasing dosage if the medication is effective or discontinuing the medication if the adverse event is severe or intolerable. If the side effect of the SSRI is minor, one should consider trying another SSRI versus changing to another class of antidepressant. If the side effect is severe, consider switching to another class of antidepressants. An adequate trial of medication is at least 6 weeks of the recommended dosage. If depressive symptoms resolve, continuation of antidepressant therapy for 12 months is recommended to prevent relapse. In older adults with a history of two or more episodes of MDD, long-term indefinite treatment should be considered at the same dose that showed efficacy. Further guidelines for long-term maintenance have not been adequately established (56).

**SNRIs**

Serotonin–norepinephrine reuptake inhibitors (SNRIs) venlafaxine and duloxetine have come to play a role in the treatment of late-life depression. In a specific guideline for geriatric depression, a 2001 expert consensus panel recommended Venlafaxine as an alternative to SSRIs as a first-line treatment for depression in the elderly and as a preferred agent in those who do not respond to SSRIs. A review of the cardiovascular profile of duloxetine reported a low occurrence of cardiovascular adverse events (AEs), suggesting that this agent may be an appropriate choice for the treatment of MDD in the elderly (57). There are also data suggesting that SNRIs may have greater efficacy than SSRIs in the treatment of depression in the general adult population and may have a favorable effect on the pain associated with depression (5,58).

Like TCAs, SNRIs block the synaptic reuptake of both serotonin and norepinephrine. However, SNRIs have respectively lower attachment to cholinergic and histaminic receptors, which gives these agents an adverse-effect profile more similar to that of the SSRIs. Duloxetine appears to increase heart rate and blood pressure slightly. However, a trial of duloxetine in older adults showed no increase in hypertension or orthostatic hypotension relative to placebo. A study of venlafaxine in older adults showed a small but statistically significant increase
in heart rate and decrease in standing blood pressure. However, a review of a large number of National Health Service records from the United Kingdom found no increase in the relative risk of significant cardiac events in patients who received venlafaxine compared with patients who received fluoxetine or citalopram. Venlafaxine has been reported to increase blood pressure with higher doses; however, a study of venlafaxine ER in depressed patients older than 80 years demonstrated no significant changes in blood pressure. A direct comparison of duloxetine and venlafaxine in younger patients suggests that there is a small but significant increase in the number of patients taking venlafaxine in whom elevated systolic blood pressure developed (31-59-60).

**Bupropion**

Bupropion is the only antidepressant available that inhibits dopamine reuptake and that acts on noradrenergic receptors. Bupropion can cause GI upset and weight loss, which may be a disadvantage in weak seniors. The most medically significant adverse effect linked to bupropion is a dose-dependent increased risk of seizures. In younger patients without a history of seizures, this risk appears to be relatively low, and it is even less in the extended-release preparation. Use caution when prescribing bupropion for an elderly depressed patient who has any additional risk factors. Bupropion may also exacerbate anxiety extremely and, unlike SSRIs and SNRIs, it is not indicated for the treatment of anxiety disorders (31).

**Mirtazapine**

Mirtazapine is an antagonist of both norepinephrine and serotonin receptors. Most of the medically serious harmful effects are comparable to those of SSRIs (rare agranulocytosis and hyponatremia, GI bleeding). Some clinicians take advantage of mirtazapine’s adverse-effect profile in treating common geriatric depression symptoms of insomnia (antihistaminic effect without anticholinergic toxicity), poor appetite (antihistaminic effect), GI distress (serotonin-2 postsynaptic antagonist effect), and anxiety (31).

**Reboxetine**

Reboxetine is a specific noradrenaline reuptake inhibitor. It has not been recommended for use in older people in the UK because there are insufficient efficacy data for the elderly. There have been some uncontrolled efficacy studies, and it appears to be well tolerated and safe in this patient group (45).

**SARIs (Trazodone & Nefazodone)**

Serotonin antagonist and reuptake inhibitors (SARIs) prevent reuptake of serotonin and also have an antagonistic effect on some serotonin receptors, which may help mitigate some of the harmful effects of SSRIs. Both available drugs in this class, trazodone and nefazodone can be sedating. In addition, nefazodone inhibits the CYP3A4 system which is problematic in older adults who may be taking multiple medications for other conditions. Nefazodone has been linked to increased rates of liver failure and is no longer widely used clinically for this purpose (31). Nefazodone is structurally related to trazodone (desyrel) and works well in patients with anxiety and depression but has relatively rare side effects such as agitation and sexual dysfunction. Nefazodone can improve sleep, too. However, the use of nefazodone has been associated with liver failure and the drug has been taken off the market in Europe and Canada (19).

**TCAs**

Tricyclic antidepressants (TCAs) have significant anticholinergic effects which result in an adverse-effect profile that is undesirable in older adults. Complications may include confusion, blurred vision, dizziness, constipation and urinary retention. TCAs are also linked to cardiovascular effects, such as postural hypotension and prolonged transition, which elevate the risk of fall or cause complications in patients with cardiovascular comorbidities. Due to these significant harmful effects, TCAs are not recommended as first-line treatment of depression in the elderly (31). All TCAs are equally effective, but their adverse effect profiles differ. The secondary amines, nortriptyline and desipramine cause fewer anticholinergic effects than other TCAs. Moreover, nortriptyline causes less postural hypotension than other TCAs, even in patients with reduced left ventricular function. Although age seems to be associated with reduced clearance of imipramine and amitriptyline, clearance of desipramine and nortriptyline does not seem to decrease with age. For these reasons, the secondary amines are preferred over the tertiary amines (imipramine and amitriptyline) for use in elderly patients. Recommended starting doses are 10 mg of desipramine or 10 mg of nortriptyline given at bedtime, with increases of 10 to
MAOIs
Monoamine oxidase inhibitors (MAOIs) inhibit the degradation of neurotransmitters and hinder their effect. The primary drawback of the MAOIs for patients is the dietary restrictions required to prevent a hypertensive crisis. Use of an MAOI also limits a clinician’s opportunities to augment antidepressant therapy with SSRIs and TCAs, which cannot be used concomitantly with MAOIs. More common is the risk of hypotension with MAOI use in the elderly. According to limited evidence on adverse effects in the elderly and the accessibility of more preserved-and not necessarily more effective alternative treatments, MAOIs are not widely used to treat geriatric depression (31). Although MAOIs are thought to be dangerous and difficult to use, drugs such as phenelzine (nardil) are to some degrees safe and effective in older patients. A full therapeutic response can be achieved after five to seven weeks of treatment. Hypotension, hypertension and food-drug interactions are the most likely problems with MAOI use. Taking agents from more than one drug class can increase a patient’s risk for developing serotonin syndrome (i.e. mental status changes, hyperreflexia, agitation, myoclonus, diaphoresis, shivering, tremor, diarrhea, incoordination and fever (19).

Drug interactions
Drug interactions are a major concern in the selection of an appropriate antidepressant. Most drugs are metabolized in the liver by the cytochrome P-450 system. Inhibition of one of these enzymes results in higher blood levels of any drug that is metabolized by that enzyme, and induction of that enzyme results in lower levels of such drugs. Two of these enzymes, CYP2D6 and CYP3A4, have particular relevance to the treatment of depression (61). Many antidepressants such as bupropion, duloxetine, fluoxetine and paroxetine inhibit the CYP2D6 enzyme, which metabolizes a numerous variety of drugs, including β-blockers such as propranolol; antipsychotics such as haloperidol and clozapine and many antidepressants—TCAs such as nortriptyline and other SSRIs. Erythromycin and grapefruit juice both inhibit the CYP3A4 enzyme, which metabolizes citalopram, sertraline, mirtazapine, and venlafaxine (62). Start these medications at low doses to allow for appropriate adjustments in response to increased or inhibited enzymatic activity. Caution patients who start taking an antidepressant about drugs such as antibiotics that could inhibit or induce the metabolism of the antidepressant. This is especially serious with antidepressants that have a narrow therapeutic window. MAOIs interact with a wide variety of medications including antihypertensives, anesthetics, pain relievers (especially meperidine) and monoamines (such as levo-dopa) (63). Non prescription supplements and herbs can also interact with the CYP system or otherwise interfere with antidepressants (31). Venlafaxine, mirtazapine and bupropion are also considered to have good safety profiles in terms of drug-drug interactions (64). SSRIs such as fluoxetine, paroxetine and fluvoxamine have higher risks of drug-drug interactions (41).

Treatment-Resistant Depression
An important chapter in the management of elderly depression is that of treatment-resistance, the definition of which states that it is an incomplete or absent response, or high tendency to recur in patients adequately treated with at least 2 antidepressant drugs at adequate doses and times of treatment. Several factors contribute to the occurrence of treatment-resistance especially in elderly depressive patients with medical comorbidities (1). Various factors have been discussed that may increase the probability of not responding to antidepressant treatment. The presence of a comorbid psychiatric or general medical disorder is very important. Keitner and colleagues reported that 53% of patients hospitalised with major depression have coexisting axis I, II, or III conditions, stated as "compound depression" (65). Other factors that guarantee consideration in the evaluation of treatment-resistant depression include female gender, family history, early or late age of onset, severity of illness, and course chronicity. Assessment of treatment-resistant depression (TRD) should include careful attention to the possibility of pseudoresistance. Causes of pseudoresistance include prescribing an inadequate dose or duration of treatment, patient noncompliance or unusual pharmacokinetics, and misdiagnosis of the primary disorder by not recognizing a secondary mood disorder or a depressive subtype. Of the clinical variables reviewed, the presence of a comorbid psychiatric or general medical disorder, older age, greater severity of illness, and chronicity of course show the strongest evidence as risk factors.
for treatment-resistant depression. Clearly, more research is essential to investigate the characteristics and predictors of treatment-resistant depression by means of using controlled trial designs and standardized definitions of treatment resistance (66).

**Strategies of Treatment**

Treatment options for refractory depression are: the switching option, the augmentation or the combination one. The switching option, the substitution of an antidepressant with another one, is used in cases of lack of tolerance or poor symptomatic reduction. The advantages of this option include better compliance, less drug interaction and reduced costs. The other two options, the combination method (association of another antidepressant to the first one) or the augmentation one (association of a non antidepressant drug) are used in cases of partial remission; the advantages of these two methods are a more rapid response, lack of necessity of titration and maintenance of the initial improvement (1,67).

**Switching**

The decision to switch a medication should be made on the basis of its effectiveness and adverse effects. If the harmful effects of a drug create significant discomfort, switching to another drug may be beneficial. A medication should be immediately stopped or tapered off if it produces medically serious adverse effects, such as hyponatremia or seizures (31).

**Add-On Treatments**

**Augmentation:** Continued treatment with antidepressants comparing to placebo is more efficacious in preventing relapses and recurrences. In absence of maintenance treatment, 30-90% who achieve recovery will experience recurrence in 8 to 48 months. Unfortunately, failure of response to SSRIs may be as high as 77%. Therefore, augmentation of the SSRI with bupropion, lithium or nortriptyline can be considered. For lithium, drug levels and renal function should be closely monitored. Furthermore, augmentation using other antidepressants such as mirtazapine and venlafaxine may also be effective. There are several atypical antipsychotics that are FDA approved as augmentation strategies. The data on treatment of non-remission of depressive symptoms is limited and results are not optimal. This will hopefully be an area of greater clinical investigation in the future (26).

**Combination:** The aim of combining antidepressants is to combine two or more mechanisms of action in an attempt to obtain a synergy (enhancement of efficacy) or enhanced tolerability (by opposing or blocking side effects) (68). Concurrent administration of two or more antidepressant agents (e.g., adding trazodone [desyrel], desipramine [norpramine] or bupropion [wellbutrin] to fluoxetine) may result in a different therapeutic response than that produced by use of either drug alone (68).

**Treatment of Comorbidity**

In the cognitively impaired: Despite the high prevalence of depression in patients with dementia, there are limited trials of antidepressants in this population. However, placebo-controlled trials of citalopram, fluoxetine, and sertraline as well as some TCAs have demonstrated efficacy in this group (30). The compromised ability of the patient to report adverse effects and the fact that s/he has stopped taking the medication is of concern, which points to the need to rely on caregivers’ reports, which may be incomplete. Moreover, confusion or cognitive impairment from anticholinergic antidepressants such as TCAs may be misinterpreted as worsening dementia, and it may go undetected. Addressing depression in older adults with dementia without using an antidepressant can be difficult and requires additional effort to consider their individual circumstances and to engage them. But psychosocial interventions that focus on helping people with dementia and their caregivers coping with the consequences of cognitive loss would be the best first step (69). In past studies, depression associated with dementia has been safely treated with SSRIs and tricyclics. These recent studies also demonstrated antidepressant efficacy in patients with dementia; patients whose depression lifts may also be associated with modest improvement in cognitive function (70).

**Comorbid physical illness**

Depression is commonly associated with medical illness in the elderly. Although trials of antidepressants in older adults are generally safe and well tolerated different from healthy people, many elderly patients have considerable medical comorbidities. A recent analysis of a large cohort in elderly patients for whom an antidepressant was prescribed found a median of 5 comorbid conditions in more than 40% of patients: hypertension,
hyperlipidemia, ischemic heart disease, and gastrosophageal reflux. While the cardiovascular adverse effects of TCAs make them undesirable to use in patients with significant cardiac disease, SSRIs with their convenient cardiovascular profile appear safe for use in this population. SSRIs also appear to be both safe and effective in the treatment of post-stroke depression. Pain was a frequent comorbid condition, and occurred in 24% of patients in the cohort mentioned above. The use of antidepressants with NSAIDs or opioids can lead to an increased risk of complications, such as GI bleeding or serotonin toxicity (70). The adverse-effect profile of SSRIs may be preferable to those of TCAs in older adults because these agents generally lack cardiovascular and anticholinergic effects (except Paroxetine, which has some anticholinergic properties). A randomized controlled trial of sertraline in patients who experienced depression after hospitalization for a myocardial infarction or unstable angina showed no difference in cardiac safety parameters or in adverse cardiac events compared with placebo. This study suggests that SSRIs are well tolerated, even in patients with significant cardiovascular comorbidities. (11).

Untreated depressed persons with comorbidities (e.g. diabetes, arthritis) are at risk for further health deterioration. Awareness of the key presenting and comparatively atypical signs of irritability and anxiety, unintended weight loss, and preoccupation with death can help identify patients so that appropriate treatments can be discussed and initiated (50). Because depression in the elderly is associated with unfavorable medical outcomes and suicide, treatment should generally be instituted (71). Although depression has been recognized as detrimental to cancer prognosis, treatment, and related quality of life not much is known about the treatment of depression among the elderly with cancer (72).

Psychotherapy
Psychotherapy alone is as efficacious as antidepressant medication in patients with mild to moderate major depression and may be used as first-line treatment (73). For many years it was thought that elderly patients could not benefit from psychotherapy because they were “no longer educable and, on the other hand, the numerous issues to be dealt with would prolong the duration of the treatment indefinitely”. This shows that the same highly focused types of psychotherapy that are effective in younger persons are also effective in elderly patients (20). Cognitive behavioral therapy (CBT), reminiscence therapy (i.e. an intervention that uses recall of former events, quality of life, feelings and thoughts to facilitate pleasure and adaption to the present), and general psychotherapy were compared in their effectiveness in treating depressive symptoms. All three types of psychotherapy were found to be effective treatments for depression in elderly people. Particularly, each format of individual therapy was significantly more effective than no intervention or placebo. CBT and reminiscence therapy had similar efficacy in treating depression in the elderly patients. The results altogether confirm the efficacy of psychotherapy for treating depression in the elderly (74).

Cognitive behavioral therapy:
CBT is a structured, goal-directed, problem-focused, and time-limited approach focusing simultaneously on the environment, behavior, and cognition. Patients learn how their thoughts contribute to symptoms of their affect and how to change these thoughts. Elevated cognitive awareness is combined with specific behavioral techniques. It is the form of psychotherapy most often used with depressed older adults and has shown to be highly effective with patients who have depression in hospital and community settings and in individual and group formats. CBT also seems to be of benefit in the management of bipolar disorder in lowering the rate of relapse, improving medication compliance, and decreasing hospitalizations.

Interpersonal therapy:
Interpersonal therapy (IPT) is a practical, focused, brief, and manual-based therapy applicable in the treatment of depression in older adults in acute phase and in relapse prevention. It focuses on disturbance of patients’ current relationships in the domains of role transition, role disparity, abnormal distress, and interpersonal deficit. The aim is to improve communication, express affect, and support renegotiated roles in relationships with the effect of
symptom reduction and improvement in functionality. Interpersonal therapy has shown clear benefits in depressed older adults. Interpersonal psychotherapy is a highly precise type of psychotherapy specifically developed for the treatment of depression (20).

**Systemic (family) therapy:**
Systemic therapy attempts to correct distorted communications and relationships as a means of helping the entire family or system, including the identified patient. Late life depression is sometimes complicated by enmeshed and high expressed emotional family or systemic relationships. It will be present if at least some part of the system (crucial members of the family) can be engaged in it. Controlled outcome studies of family therapies for depression suggest that the addition of problem-centered, family-based interventions may improve family function and enhance patient recovery from depressive symptoms. Cognitive analytical therapy or brief dynamic therapy CAT or brief dynamic therapy represents a modern integration of analytic and cognitive therapy traditions to offer a brief, structured, and collaborative therapeutic experience in a coherent way of linking the past and present. It shows that later life is the period when coping mechanisms are challenged by disability, losses, and changes in social role which can easily resurface pre-existing trauma and low self-esteem that lead to affect deregulation and interpersonal difficulty. Patients who have personality disorders and past traumatic experiences living in highly dysfunctional relationships or isolation can get help from a dynamic or CAT approach (75).

**Brief psychodynamic therapy:**
From a brief dynamic perspective, depression is often conceptualized from a psychodynamic perspective as being the result of unresolved, unconscious conflicts, usually stemming from childhood. The goal of this therapy for the patient is to understand and cope better with these feelings. As such, brief psychodynamic therapies focus on the reflection of past experiences, clarification of affect, the therapeutic relationship, and the confrontation of maladaptive interpersonal patterns, wishes, or conflicts (75,76)

**Psychoeducation:**
Psycho-education provides patients and families with information about their diagnosis, its treatment, how to recognize relapse signs to prevent it, and strategies to cope with the reality of prolonged emotional or behavioral difficulties. It can be a component of or an adjunct to other forms of therapy and may be directed toward the patient or the patient’s family. The main goal is to reduce confusion, distress, and anxiety within the patient or the patient’s family to facilitate treatment compliance and reduce the risk of relapse. In combination with primary treatments, psychoeducation is particularly helpful for patients and the families of patients who have bipolar disorder (56).

**Exercise Programs:**
Several randomized, controlled trials suggest that short-term (e.g. 12-week) supervised, group-based physical-exercise programs involving walking or other forms of aerobic exercise can reduce depression in older adults; 45 to 65% of program participants have a substantial reduction in symptoms of depression as compared to 25-30% of controls. A physical-exercise program could be a first-line strategy for patients with mild-to- moderate depression who prefer this approach, but it may be difficult for patients with depression to engage in such a program, and additional treatment with antidepressants or psychotherapy may be needed (39).

**ECT (Electroconvulsive Therapy)**
Several randomized, controlled trials have established the efficacy of ECT for severe late-life depression, with efficacy rates ranging from 60 to 80% (78). ECT is particularly indicated for patients with depression that is resistant to other treatments and for patients at risk for serious harm because of psychotic depression, suicidal ideation or severe malnutrition. ECT is usually administered as a series of 6 to 12 treatments in an inpatient psychiatric setting over a period of 2 to 4 weeks. Common side effects include headache that usually responds to analgesics and temporary confusion or memory impairment. Less common side effects include memory loss for events during the period surrounding treatment and falls immediately after treatment sessions. The mortality associated with ECT is less than 1 death in 10,000 patients. A successful course of ECT should be followed by maintenance pharmacologic treatment because of high rates of relapse. In a randomized trial involving patients with depression that had improved after ECT, 6-month relapse rates were 84% among patients receiving placebo, 60% among patients receiving nortriptyline, and 39% among patients
receiving lithium plus nortriptyline (39,79). Contraindications include recent myocardial infarction, brain tumor and uncontrolled heart failure (19). ECT is also considered as an alternate treatment for severe depression, specifically in cases where a patient has failed to respond to two antidepressants or is acutely suicidal such that a quick improvement in symptoms is required for the patient’s safety or if the patient is unable to take medications owing to medical problems. In the elderly it has been associated with better treatment outcomes and fewer side effects than medications. In the case of treating psychotic and severe depression with ECT, another advantage is that an antidepressant typically exists in maintenance treatment to avoid the use of an antipsychotic medication and its potential side effects with long-term use (41). Geriatric patients obtained more benefit from education, as shown by their greater improvement in decisional capacity after education (80). With respect to the goal of maximizing efficacy plus minimizing cognitive side effects, dispute continues about unilateral vs. bilateral electrode position. It is thought that Right unilateral (RUL) ECT causes less cognitive impairment than bitemporal, but bitemporal ECT is believed to be more effective than unilateral ECT (80). The relation between electrode position and electrical dose relative to a patient’s seizure threshold is controversial. Seizure threshold is the minimum electrical intensity required to induce an adequate generalized grand mal seizure. It is well known that a generalized tonic-clonic seizure is necessary for ECT to exert the expected antidepressant effect (41). However, several studies have shown that, while a generalized seizure is sufficient for the efficacy of bilateral ECT, the patient should not categorized for RUL treatment (41,80). ECT, however, had greater memory impairment at 1 week and 2 months after finishing ECT. These results led to this conclusion that “right unilateral ECT at high dose is as efficacious as a robust form of bilateral ECT but produces less severe and persistent cognitive effects” (80).

Length of seizure, beyond the widely quoted minimum criterion of 20 seconds of motor or 25 seconds of electroencephalographic manifestation, is not related to ECT efficacy (80). Many clinicians recommend avoiding the use of benzodiazepines in elderly patients during ECT, if possible. If a benzodiazepine is required, lorazepam at a dose of 0.5 to 1.0 mg daily is the most appropriate choice. Antipsychotic medications, which can lower seizure threshold, can be an effective alternative to benzodiazepines in the acute management of agitation or severe anxiety associated with late-life depression. In patients with seizure disorder, antiepileptic medication should initially be maintained at a therapeutic dosage, because dosage reduction or discontinuation increases the patient’s risk of experiencing seizures between ECT treatments (41). The dosage should be cautiously reduced only if an adequate seizure cannot be elicited. In the case of patients taking antiepileptic medications as mood stabilizers, it is preferable to withdraw the medications prior to ECT (80).

Controlled studies have established that bitemporal ECT administered 3 times weekly results in more rapid improvement than treatment twice weekly, but there is no difference between the 2 schedules in the total number of treatments required to achieve response or in the percentage rate of response. Conversely, the more frequent schedule is associated with more retrograde amnesia, both immediately after finishing the course of ECT and at 1-month follow-up. Thus, twice-weekly administration may be the optimal schedule for bitemporal ECT in the elderly, unless clinical indications or other considerations (for example, length of hospitalization) require the more rapid antidepressant effect of thrice-weekly treatment. Comparable data on the frequency of RUL ECT are not available (80).

There is considerable variability in the number of ECT treatments required for eliciting response. As a result, the number of treatments in a course of ECT should be decided on a case-by-case basis. ECT is typically discontinued once symptoms remit or when symptoms reach a plateau of improvement after 2 consecutive treatments. Among elderly patients with major depression, 6 to 12 treatments are often required to achieve maximal benefit, but some patients may need more than 12 treatments. In the case of no response or minimal response many experts recommend at least 10 to 12 bitemporal treatments before the depressive episode is labeled nonresponsive (78,80).

The mortality rate associated with ECT is only 0.2 to 0.4 per 10000 treatments, no higher than that expected with general anesthesia alone. Cardiovascular complications constitute the principal cause of ECT-related morbidity. Delivery of the ECT stimulus induces a brief parasympathetic
response that can result in sinus bradycardia and hypotension. Not infrequently, transient asystole occurs. As the patient starts to seizure, a discharge in catecholamines from the adrenal medulla results in increased heart rate and blood pressure. In patients with ischemic heart disease, this period of increased myocardial oxygen demand may increase the risk of cardiac ischemia. In turn, ischemia is the main cause of arrhythmias. ECT use in medically ill patients has been extensively reviewed elsewhere, and a detailed discussion is beyond the scope of this article. ECT has been safely and effectively performed in the presence of a wide range of serious medical conditions, including: severe ischemic heart disease, aortic stenosis, chronic airways disease, osteoporosis, aortic and cerebral aneurysms, brain tumors, epilepsy, and recent stroke. Patients with pacemakers and patients taking anticoagulants can safely undergo ECT. As with any treatment, the risks of ECT must be balanced against its potential benefit and the risks and benefits of alternative treatments or no treatment. It is worth emphasizing that untreated depression can have severe medical consequences in the elderly, including dehydration, malnutrition, skin breakdown or deep venous thrombosis secondary to prolonged immobility and an increased risk of mortality. Further, untreated depression can adversely affect recovery from various medical and neurological conditions (78-80).

Depression relapse in response to ECT is a significant problem. Several studies suggested that despite continuing antidepressant medication, the relapse rate during the 6 to 12 months exceeds 50% following acute ECT. Preventing the relapse still is a major challenge for the field. A primary indication for ECT is to obtain an adequate response of antidepressant medication, yet these medications are usually prescribed as supplementary treatment following ECT. Thus, after responding to ECT, patients generally switch back to a treatment modality that had shown ineffectiveness. Therefore, the resistance to antidepressant medication predicting post-ECT relapse is not surprising. To solve this problem, ECT after response is better to be continued. Currently available, albeit limited, data suggest that continuing ECT (C-ECT) is a safe, efficacious and cost-effective way to prevent relapse (78-80).

Newer Modalities

**Vagus nerve stimulation:**
Vagus nerve stimulation (VNS) was initially used and finally approved for treatment of refractory epilepsy in 1997. Noticing its mood-brightening effect on epileptic patients, anatomic afferent connections of the left vagus nerve to the CNS and to structures relevant to mood regulation lead to studies conducted to determine the effectiveness for depression. Many of these studies demonstrated its long-term benefit for treatment-resistant depression, which resulted in its FDA approval in 2005 for the same indication. So far studies have failed to show its effectiveness as monotherapy or in the acute setting. VNS may be more promising as a long-term maintenance treatment to sustain remission than as an initial treatment to bring someone out of depression. Under general anesthesia, a pulse generator is implanted in the left chest wall and a wire threaded into the neck and around the left vagus nerve. The stimulator, similar to a cardiac pacemaker, is programmed through an external hand held device. This procedure is safe (the only common adverse effect is hoarseness) and causes fewer side effects than antidepressant medications and ECT. Performing a surgical procedure under general anesthesia is a disadvantage as is the one-time high cost. Its safety and low side-effect profile makes it a good modality for selected elderly patients, although there is no adequate controlled data in this age group (56,81,82).

**Transcranial magnetic stimulation (TMS):**
Repetitive transcranial magnetic stimulation (rTMS) uses an electric coil to generate a magnetic field that stimulates the cerebral cortex. It is well tolerated by patients and, in contrast to ECT, does not require the use of anesthesia and does not appear to cause cognitive impairment. Randomized controlled and meta-analytic studies of rTMS have produced conflicting results. A subsequent randomized trial of rTMS in 60 patients who had TRD did show a significantly higher rate of response in two active treatment groups (high-frequency left-sided rTMS and low-frequency stimulation to the right prefrontal cortex) compared with placebo. The absolute benefit, however, appeared to be relatively small. rTMS seems most promising to those with depression who have not responded to medication before going on to ECT. Once its benefit is established this is another safe and potential treatment option in the geriatric group. One study showed no significant benefit for TRD in the elderly, however rTMS is not FDA approved at the present time (56,83,84).
Deep brain stimulation (DBS) is an FDA-approved treatment of refractory Parkinson’s disease and other movement disorders. Stimulating electrodes (1 mm in diameter) are implanted stereotactically, through a scalp burr hole and under MRI visualization into the subgenual cingulate region (Brodmann area 25), one lead on each side. The leads are connected to pulse generators placed in the chest. The stimulators are programmed using telemetry. Electrodes are directed to this metabolically overactive region in TRD. The high-frequency stimulation in DBS is believed to work by inhibiting neuronal activity. Patients selected for this procedure are severely and chronically ill and have not responded to any of the available treatment modalities, in most cases, ECT. Mayberg et al study results in March 2005 showed a remarkable outcome. Five of 6 patients experienced substantial respite from their depressive symptoms, and in follow up 4 patients remained well after 6 months of treatment. So far, fewer than 20 patients who have depression worldwide have undergone DBS. Given its invasiveness and the need for more data, DBS would be reserved for patients who have been severely impaired by depression and have been refractory to all other treatment modalities (56-85-86).

Conclusion
Finally, as already said, one of the major obstacles to the therapeutic response is the lack of compliance influenced by several factors such as: cognitive impairment, complexity of dosages, side effects, lack of comprehension of the depressive symptoms, treatment costs and lack of family support, and finally, fear of stigma. On the contrary, factors improving compliance to treatment include a complete physical and cognitive assessment of the patient, involvement of relatives in the therapeutic program, maintenance of frequent contacts and supply of clear and comprehensible information on diagnosis and therapeutic management, these being generally, the cardinal points of the so-called good medical practice. The fact that depressed individuals do not receive the necessary treatment may lead to significant negative consequences such as a reduction in their quality of life, the chronification of emotional problems, an increase in the use of health services or an increase in the risk of suicide. Therefore, the application of an adequate intervention for the problems of depression must be an essential objective for assistance at the primary health care level and thus, important efforts in this direction are needed (87). In the oldest group of community-dwelling patients to be studied, medication was not more effective than placebo for depression treatment. However, according to the considerable psychosocial support received by all patients, the placebo condition shows more efficacy than the ingestion of an inactive pill. There was a remarkable range across sites in response to medication, 18% to 82%, and to placebo, 16% to 80% (88). Late-life depression represents an important opportunity for pharmacists to participate in the care of their aging patients. This common psychiatric illness leads to poor quality of life and is associated with a significant mortality risk, and can adversely influence the outcomes of comorbid medical illnesses. Late-life depression can be part of an unreported bipolar illness; it can also be associated with symptoms of psychosis and/or anxiety. The resulting psychiatric pharmacotherapy may therefore include various combinations of psychotropic medications. Pharmacists know that patients receiving multiple concurrent medications are at increased risk for adverse effects, drug interactions, treatment non-adherence and poor treatment outcomes. Taken together, this makes late-life depression an important illness for which pharmacists should screen their patients’ situation for recommending the use of rating scales such as the PHQ-9 or GDS. Elderly patients being considered for antidepressant treatment should have several factors evaluated prior to the selection of an antidepressant. History of depressive episodes and corresponding antidepressant treatment, as well as current pharmacotherapy are among the most important pre-treatment considerations. Once a patient is receiving an antidepressant the psychiatrist should help the patient use rating scales to measure depression symptom severity. Antidepressant dose and treatment durations are also important concerns for the psychiatrist to reinforce with the patient. The goal of the psychiatrist is to help the patient safely achieve remission (27).

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Case Report

Apert syndrome: a case report

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Apert syndrome is a genetic disorder first described by Eugene Apert in 1906. Its incidence is approximately one in 50000 births. This syndrome is associated with many abnormalities in the body and affects the central nervous system. Rehabilitation can increase children and their parent's quality of life. We report a case of Apert syndrome and the occupational therapy program conducted. In this paper We report a case of Apert syndrome and the occupational therapy program conducted. He was diagnosed by a neurologist upon physical examination.

Keywords: Apert syndrome, Rehabilitation

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Introduction
Over the past decades advances have been made in the prevention and treatment of developmental malformations. This revolution in our conceptualization of developmental anomalies has led to an improved ability to handle and prevent them. Despite these improvements, some conditions remain or continue to exhibit a large number of sporadic occurrences (1). Apert syndrome is one of these conditions. It is a genetic disorder first described by Eugene Apert in 1906. Apert syndrome is known to be inherited as an autosomal dominant complex multisystem disorder, but most cases are sporadic. Although Apert syndrome is rare, its incidence is approximately one in 50000 births (4.5% of all craniosynostosis cases have Apert syndrome) (1, 2).

This syndrome is characterized by: craniofacial dysmorphism, hands and feet syndactyly and craniosynostosis (premature fusion of cranial sutures). Other anomalies include: congenital heart defects, central nervous system (CNS) abnormalities (including defect of corpus callosum and ventriculomegaly), limitation of shoulder movement, short humerus, urogenital anomalies, dermatologic manifestations, hearing loss, ear infection, sleep apnea, severe acne, poor intellectual development, and increased incidence of eye injuries (3, 4).

Apert syndrome has no known cure but orthopedic surgery can help correct the abnormalities. Surgery takes place in three steps: release of fusion, midface advancement and correction of wide set eyes. Other surgeries may be necessary depending on the individual’s problems (such as: myringotomy, tracheotomy). Rehabilitation too can promote children and their parents’ quality of life (5). We report a case of Apert syndrome and the occupational therapy program conducted. He was diagnosed by a neurologist upon physical examination.

Case report
"B.H." was an 11 year old boy. He has many aspects of Apert syndrome but no cardiac disorder. This young man was referred to the Occupational therapy clinic/ward because of psychomotor retardation at the age of 15 months. He is the first child of non-relative young parents with a history of epilepsy in the maternal aunts.

History during Pregnancy: Severe edema with hypertension since 5th month and amniotic leakage from 6th month.

History during Delivery: cesarean section (C/S) by 32 weeks due to rupture of membranes and hemorrhage. Birth weight was 2200 gm. He was admitted due to poor feeding and severe irritability by the 7th day.

Immunization: Up-to-date. He had high fever for 3 days after his first immunization.

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EEG: abnormal (slow background with scattered slow spike waves).
MRI: prominent brain sulci and ventricular system were noted for his age, indicative of brain atrophy. Corpus callosum was hypoplastic especially in the splenium part.

Abdominal ultrasound: normal
TORCH: normal
ABR: Bilateral sensorineural deafness
Ophthalmologic consultation: bilateral cataract (had been operated by age 2 months)
Chromosomal study: NL (Fig1)

Metabolic studies including serum and urine analysis, serum NH3, lactate, Urinary reducing substances were normal.
Medication: Primidon 20 mg/kg/day

Growth & Development at first OT observation (by age 15 months): Head control on prone position, no sitting, no speech, no hand regard or using. He was irritable, hypersensitive, mild hip abduction restriction, large hand thumb, polydactyly of hands and feet; double and fused foot thumb. He made poor eye contact, had no organomegaly or skin disorder, and had trouble swallowing.
He had surgical operation for polydactyly by 19 months.

Occupational therapy interventions:
OT programs for B.H. was based on Neurodevelopment facilitation techniques, feeding program and dark room. After 12 months OT intervention and 47 sessions, he was more cooperative, more alert and had fair swallowing capability. He made no tremendous motor system improvement, however he could control his head, sit with support, roll to both sides and react to others.

OT programs for his parents included: 1) Activity Daily Living (ADL) training such as bathing, bed mobility, dressing and eating. 2) Injury prevention or reduction, education and safety awareness training during his care with proper methods and suitable devices. 3) Emotional and social support to cope with this condition and 4) teaching coping strategies.
After 12 months of the OT program his parents had learnt caring methods very well and their quality of life had improved significantly (according to the SF-36 questionnaire).

Conclusions
Apert syndrome is rare and has no known cure. Parents of children affected may lack knowledge and skills in specific areas of parenting, such as mobility, providing for a child’s safety, feeding, or daily routine care. The rehabilitation team especially occupational therapists can provide these services. They can help parents cope with their condition and to participate fully as their role of parents.

References:
Contents

Original articles

The Effect of Sensory Room Intervention on Perceptual-Cognitive Performance and the Psychiatric Status of Schizophrenics
Ara Shaghahi; Ashraf Karbafaliy Noori; Seyed Ali Hosseini, PhD; Hossein Sourtigi

Reconstructing, Investigating the Reliability and Validity and Scoring the Stanford Diagnostic Reading Test
Bahram Saleh Sedighpour, PhD; Sara Dazai

Fine Motor Development of Low Birth Weight Infants at the Corrected Age of 8 to 12 months
Sepideh Nabi; Farzaneh Ali Abadi; Bahareh Moghafari

The relationship between Mental Pressure and Job Burnout of nurses working in the centers of mentally disabled adults
Sedighe Bakhtiari Shahri

Age and Gender Effects on Auditory Brain Stem Response (ABR)
Yones Lotfi, MD; Farzaneh Zamiri Abdollahi

Comparison of Early Active and Passive Post-operative Mobilization of Flexor Tendon in Zone 2
Fereydoun Layeghi, MD; Maryam Farzad2

Compression of Cognitive Flexibility and Adjustment of Students with Developmental Coordination Disorder and Typically Developing Students
Hassan Sedghi; Abbas Abolghassemi, PhD; Najer Hajloo, PhD

Body Part Concerns Questionnaire (BPCQ) in an Iranian Population with Special Needs
Kaleypour Khadem, Asghar Daudkouhi, PhD; veil Nasim, MD.

Recourse Allocation in Young and Elderly Adults
Fatemeh Bazrafkan, Afsaneh Hassani Mehraban, PhD; Mojgan Moghadam, PhD.

The Effects of Unloader Knee Orthosis and Lateral Wedge Insole in Patients with Mild and Moderate Knee Osteoarthritis (OA)
Mokhtar Arazpour, PhD; Fatemeh Zarezadeh; Monireh Ahmadi Bani

Attentional Demands of Balance under Dual Task Conditions in Young Adults
Monireh Nobahar Ahari; Seyed Ali Hosseini, PhD; Vahid Nejati, PhD

Reviews/Short communication

Exercise as a Treatment to Improve Quality Of Life in Patients with Cancer (A Review of the Literature)
Kasra Mir Hosseini; Abbas Rahimi, PhD; Hessam Soud Akbar

Treatment of Depression in the Elderly: A systematic review
Arash Miratizadeh, MD; Mohammed Reza Khodaei, MD.

Case Report

Apert syndrome: a case report
Masoud Gharib; Nazila Akbar Fahimi