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Effect of Core Stability Exercises at Home on Functional Ability and Chronic Low Back Pain (LBP) in Male Dentists

Reza Rajabi [1], Akram Ahmadi Barati [1, *] and Leila Farhadi [2]

[1] Department of Physical Education and Sport Science, University of Tehran, Tehran, Iran
[2] Marketing and Media Orientation of Sport, University of Kurdistan, Kurdistan, Iran

[*] *Corresponding author*: Department of Physical Education and Sport Science, University of Tehran, Tehran, Iran. Email: akramahmadi63@yahoo.com

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Abstract

Background: Lumbar Back Pain (LBP) as the most common musculoskeletal disorder in dentists has increased. Core stabilization exercises, as a new exercise method, can affect individual's abdominal and lumbar muscles. Given the deleterious effects of LBP on the performance of dentists.
Objectives: This study aimed to assess the effect of core stabilization exercises at home on functional ability and chronic LBP in male dentists.
Methods: The population of the present quasi-experimental study included all male dentists in Kermanshah. Forty volunteered dentists with LBP were divided to experimental and control groups. Research tools included Quebec Back Pain Questionnaire for measuring LBP and Oswestry Disability Questionnaire for measuring the degree of disability in daily living activities. The exercise program was designed for the experimental group as three sessions per week for six weeks. Data were analyzed with paired and independent *t*-tests and the normality of the data was verified with Kolmogorov-Smirnov test.
Results: Spine stabilization exercises have a significant effect on functional ability (P = 0.02) and level of pain in male dentists of Kermanshah (P = 0.04).
Conclusions: This intervention is safe, easy, accessible and effective without any side effects.

Keywords: Male Dentists, Chronic Low Back Pain, Core Stabilization Exercise, Functional Ability

1. Background

Musculoskeletal disorders in dentists significantly lead to the work absence and reduced productivity (1). In many studies, low back pain (LBP) is one of the most common musculoskeletal problems in dentists. Its incidence varies in different studies (2). A variety of causes are mentioned for musculoskeletal disorders in dentists. In addition to physical factors such as physical conditions, work habits, psychosocial factors are also considered as a risk factor. The severity of LBP depends on many occupational and non-occupational factors. Dentistry is a profession which requires an accurate, constant and fixed physical position. The technical skills of a dentist, the place where they work, and the tools and technology they use affects their physical condition. The profession of dentistry differs from other jobs for example, changing the position of the dentist's chair so that the dentist and patient themselves feel comfortable and as a result of proper diagnosis and clinical judgment, will enhance the dentist's performance (3).

Although the underlying cause of LBP has not yet been determined, poor muscle control of the trunk is suggested as a possible cause. About 85% to 90% of dentists have non-specific chronic LBP (4, 5), which affects a large group of dentists with different pathological or pathophysiological conditions that are classified into groups with similar characteristics, abnormalities and functional impairments (6, 7). Since in most cases, the pathomechanical diagnosis of chronic LBP is difficult, there is still no consensus on its classification among dentists. However, many scholars have considered the lumbar spinal segmental instability as one of the pathomechanical mechanisms for non-specific chronic LBP (8). In terms of biomechanics, human spinal cord has a considerable structure that needs to be stable (9).

Functional stability involves static and movable stability in response to different body requirements, such as moving in different directions and bearing body weight. Inactive structures, such as bones, joints and ligaments, alone do not respond to this need; therefore, active struc-

tures, i.e. muscles, mechanically stabilize the spine, which becomes the first important factor in securing stability and creating balance. In general, the major problem in mechanical backache is often associated with clinical spinal instabilities, or, in other words, the reduction of the capacity against the physiological forces involved in the absence of neurological deficits, deformity and pain (8).

Panjabi believes that the spine stability system can be checked in three domains:

1. The inactive system including vertebrae, intervertebral discs, spinal ligaments, and articular capsules and inactive muscles.

2. The active system including an active feature of the muscles and tendons.

3. The neuropsychiatric system including receptors and other aspects of neuronal control.

Under normal conditions, all three systems provide mechanical stability of the spine, but if any of the subsets fail, the other systems provide their own performance and compensate for the stability of the spine (10). A large body of research has addressed dentists and the impact of their occupation on their body structure regarding LBP. In this regard, Pradeep's study showed that after neck pain, back pain is the most common musculoskeletal disorder in the dentistry students (11). Talpos-Niculescu et al. showed that general pain was common in dentists, but most of the pain was experienced by dentists with no regular physical activity (12).

Spinal stabilization programs are one of the most commonly used therapies for the treatment of chronic LBP. Their main goal is to gain strength, endurance and flexibility of the spinal muscles to improve damaged tissues and return to normal daily activities and as well as retraining and recalling stabilizing muscles in limb movements and functional movements in segmental control, lumbar stability has a great role (13).

Evidence shows that morphological and functional changes in stabilizing muscles, such as transverse abdominal muscles and multifidus, improve with regular exercises. Furthermore, stability exercises play an important role in training and performance of these muscles (14, 15). Javadian et al. conducted a study titled "the effect of stability training on functional pain and functional disability in patients with segmental waist instability in 30 patients aged 18 to 45 years". Their results showed that stability training with routine exercise has a positive effect on decreasing pain intensity, functional disability and increasing muscle endurance. It is recommended to use these exercises in treating patients with segmental instability of the low back (16). Puntumetakul et al. studied the effects of 10 weeks of central stabilization training on back pain in patients with lumbar instability, and concluded that 10 weeks of central stability training had a long lasting effect on outcomes and improved the function of the abdominal muscles compared to conventional treatments (17). Wang et al. compared general and central stability exercises and concluded that central stability exercises were more effective in reducing pain and functional improvement of chronic LBP (18). Central stabilizing exercises as a new training method can affect the muscles of the abdominal and lumbar areas. The results of their research indicate a decrease in the severity of back pain. The presence of a strong body center is effective in facilitating movements during basic exercises. The center of the body should be appropriately practiced to effective body weight distribution and shock absorption. It seems that the strengthening of the central muscles of the body in dentists, who are mainly in a fixed physical position for a considerable period of time, can help in controlling and preventing their occupational complications. This study evaluates and compares the effects of spinal stabilization exercises on dentist's chronic LBP. Considering the possible effects of spinal stabilization exercises on the level of LBP, as well as other specific features of these exercises, the effect of these exercises on chronic LBP may be important for dentists.

2. Objectives

The aim of this study was to determine the effect of spinal stabilization exercises on the functional ability and the amount of LBP in dentists.

3. Methods

The present research is quasi-experimental. The study group included male dentists in Kermanshah. Forty dentists with low back pain with a possible occupational nature were voluntarily recruited as the statistical sample and randomly divided into an experimental group (41.50 $\pm$ 7.917 years, work experience of 18.20 $\pm$ 8.791 years) and a control group (42.5 $\pm$ 7.316 years old, work experience of 17.65 $\pm$ 6.877 years). Inclusion criteria were at least 3 months of LBP based on their medical record and the age range of 30 - 55 years. None of them had previous history of spondylolisthesis, osteoporosis, pelvic and vertebral fractures, previous surgeries, tumor, and infection. The exclusion criteria included failure to cooperate in rehabilitation sessions, absence in three consecutive therapeutic sessions.

All subjects voluntarily participated in the study after completing the consent form. The experimental group participant in the program of spinal stabilization and control group did not perform any kind of physical activity

for spinal stabilization training. In the beginning, pre-test was performed then, the exercise protocol was performed on the patients and the post-test was performed and the scores of pre and post-test were compared.

The instrument of this study was the standard questionnaire of Quebec back pain for measuring and assessing the amount of LBP and Oswestry Disability Questionnaire for measuring disability in daily activities. The standard questionnaire for of Quebec back pain consists of 25 questions, 5 items (minimum 0 and maximum 4) that assess pain in everyday activities between 0 - 100. Score 0 indicates a healthy individual, 0 - 25 indicates mild pain, 25 - 50 moderate pain, 50 - 75 severe pain and 75 - 100 very severe pain and quite acute that prevents the individual from performing the desired activity (19).

Oswestry Questionnaire assesses the level of patient's ability to function in 6 of 10 options (minimum 0 and maximum 5) in the areas of tolerance and coping with pain severity, personal care, lifting, walking, sitting, standing, sleeping and social life. It also evaluates travel and changes in pain level. In the worst case of disability, the score of 5 is given to each section, which in total 10 points scores will be 50 that total disability is calculated by multiplying the sum score of each part in the number 2. In fact, this questionnaire evaluates the performance disability between 0 - 100. The score 0 indicates healthy and painless function, 0 - 25 means mild disability, 25 - 50 moderate disability, 50 - 75 severe disability, and 75 - 100 indicates severe disability that prevents the individual from performing conventional activities (20). In the present study, samples were selected from individuals whose score of pain and disability was more than 25 (21). Previous studies have approved the validity and reliability of Kibbutz and Oswestry Questionnaires for assessing the severity of LBP and disability in daily activities with a reliability of 0.84 (22).

After selecting the subjects and performing the initial tests including measuring pain and disability functional, the training program was run regularly for 6 weeks, 3 sessions per week and 30 minutes each session. The treatment session comprised of a 5-minute warm-up phase (jogging, soft running and tensile movements), 20 minutes of main training and 5 minutes of cool-down.

Regarding the difference in the ability of individuals to perform exercises for each group for 4 weeks training was considered so that, according to their ability, they have the opportunity to complete them until the sixth week. The treatment sessions were daily and at the end of six weeks, the individuals completed the Quebec Back Pain Questionnaire and Oswestry Questionnaire again. The type of treatment was largely different based on the severity of the symptoms in the dentists. In general, the stages and types of exercises since the beginning of the treatment program ranged from simple to complex as follows (Appendix 1 in Supplementary File):

The core stabilization exercises in present study were a major emphasis on the multifidus muscle and transverse abdominal (23).

Descriptive and inferential statistics were used to analyze the data. At the descriptive level, statistical characteristics such as mean and standard deviation were used. At the level of inferential statistics, Kolmogorov-Smirnov test was first used to show the normal distribution of data and the Leven test was used for homogeneity analysis of variance. Paired sample *t*-test was used for within-group comparison between pre and post-test and independent *t*-test was utilized for between-group comparisons. SPSS software version 22 was used to perform statistical analysis.

4. Results

For analyzing the results and testing the hypotheses in this research, paired sample *t*-test and independent *t*-tests and Kolmogorov-Smirnov test were used to check the normality of the data.

According to Table 1, the scores for both experimental and control groups had normal distribution. Therefore, parametric tests were used to determine the comparing between these groups.

First hypothesis: Core stabilization exercise at home has a significant effect on LBP in dentists in Kermanshah.

As shown in Table 2, comparison of mean and standard deviation of LBP before and after exercise showed a decrease in the mean of LBP in the experimental group.

Based on the results of paired sample *t*-test (Table 3), LBP was significant in the experimental group ($P = 0.001$) before and after training, while no significant difference was observed in the control group ($P = 0.50$), indicating the effectiveness of core stability exercises on LBP in dentists in Kermanshah.

The significance level of *t*-test in Table 4 shows that there is no significant difference between the pain level in the experimental and control groups before the exercise ($P > 0.05$), but this difference is significant after the training between the two groups. Therefore, according to the results, the research hypothesis is accepted.

Second hypothesis: Core stabilization exercises have a significant effect on the functional ability of dentists in Kermanshah.

As shown in Table 5, the comparison of mean and standard deviation of functional ability before and after exercise indicated a decrease in the mean of functional ability in both groups. But this decline was higher in the experimental group.

Table 1. Significance Level of Kolmogorov-Smirnov Test (K-S)

Variables	Experimental Group		Control Group	
	Mean ± SD	Sig K-S	Mean ± SD	Sig K-S
Functional ability (pre-test)	60.48 ± 24.16	639.0	20.48 ± 59.16	65.0
Pain level (pre-test)	40.44 ± 12.12	717.0	60.44 ± 51.11	61.0
Functional ability (post-test)	40.37 ± 49.15	493.0	35.47 ± 88.15	69.0
Pain level (post-test)	90.35 ± 77.11	722.0	45.44 ± 33.11	61.0

Table 2. The Mean and Standard Deviation (SD) of the Intensity of Low Back Pain (LBP) Before and After Exercise in Both Groups

LBP	Number	Mean ± SD
Pre-test		
Experimental group	20	40.44 ± 12.12
Control group	20	60.44 ± 14.15
Post-test		
Experimental group	20	40.37 ± 49.15
Control group	20	35.47 ± 88.15

Table 3. Paired *t*-test of Low Back Pain (LBP) Before and After Training in Each Group

Groups	Mean ± SD	T	Df	P Value
Experimental group	8.50 ± 4.35	8.72	19	0.001*
Control group	0.15 ± 0.98	0.67	19	0.50

Abbreviations: Df, degree of freedom; SD, standard deviation.

Table 4. Results of the Comparison of the Mean of Pain Intensity in the Experimental and Control Groups

LBP	Leven Test		T	Df	P Value
	f	P Value			
Pre-test	1.65	0.20	0.236	38	0.816
Post-test	1.48	0.23	2.076	38	0.047*

Abbreviations: Df, degree of freedom; LBP, Low Back Pain.

Table 5. Mean and Standard Deviation (SD) of Functional Ability Before and After Exercise in Both Groups

Functional Ability	Number	Mean ± SD
Pre-test		
Experimental group	20	70.48± 290.16
Control group	20	20.48 ± 593.16
Post-test		
Experimental group	20	40.37 ± 493.15
Control group	20	35.47 ± 885.15

Table 6. Paired *t*-test of Functional Ability Before and After Training in Each Group

Groups	Mean ± SD	T	Df	P Value
Experimental group	11.30 ± 5.60	9.02	19	0.001*
Control group	0.85 ± 2.20	1.72	19	0.10

Abbreviations: Df, degree of freedom; SD, standard deviation.

Table 7. Results of the Comparison of the Mean of Functional Ability in the Experimental and Control Groups

Functional Ability	Leven Test		T	Df	P Value
	f	P Value			
Pre-test	0.12	0.72	- 0.053	38	0.958
Post-test	0.03	0.84	- 2.33	38	0.025*

Abbreviation: Df, degree of freedom.

Based on the results of paired sample *t*-test (Table 6), functional ability was significant in experimental group (P = 0.001) before and after training, while no significant difference was observed in the control group (P = 0.10), indicating the effectiveness of core stability exercises on the functional ability in dentists in Kermanshah.

The significance level of *t*-test in Table 7 shows that there is no significant difference between the functional ability of the experimental and control groups before the exercise (P > 0.05), but this difference is significant after the exercise between the two groups. Therefore, according to the results, the research hypothesis is confirmed.

5. Discussion

The results of this study showed that spinal stabilization exercises had a significant effect on functional ability and chronic pain in male dentists, which is consistent with studies by Jadeian et al. (2012), Puntumetakul et al. (2013) and Wang et al. (2012).

In the past decade, there were sports called stabilization exercises. These exercises focus on the ability of the spine to stabilize in different physical situations, and it strengthening of multifidus, the transverse abdominal, and position muscles (24). Because of the special role of these muscles in the stability of the spine, it is claimed that these exercises can improve the function of patients

by stabilizing these muscles. Stabilization exercises have a greater effect on the small, deep and posterior body muscles and maintaining the correct body position, and improving the patient's pain. These exercises also activate the abdominal and back muscles and boost their strength. In chronic LBP, muscle neuromuscular coordination is disrupted, which itself, as a vicious cycle, exacerbates LBP. It seems that stabilizing exercises can break this vicious cycle (25).

The goals set for the stabilization exercises are to improve the stability, strength, coordination, sense of position and movement sensation of the spinal segments to support spinal function. Increasing the activity and strength of paraspinal muscles by training will improve the patient function and reduce the pain level (26). Electromyographic studies also suggest that large serine, abdominal and lumbar spine muscles exercises increased their strength, flexibility, tolerance and coordination, which reduced the pain and improved patient function. In this study it is likely that other reasons dentist's better functional abilities are due to improvement of associated physiological factors such as strength, musculoskeletal inductance and coordination.

5.1. Conclusions

This study shows that after two or more training sessions of spinal stabilization exercises, which do not require specific devices, dentists can easily practice without the presence of a trainer. These exercises are easy and can be done anywhere. For effectiveness and safety of these exercises, as well as their accessibility, they can be used to improve functional ability and recovery from LBP and even prevent osteoporosis.

Supplementary Material

Supplementary material(s) is available here [To read supplementary materials, please refer to the journal website and open PDF/HTML].

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Footnotes

Authors' Contribution: All authors made substantial contributions to conception and design; and Reza Rajabi, Akram Ahmadi Barati made contributions to acquisition of data, analysis, and interpretation of data; with Akram Ahmadi Barati making a substantial contribution in participating in drafting the article; and Akram Ahmadi Barati and Leila Farhadi making a contribution to revising it. All authors give final approval of the version to be submitted and also any revised version.

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