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Original Research Article

Impact of Hand Eye-Coordination Exercises on Upper Limb Functional Performance and Disability Among Dentists with Chronic Non-Specific Low Back Pain

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ABSTRACT

BACKGROUND: Recent studies on dentists have reported that 70% of them are experiencing chronic nonspecific low back pain. The significance of hand-eye coordination in the treatment of low back pain has remained unrecognized and unappreciated until now. Therefore, the goal of this study was to combine the effects of hand-eye coordination exercises with core strengthening exercises in dentists with chronic non-specific low back pain.
METHOD: This experimental study included 30 dentists with chronic non-specific low back pain. The samples were randomly divided into experimental (n = 15) and control (n = 15) groups. The experimental group performed hand-eye coordination exercises using the racket driller exercises along with the conventional exercises for 6 weeks on alternate days. The ODI, Plank test, and Alternate Wall toss test were used to measure impairment, core muscular strength, and hand-eye coordination. Between the Plank and AWT tests, there was a 2-hour rest time.
RESULTS: The experimental group showed a significantly greater improvement in disability ($p<0.01$), core muscle strength ($p<0.05$), and hand-eye coordination ($p< 0.05$) than the control group.
CONCLUSION: Hand-eye coordination exercises combined with core muscle strengthening exercises can improve upper limb functional performance and disability in dentists with chronic non-specific low back pain.

KEY WORDS: Chronic Non-specific low back pain, Core muscles, Hand-eye coordination, Plank test, Oswestry disability Index, Racket drill exercise.

INTRODUCTION

Non-specific low back pain is low back pain that is not attributable to a recognizable, known specific pathology. Non-specific LBP is the most commonly reported problem in the population. Only 10% of LBP cases have a specific cause owing to a particular disease. Approximately 7–10% of patients experience CLBP, and 1% experience physical impairments. A healthy lifestyle is hampered by CLBP because it causes functional loss, in addition to pain. A study on low back pain among dentists found that 70% of dentists experienced this condition. [1-3] A cross-sectional study among dental professionals in Karnataka's Dakshina Kannada and Coorg regions found that 54% of dentists reported lower back pain. [4]

Dentists are sedentary by nature and spend a lot of time sitting in chairs, so treatments take a long time to complete. After working for a long time, dentists develop a bad posture, which weakens their core muscles. [5] The lumbo-pelvic-hip complex is another name for the core muscular network, which is a three-dimensional space with defined muscle boundaries. The core muscles, which are layers of muscles with similar functions, help the limbs move freely on a stable base of support by providing stability. When the sensorimotor mechanoreceptor system is activated, these muscles are recruited in response. The shortcomings of this mechanism lead to an uneven distribution of the load, negatively affecting stability. The main causes of back pain include weak core muscles and poor sensorimotor coordination. To prevent back pain, core muscle strength must be sufficient to handle external loads and maintain spinal alignment. [1] The test-retest reliability and validity findings of this study indicate that the plank is a valid and reliable exercise for assessing core strength. [6-8] Numerous exercises and physical modalities, such as proprioceptive neuromuscular facilitation training, therapeutic ultrasound, and core stabilization exercises, are known to reduce low back pain. [9]

A study conducted in 2017 revealed a significant correlation between core muscle strength and hand-eye coordination in individuals with low back pain who were not athletes. Based on this, we proposed that the performance of core muscles could influence hand-eye coordination, given their shared impact on both gross and fine motor functions. [10] This connection underscores the importance of understanding how core strength supports coordinated visual and motor tasks.[11] To effectively coordinate hand and eye movements, the brain must process visual inputs while adapting to continuous shifts in head, eye, and shoulder positioning. [8] This process involves using visual feedback to guide precise hand movements—skills that are particularly essential in fields like dentistry. [12,13]

Hand-eye coordination relies on the integrated functioning of three primary systems: the gaze system, which focuses on task-relevant objects; the motor system of the limbs, which executes the physical action; and the visual system, which supplies information to both. These are governed by a fourth component, the schema system, that determines the task at hand and sequences the necessary actions. [14] To assess hand-eye coordination, the alternate wall toss test was employed. Research by Anusha Reddy, Arunachalam R, and others further confirmed a robust association between core strength and hand-eye coordination. [10]

The core serves as the foundation of the functional kinetic chain, offering essential proximal stability to enable effective distal movement and limb control. A 2020 study demonstrated that a structured six-week plank regimen significantly improved core stability among sedentary dental professionals. [15] Since dentistry heavily relies on fine motor skills and precise hand-eye coordination, improving these areas is crucial. [12,13] The findings of this study indicate that a four-week program of hand-eye coordination exercises can effectively enhance coordination abilities. These coordination exercises typically involve repetitive upper limb motions while maintaining focus on a fixed target and engaging postural reflexes to complete the task efficiently. Activities such as tapping a ball with a racket repeatedly activate the shoulder, arm, and hand muscles, while primarily engaging the core for both static and dynamic stabilization. [16] Despite its relevance, the role of hand-eye coordination in addressing low back pain has largely been overlooked. Therefore, this study sought to evaluate the combined impact of hand-eye coordination training and core strengthening exercises in dentists suffering from chronic, non-specific low back pain

MATERIALS AND METHODOLOGY

STUDY DESIGN: Experimental study
STUDY SETTING: Sri Venkateshwaraa Dental College
STUDY POPULATION: Dentist with chronic non-specific low back pain Selected as per selection criteria
SAMPLE SIZE: 30 Samples
Group A - n = 15 (Experimental group)
Group B - n = 15 (Control Group)
SAMPLING METHOD: Sequential random sampling method
STUDY DURATION: 6 months
TREATMENT DURATION: 6 weeks
TOOLS: Oswestry disability index, Plank test, Alternate wall toss test
OUTCOME MEASURES: Functional disability, Core muscle strength Hand-eye coordination

MATERIALS USED

Consent form, Oswestry disability index (ODI) questionnaire form, Blanket for Plank test, Measurement tape, Ball for AWTT, Stopwatch, Table tennis bat and ball

SELECTION CRITERIA

INCLUSION CRITERIA:

- ❖ Participants aged between 25 and 45 years.
- ❖ Individuals experiencing low back pain for a minimum duration of 3 months.
- ❖ Subjects with an Oswestry Disability Index (ODI) score ranging from 21% to 40%.
- ❖ Participants who scored below 20 on the Alternate Wall Toss Test, indicating reduced hand-eye coordination.
- ❖ Individuals who were unable to hold a plank position for more than 30 seconds, suggesting core muscle weakness

EXCLUSION CRITERIA:

- ❖ Dentists with a recent history of abdominal surgery, trauma, or chronic orthopedic conditions were excluded from participation.
- ❖ Individuals with low back pain resulting from other orthopedic pathologies, such as acute disc bulge, intervertebral disc prolapse (IVDP), or a recent history of upper limb fractures or injuries, were not considered, as the intervention involved upper limb movement.
- ❖ Participants unable to perform the plank test due to obesity or other health complications were excluded.
- ❖ Subjects with neurological disorders affecting coordination, gaze stabilization, or target fixation, as identified through clinical history, were also excluded from the study.

PROCEDURE

EXPLANATION OF THE STUDY TO THE DENTIST:

At the outset, dentists with chronic non-specific low back pain (CNSLBP) were briefed on the purpose and importance of the study, following which they were invited to read and sign the informed consent form.

SCREENING THE PARTICIPANTS BASED ON SELECTION CRITERIA:

The Oswestry Disability Index (ODI) was administered to the participating dentists, accompanied by clear instructions on how to complete the questionnaire. Those who fulfilled the inclusion criteria and scored between 21% and 40% on the ODI were selected for the study. [17,18] (Figure 1: Study briefing provided to the dentists). In addition to the ODI score, participants were required to meet further eligibility criteria, which included an assessment of core muscle strength using the Plank Test and evaluation of hand-eye coordination through the Alternate Wall Toss Test.

Figure 1- Explanation of the study to the dentist

PLANK TEST:
To evaluate core muscle weakness, participants were instructed to perform a plank exercise, and only those demonstrating significant weakness were included in the study. Each individual was provided with a mat, and the therapist first demonstrated the correct plank technique. Participants then assumed a prone position, supported their upper body on their elbows, lifted their trunk, and fully extended their knees, maintaining this posture for a duration of 30 seconds. Those who were unable to sustain the position beyond 30 seconds were deemed eligible for inclusion in the study. [19] Bridging maneuvers appear to be practical, dependable, and valid techniques for assessing the endurance capacity of lumbar spine stabilization. Prone bridging specifically targets core flexors. [20]

Figure 2- Assessing the core muscle strength

ALTERNATE WALL TOSS TEST:
Participants were given a tennis ball and positioned approximately 2 meters from a wall. They were instructed to throw the ball

against the wall with one hand and catch it with the opposite hand, repeating the action continuously. A stopwatch was used to time the test for 30 seconds, during which the number of successful catches was recorded. In cases where the ball was dropped, the timer was paused and resumed once the participant was ready to continue. [21] Participants who completed the Alternate Wall Toss Test (AWTT) and recorded fewer than 20 successful catches were identified as having reduced hand-eye coordination and were selected for the study. A rest period of 2 hours was provided between the AWTT and the Plank Test to prevent fatigue and ensure accurate assessment.

Fig 3.1 & 3.2 – Assessing Hand-eye Coordination with AWTT

TREATMENT:

In this study, all participants underwent core muscle strengthening exercises as part of the standard therapeutic intervention. However, only Group A received additional instruction in hand–eye coordination exercises. Participants in both groups were fully informed about the exercises assigned to them, including the prescribed frequency and duration.

Experimental Group (Group A): Received a combination of hand-eye coordination exercises and conventional therapy (core muscle strengthening exercises).

Control Group (Group B): Received only conventional therapy involving core muscle strengthening exercises.

CONTROL GROUP:

CORE MUSCLE STRENGTHENING EXERCISES-6 WEEK GRADED PLANK PROTOCOL

Both groups participated in traditional core strengthening exercises as part of their treatment protocol. These exercises were performed four times per week over a six-week period.

Core Strengthening Protocol – Plank Exercise:

Starting Position: Participants began in the standard plank position, body aligned parallel to the ground with a firm, straight trunk, supported by the forearms and toes. Emphasis was placed on avoiding sagging or arching of the back.

Body Alignment: Participants were instructed to lie face down with legs extended, elbows bent directly beneath the shoulders, and feet placed hip-width apart. They engaged their abdominal muscles, tucked their toes under, and lifted their bodies off the ground, keeping forearms flat on the floor.

Initial Hold Duration: In the first week, participants held the plank for 15–20 seconds or until they were able to perform the hold comfortably.

Progression Plan: Starting from the second week, the duration of the plank hold was increased by 1.5 times compared to the previous week. This progression continued throughout the six-week period. [15]

Fig 4 - 6 week graded plank protocol

EXPERIMENTAL GROUP: HAND-EYE COORDINATION EXERCISES

Research has demonstrated that Racket driller exercises enhance hand-eye coordination, which is why these exercises, along with core muscle strengthening routines, were recommended for GROUP A (Experimental). There are two methods for performing these exercises.

Fig 5.1 - Racket driller exercise 1: Tapping vertically upwards

Hand-Eye Coordination Training – Racket Driller Exercises

To enhance hand-eye coordination, participants in Group A (Experimental Group) performed two types of racket driller exercises using a table tennis bat and ball. Each exercise was designed to involve repeated upper-limb activity and visual tracking, engaging both dominant and non-dominant hands. [16]

Racket Driller Exercise 1: Tapping Vertically Upwards

Participant Position: The participant stood upright, holding a table tennis ball in one hand and a bat in the other.

Procedure:

Tap the ball vertically upward toward the ceiling 50 times using the right hand and bat.

Repeat the same with the left hand and bat for 50 taps.

After a 2-minute rest, perform 50 upward taps using both hands alternately. [16]

Racket Driller Exercise 2: Tapping Vertically Downwards

Participant Position: The participant stood straight, again holding the table tennis ball and bat.

Procedure:

Tap the ball downward toward the ground 50 times using the right hand.

Repeat with the left hand for another 50 taps.

After a 2-minute rest, repeat the downward tapping 50 times using both hands alternately. [16]

Fig 5.2 - Racket driller exercise 2: Tapping vertically downwards

Intervention Protocol

Experimental Group (Group A):

Participants in the Experimental Group engaged in both hand-eye coordination exercises (Racket Driller Exercises 1 and 2) and core muscle strengthening exercises. These sessions were conducted four times per week over a period of six weeks.

Control Group (Group B):

Participants in the Control Group performed only core muscle strengthening exercises, with the same frequency and duration-four sessions per week for six weeks.

STATISTICAL ANALYSIS

WITHIN THE GROUP ANALYSIS FOR GROUP A – PAIRED 't' TEST

TABLE NO 1: Showing the pre- and post-test values of Group A (paired t-test values)

GROUP A									
Components	Mean		Standard deviation (SD)		Sample size		Paired 't-test		Degree of freedom
	Pretest	Post test	Pre test	Post test	Pre test	Post test	t-value	'p' value	
ODI	31.33	12.53	4.36	2.99	15	15	22.9923	<0.0001	14
PLANK TEST	23.80	35.07	2.18	3.26	15	15	26.1664	<0.0001	14
AWTT	14.20	27.60	3.05	5.10	15	15	20.9883	<0.0001	14

The 'p' value of ODI, Plank test & AWTT is <0.0001, considered extremely significant.

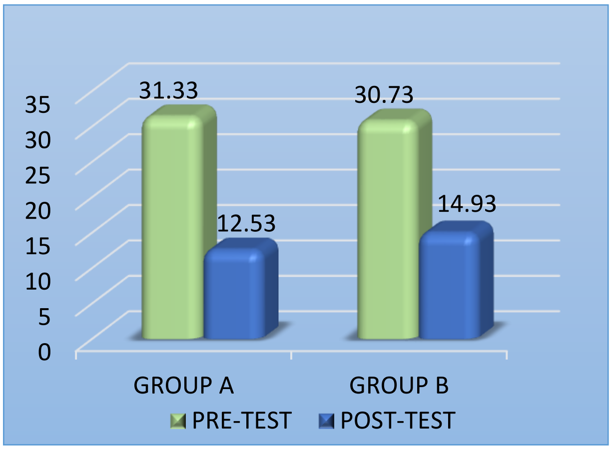
WITHIN THE GROUP ANALYSIS FOR GROUP B – PAIRED 't' TEST

TABLE NO 3: Showing the pre- and post-test values of Group B (paired t-test values)

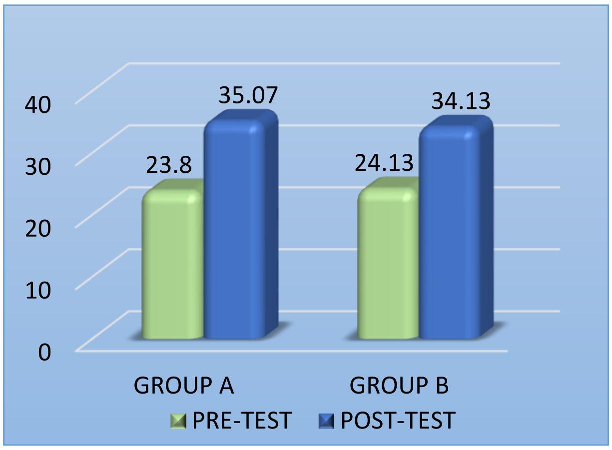
GROUP B									
Components	Mean		Standard deviation (SD)		Sample size		Paired t-test		Degree of freedom
	Pre test	Post test	Pre test	Post test	Pre test	Post test	t-value	'p' value	
ODI	30.73	14.93	4.28	2.81	15	15	23.565	<0.0001	14
PLANK TET	24.13	34.13	2.10	1.85	15	15	38.7298	<0.0001	14
AWTT	13.67	25.13	3.15	4.14	15	15	24.0512	<0.0001	14

The 'p' value of ODI, Plank test & AWTT is <0.0001, considered extremely significant.

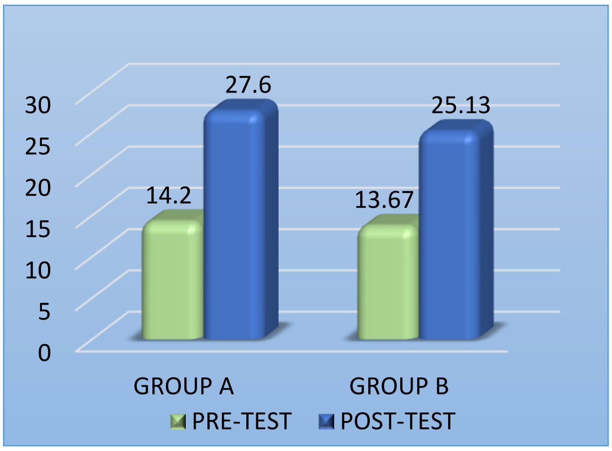
GRAPH 1: WITHIN THE GROUP ANALYSIS OF OSWESTRY DISABILITY INDEX IN GROUP A AND GROUP B



GRAPH 2: WITHIN THE GROUP ANALYSIS OF PLANK TESTS IN GROUP A AND GROUP B



GRAPH 3: WITHIN THE GROUP ANALYSIS OF ALTERNATE WALL TOSS TEST IN GROUP A AND GROUP B



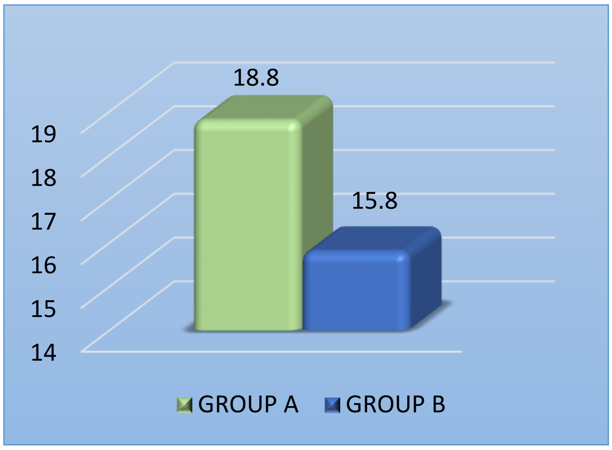
BETWEEN THE GROUP ANALYSIS (GROUP A & GROUP B) – UNPAIRED 't' TEST

TABLE NO 4: Showing the mean differences between Group A and Group B (unpaired 't' test values)

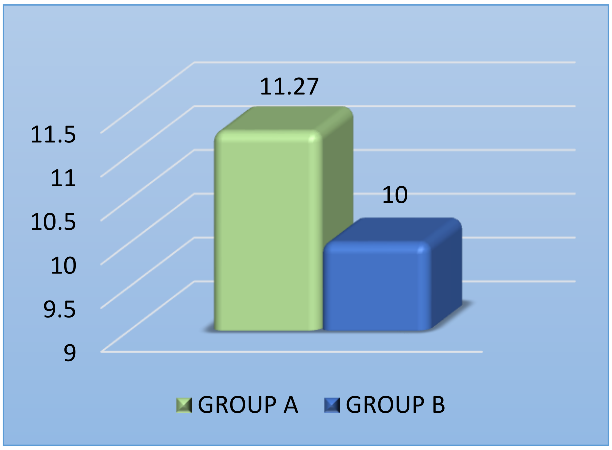
Components	Group A			Group B			Unpaired t-test		Degree of freedom
	Mean	Standard deviation (SD)	Sample size	Mean	Standard deviation (SD)	Sample size	t-value	'p' value	
ODI	18.8	3.16	15	15.8	2.59	15	2.83715	0.008	28
PLANK TEST	11.27	1.67	15	10	1.00	15	2.5229	0.017	28
AWTT	13.40	2.47	15	11.60	1.80	15	2.2773	0.030	28

The 'p' value of ODI between the groups is < 0.01, considered very significant.
The 'p' value of the plank test and AWTT between the groups is <0.05, considered significant.

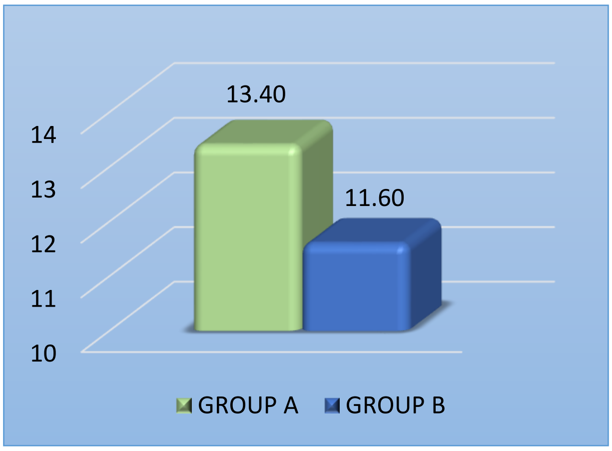
GRAPH 4: BETWEEN THE GROUP ANALYSIS OF OSWESTRY DISABILITY INDEX IN GROUP A AND GROUP B



GRAPH 5: BETWEEN THE GROUP ANALYSIS OF PLANK TEST IN GROUP A AND GROUP B



GRAPH 6: BETWEEN THE GROUP ANALYSIS OF ALTERNATE WALL TOSS TESTS IN GROUP A AND GROUP B



RESULTS

The statistical analysis for this study was conducted using the online tool available at www.socscistatistics.com. The Mean and Standard Deviation for the pre- and post-test scores of the Oswestry Disability Index (ODI), Plank test, and Alternate Wall Toss Test were calculated, and the findings were recorded.

WITHIN THE GROUP ANALYSIS: DISABILITY - ODI

WITHIN EXPERIMENTAL GROUP A: The Mean and SD for ODI pre- and post-test scores are 31.33 ± 4.36 and 12.53 ± 2.99, respectively, with a 't' value of 22.9923. A paired t-test within the experimental group revealed a highly significant result (p<0.0001).

WITHIN CONTROL GROUP B: The Mean and SD for ODI pre- and post-test scores are 30.73 ± 4.28 and 14.93 ± 2.81, respectively, with a 't' value of 23.565. A paired t-test within the control group also indicated a highly significant result (p<0.0001).

The pre- and post-test ODI scores, which reflect disability, showed notable improvement in both the experimental and control groups, with a greater enhancement observed in Experimental Group A.

CORE MUSCLE STRENGTH-PLANK TEST

WITHIN EXPERIMENTAL GROUP A: The Mean and SD for Core Strength pre- and post-test scores are 23.80 ± 2.18 and 35.07 ± 3.26, respectively, with a 't' value of 26.1664. A paired t-test within the experimental group yielded a highly significant result (P < 0.0001).

WITHIN CONTROL GROUP B: The Mean and SD for Core Strength pre- and post-test scores are 24.13 ± 2.10 and 34.13 ± 1.85, respectively, with a 't' value of 38.7298. A paired t-test within the control group also showed a highly significant result (P <0.0001).

The pre- and post-test core strength scores showed significant improvement in both groups, with a more pronounced improvement in Experimental Group A.

HAND-EYE COORDINATION - AWTT

WITHIN EXPERIMENTAL GROUP A: The Mean and SD for AWTT pre- and post-test scores are 14.20 ± 3.05 and 27.60 ± 5.10, respectively, with a 't' value of 20.9883. A paired t-test within the experimental group indicated a highly significant result (p<0.0001).

WITHIN CONTROL GROUP B: The Mean and SD for AWTT pre- and post-test scores are 13.67 ± 3.15 and 25.13 ± 4.14, respectively, with a 't' value of 24.0512. A paired 't' test within the control group also showed a highly significant result (p<0.0001).

The pre- and post-test AWTT scores, reflecting hand-eye coordination, showed significant improvement only in Experimental Group A.

BETWEEN THE GROUP ANALYSIS: ODI

The Mean and SD of the differences between pre- and post-test ODI scores for Group A are 18.8 ± 3.16, and for Group B are 15.8 ± 2.59, with a t-value of 2.83715.

Statistical analysis was conducted using an unpaired t-test between groups, which revealed a statistically significant P-value (<0.01). The average difference between the pre- and post-test values for Groups A and B indicates that the experimental group was more significant than the control group. There was a bigger improvement in functional results in Group A compared to Group B.

PLANK TEST

The mean and standard deviation of the differences in pre- and post-test values for the Plank test in Group A were 11.27 ± 1.67, while in Group B, they were 10.00 ± 1.00, with a t-value of 2.5229.

Statistical analysis using an unpaired t-test between the groups showed statistical significance (p<0.05). The mean difference between the pre- and post-test values for Groups A and B demonstrated that the experimental group was more significant than the control group. There is a notable improvement in core muscle strength in experimental Group A compared to control Group B.

AWTT

The mean and standard deviation of differences between pre- and post-test values for AWTT in Group A were 13.40 ±

2.47, and in Group B, they were 11.60 ± 1.80, with a t-value of 2.2773.

Statistical analysis using an unpaired 't' test between the groups shows statistical significance ($p<0.05$). The mean difference between the pre- and post-test values for Groups A and B indicates that the experimental group was more significant than the control group. There is greater improvement in hand-eye coordination in experimental Group A compared to control Group B.

The results showed that Group A, which received hand-eye coordination exercises along with core muscle strengthening exercises (conventional therapy), showed significant improvement in the Oswestry disability index, plank test, and alternate wall toss test compared with Group B, which only received core muscle strengthening exercises (conventional therapy).

DISCUSSION

This study aimed to evaluate the effectiveness of hand-eye coordination exercises in enhancing upper limb functional performance and reducing disability among dentists suffering from non-specific low back pain. Dentists were specifically chosen due to the high prevalence of low back pain in this profession, which negatively impacts both their work efficiency and overall quality of life. A total of 30 participants, aged between 25 and 45 years and meeting the defined inclusion and exclusion criteria, were enrolled. The participants were randomly assigned to two groups: Group A received a combination of hand-eye coordination exercises and core strengthening routines, while Group B engaged in conventional exercise therapy. Outcome measures included the Oswestry Disability Index (ODI), the Plank Test for core strength, and the Alternate Wall Toss Test for hand-eye coordination. Comparative analysis of pre- and post-intervention data revealed a significant decrease in disability levels, alongside marked improvements in both core stability and coordination abilities.

The impact of a five-week core stability training program on upper body performance in college athletes. The results revealed a 19% improvement in the Upper Quarter Y-Balance Test (UQ-YBT) and a 35% increase in the Functional Throwing Performance Index (FTPI) among those who underwent the training. In contrast, the control group, which did not participate in the training, showed no significant gains. These findings reinforce the association between core stability and upper limb function. [22] In the present study, both the experimental and control groups exhibited statistically significant improvements in disability scores, core muscle strength, and hand-eye coordination. Previous research also supports the effectiveness of core strengthening in sedentary populations. For instance, a six-week plank-based core training program was shown to enhance core stability in dentists who spend prolonged hours seated. A related study conducted at Rural Dental College, PIMS, involving 50 dentists with a mean age of 22.7 years, reported notable improvements in core strength as measured by the hip bridge test following the intervention. [15] In the current study, the plank test was used to evaluate core muscle strength.

According to Bashir SF and Nuhmani S, the core provides a stable biomechanical base that supports the efficient functioning of peripheral muscles. Acting as essential connectors within the kinetic chain between the upper and lower limbs, core muscles play a critical role in maintaining stability and producing force during limb movements. [23]

McKeen et al. describe the core as the central point of the body's gravity and the origin of all movement. Achieving core stability involves the coordinated function of both local and global stabilizing systems. Local stabilizers such as the transverse abdominis, internal obliques, multifidus, pelvic floor, and diaphragm are directly connected to the vertebrae and play a key role in minimizing spinal stress. In contrast, global stabilizing muscles like the quadratus lumborum, psoas major, external oblique, rectus abdominis, gluteus medius, and the adductor complex are responsible for transferring loads between the upper and lower extremities and for regulating eccentric strength of the core. [24] These components were considered essential for evaluating core function in the present study.

Warabi et al. emphasized that core stability plays a vital role in maintaining trunk control, which is essential for optimizing the generation, transfer, and modulation of forces between the limbs during functional tasks. When core stability is compromised, it may lead to altered strength and is often associated with deficits in muscular strength, endurance, and the timing of upper limb activities. [25] Supporting this, Brumitt J, Dale RB, and colleagues observed that in individuals with strong core musculature, core muscles are activated in a feed-forward manner, engaging in anticipation of upper extremity movements to provide dynamic stability. [26] This relationship between shoulder dysfunction and core instability has also been highlighted by Radwan et al. [27]

Bindesh Patel and colleagues explored how racket driller exercises involve repetitive upper limb motions and target fixation. The continuous tapping of the ball with a racket engages the shoulder, arm, hand, and core muscles to maintain control during the activity. This control occurs through rapid postural responses to anticipated and unanticipated disturbances, including forces through the extremities. The neuromuscular system integrates feedforward and feedback mechanisms to address these forces and maintain core stability. Training sends sensory information to the central nervous system (CNS) and activates muscles quickly. Repeating movements improves muscle strength, endurance, and control through sensory processing pathways. [16] While certain studies indicate that core strength can positively influence upper extremity function reflected in the control group that engaged solely in core strengthening exercises, only a modest improvement in hand-eye coordination was observed. Moreover, this approach was less effective in reducing disability compared to the experimental group, which performed a combination of hand-eye coordination and core strengthening exercises.

Anusha Reddy's 2017 study highlighted the importance of hand-eye coordination training for individuals with low back pain, demonstrating its positive impact. [10] Similar outcomes were observed in the present study. The combined approach of hand-eye coordination training and core stability exercises significantly improved upper extremity performance and overall function in dentists experiencing low back pain, particularly beneficial for professionals working in prolonged stooped postures and performing tasks requiring high precision.

After six weeks of intervention, outcome measures revealed that both groups experienced statistically significant improvements in core muscle strength, hand-eye coordination, and reductions in disability. However, comparative analysis between the groups showed that the experimental group receiving both hand-eye coordination and core strengthening exercises achieved greater reductions in disability, along with more pronounced gains in core strength and coordination, than the control group

CONCLUSION

Based on the results and discussion, it can be concluded that the combination of hand-eye coordination exercises and core muscle strengthening (Group A) produced significantly greater improvements in upper limb functional performance and reduction in disability compared to core strengthening alone (Group B) in dentists with chronic non-specific low back pain over a 6-week intervention period. Therefore, the null hypothesis was rejected.

LIMITATIONS AND RECOMMENDATIONS

LIMITATIONS:

- This study was conducted on a small scale with 30 samples.
- 6 weeks of treatment duration, while not capturing long-term effects.
- Our population consisted of working-age NSCLBP patients whose results may not correlate with older age groups.

RECOMMENDATIONS:

- Dentists need these exercises with additional ergonomic education.
- Future studies should consider another outcome tool, such as the Sorensen test, to assess core muscle strength.
- Standardized Virtual reality tools can be used for Hand-eye Coordination training.

Declaration by Authors

Ethical Approval: The panel members approved this study, and informed consent was secured from all participants.

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Conflict of Interest: No conflict of interest

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