ijlpr 2023; doi 10.22376/ijlpr.2023.13.2.SP2.L59-L69

International Journal of Life science and Pharma Research

ISSN 2250-0480

Research Article

Efficacy of Comprehensive Corrective Exercise Program for Upper Crossed Syndrome Among Dental Students- A Cross Sectional Randomized Interventional Trial

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Abstract: Upper cross syndrome (UCS) is a muscle imbalance caused by the weakening and lengthening of the posterior upper back and neck muscles combined with the tightening and shortening of the opposing anterior pectoral chest and neck muscles. The tight muscles are scalene, latissimus dorsi, subscapularis, levator scapula, upper trapezius, sternocleidomastoid, pectorals, suboccipitals, and cervical erectors spinae, and the weak muscles are infraspinatus, deltoid, deep cervical flexors, middle and lower trapezius, serratus anterior, rhomboids, and the supraspinatus. The aim of the present study is to evaluate the effectiveness of comprehensive corrective exercise program (CCEP) for upper cross syndrome among dental students. This study consists of 18 participants of dental students, both male and female, with UCS, aged between 18 and 25 years. They were screened primarily by observation for main factors related to UCS that include altered alignment of postural deviation. The participants were randomized into interventional group, received CCEP for 8 weeks and control group, follow their usual work.: Analysis of Visual Analogue Scale ($p<.05$), and Reedco scale ($p<.05$) revealed significant effects. The participants in Interventional Group exhibited greater improvement in terms of pain intensity and posture compared to the participants in control group.: This study showed that the CCEP for people with UCS is achievable and brings about postural change. The CCEP significantly improves the angles of the head forward, shoulder forward, and thoracic kyphosis of dental students.

Keywords: Upper Cross Syndrome, Exercise Program, Dental Students, REEDCO Scale, Visual Analogue Scale, Posture

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Received On 18 November 2022
Revised On 15 January 2023
Accepted On 14 February 2023
Published On 01 March 2023

This research did not receive any specific grant from any funding agencies in the public, commercial or not for profit sectors.

Citation Murugaraj. T, Hemalatha.R, Sabarish Hariharan.N, Srinivasan. M, Nandini Eshwari. H, and Shanmugananth.E , Efficacy of Comprehensive Corrective Exercise Program for Upper Crossed Syndrome Among Dental Students- A Cross Sectional Randomized Interventional Trial.(2023).Int. J. Life Sci. Pharma Res.13(2), L59-L69 http://dx.doi.org/10.22376/ijlpr.2023.13.2.SP2.L59-L69

1. INTRODUCTION

Upper cross syndrome is a muscle imbalance caused by weakening and lengthening of the posterior upper back and neck muscles combined with the tightening and shortening of the opposing anterior pectoral chest and neck muscles. The tight muscles are scalene, latissimus dorsi, subscapularis, levator scapula, upper trapezius, sternocleidomastoid, pectorals, suboccipitals, and cervical erectors spinae, and the weak muscles are infraspinatus, deltoid, deep cervical flexors, middle and lower trapezius, serratus anterior, rhomboids, and the supraspinatus [1] Upper cross syndrome can be caused by a variety of movements, but the majority of cases are caused by poor posture, specifically sitting or standing with the head forward for extended periods of time. Activities that promote the posture question include computer and laptop use, driving, watching TV, playing games and cell phone use, reading, and biking. [2-6] .This syndrome produces typical changes in posture that include forward head posture, thoracic kyphosis, elevation and protraction of the shoulder, and winged scapula. Upper cross syndrome symptoms include headache, neck pain, strain in the upper back of the neck, and often a weakness in the front of the chest, pain in the upper back, particularly the shoulder, tiredness, restricted range of motion in the neck and shoulder, numbness, tingling, and pain in the upper arm, pain and reduced range of motion in the ribs, and lower back pain [7-9,11,12].The upper cross syndrome could be an indication of fundamentally expected sensory motor dysfunction which prompts an imbalance in muscle activation, movement pattern, and postural alignment. Previous studies showed that this pain might be associated with abnormal alignment [13-15]. One of these malalignments is the upper crossed syndrome, which is defined as a muscular imbalance pattern by Vladimir Janda MD (1923 – 2002). Upper cross syndrome refers to specific altered muscle activation and movement patterns along with some postural deviation. [16-18.] The specific postural changes include forward head and shoulder posture and increased thoracic kyphosis. [19,20]. The comprehensive corrective exercise program can be useful in improving upper cross syndrome because of a multifaceted focus on muscle activation, movement patterns, and posture simultaneously across the whole body instead of concentrating only on the part of the body where the pain occurs. With a comprehensive corrective exercise program especially stretching and self-myofascial release, the warm-up is a key time to enjoy ideal range of motion and muscle alignment. This will help to prevent injury, improve posture, and warm up the upper back. The comprehensive approach is novel in the field of corrective exercise designed to correct musculoskeletal disorders and to prevent secondary complications such as pain and injury. [21-24.]This focused only on correcting postural deviation in the upper crossed syndrome by comprehensive corrective exercise in which stretching exercise for short muscles and strengthening exercise for weak muscles are prescribed at the sight of malalignment, while the neuromuscular factor and related moment pattern may not be considered [252627.] The aim of the present study is to evaluate the effectiveness of comprehensive corrective exercise program for upper cross syndrome among dental students.

2. MATERIALS AND METHODOLOGY

2.1 Sampling

This is a parallel-group randomized controlled trial, and it was conducted at Indira Gandhi Dental College, Sri Balaji Vidyapeeth University, Pondicherry after ethical approval (MGMCRI – faculty/04/2019/06.) Dental students are the target population, and 18 participants were selected for this study. The study participants, were taken on the basis of inclusion and exclusion criteria. Participants with frequently occurring neck and shoulder pain for more than a month, both male and female, aged between 18 and 25 years, were included. All patients with congenital shoulder deformities, recent fractures, recent surgery, recent trauma, any malignancy related to soft tissues and joints, and having a body weight outside the normal range (BMI between 18 and 25) were excluded.

2.2 Inclusion and exclusion

The participants were made aware of the study and the proper consent form was taken. The participants were then asked to follow the instructions. They were screened and diagnosed primarily by the department of orthopaedics to rule out any bony abnormality or any other defects with minimal investigations and observation for the main factors related to upper cross syndrome that include altered alignment of postural deviation. Unwilling students were excluded.[28.] Participants are then referred to the Physiotherapy Department for the interventions. The 18 participants with upper crossed syndrome were selected based on the Reed-Co-Scale alignment and a special test for upper crossed syndrome.

2.3 Inclusion

The dental participants who have upper crossed syndrome who were willing to take part in the study with a full informed consent:

2.4 Exclusion

The participants who were unwilling and having any other systemic illness or not able to comprehend the study protocol were excluded

2.5 Randomization

In this parallel group randomised control trial, participants were randomly assigned to either the intervention group or the control group using computer-generated block randomization in a one-to-one ratio. This was done by opening sequentially numbered, opaque, and sealed envelopes, which revealed a card that said which group the participant was randomly assigned to, either the intervention group or the control group.

2.6 Data collection

An intervention group receiving an 8-week comprehensive corrective exercise program is followed by a control group who will only do their daily activities. They were re-assessed for postural changes such as forward head posture, thoracic kyphosis, and elevation and protraction of the shoulder as measured by the Reed-co-scale [29.] The proper position of the

head, thoracic spine and shoulder was analysed by using the reed-co- scale and the pain intensity was measured by using the visual analogue scale. The reed-co- scale rating and the visual analogue scale rating were recorded and documented before and after intervention [30,31].

2.7 *Outcome Measure Reed co scale*

Reedco's posture score (REEDCO, 1974) is a standardised instrument and is administered by visual assessment of 10 postural features seen laterally (sagittal view includes neck, upper back, trunk, abdomen, and lower back) or from behind (coronal view including head, shoulders, spine, hips, and ankles). The scores are distinguished as follows: a value of 0 corresponds to poor posture or severe deviation, a value of 5 corresponds to fair posture or minimum to moderate deviation, and a value of 10 corresponds to good posture or normal alignment [29].

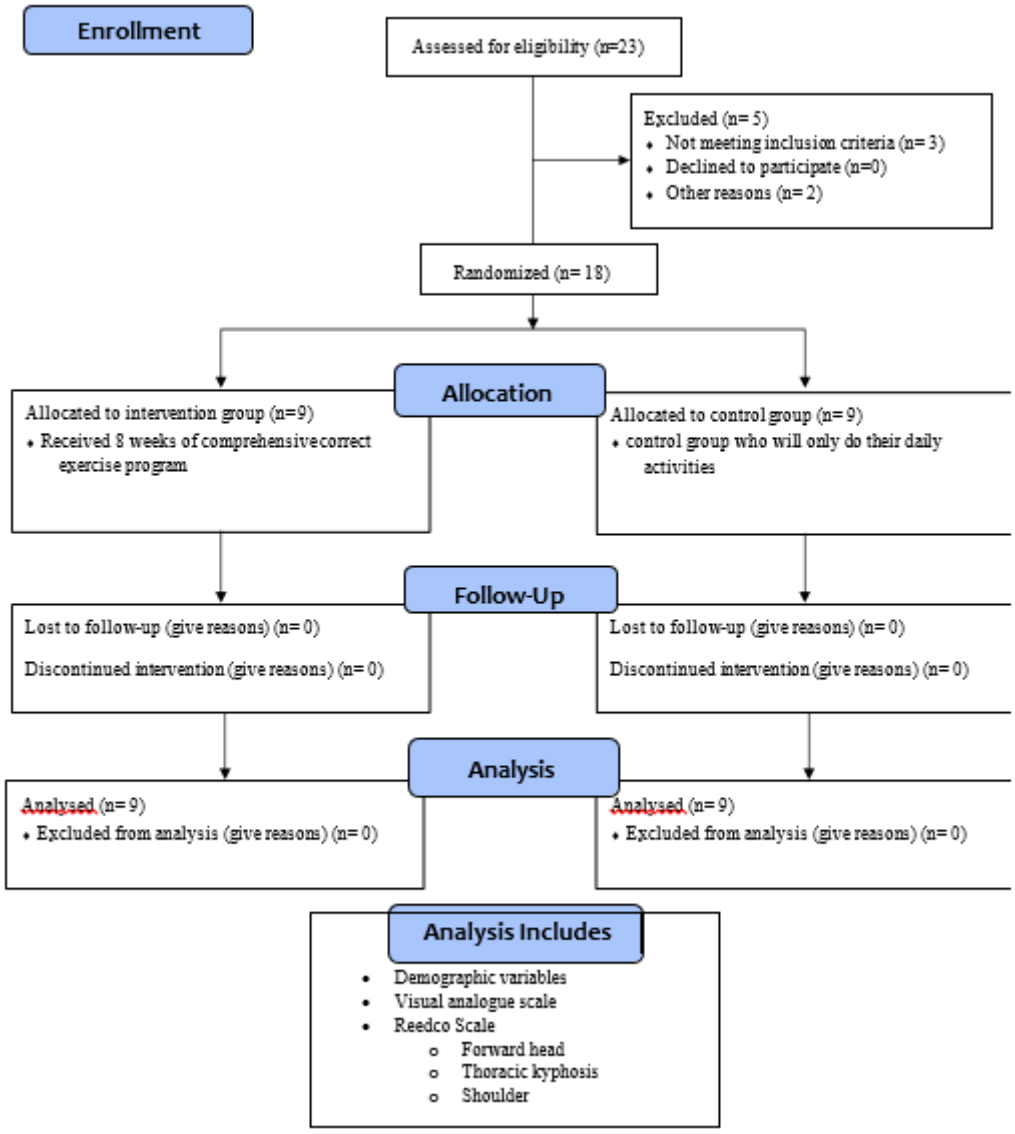


Fig 1. Study Flow diagram of the progress through the phases of a parallel randomised trial of two groups

2.1 Visual analogue scale

The VAS is most ordinarily a straight 100-mm line without demarcations that has the words "no pain" at the left-most end and "worst pain imaginable" (or something similar) at the right-most end. It has been verified and proved to be sensitive to changes in a patient's pain experience, which is an advantage of the VAS. It is simple to use and generally simple to comprehend for the majority of patients. It prevents individuals from using imprecise language to express pain and enables valid measurement comparisons across time [32.]

2.2 *Intervention Procedure/correction exercise protocol*

Subjects in this group received the comprehensive corrective exercise program, which consists of three phases: the initial phase, improvement phase, and the maintenance phase [1].

2.3 The initial phase exercise includes

1. Lying supine on a foam roll in three different arm abduction angles
2. Side lying external rotation
3. Side lying forward flexion
4. Standing diagonal flexion
5. Military press

The initial phase exercise duration is 2 weeks and the exercise were performed for 7 sets of 10 second hold to 10 sets of 15 second hold.

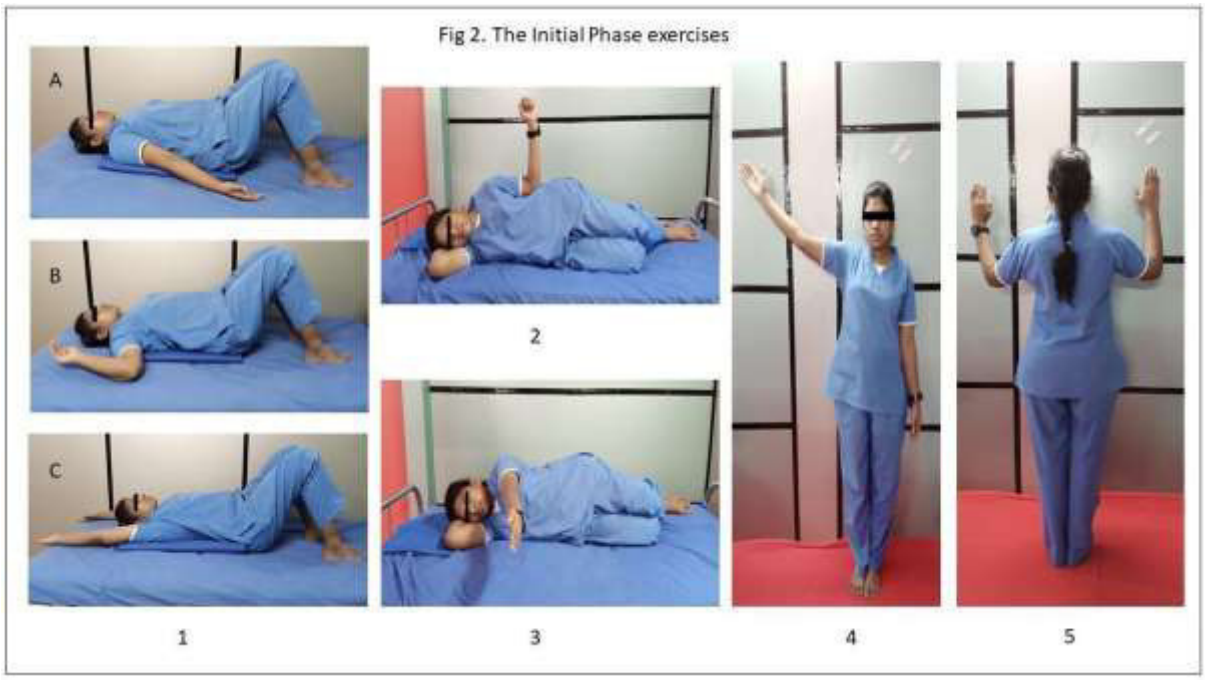
2.4 The improvement phase exercise includes

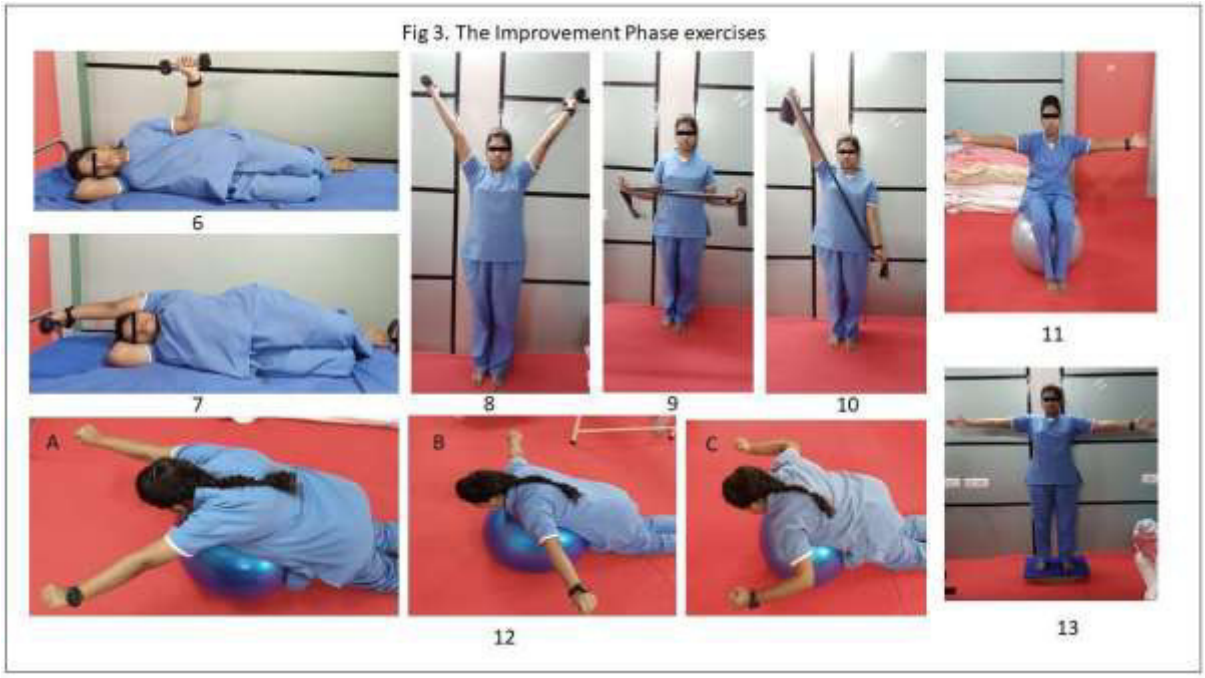
1. Side lying external rotation with dumbbell
2. Side lying forward flexion with a dumbbell
3. Standing diagonal flexion with a dumbbell
4. Standing diagonal flexion with theraband
5. Abduction in sitting on a training ball
6. Lying prone V, T and W exercise
7. Abduction in standing on a balance board.

2.5 Training protocol duration

The improvement phase duration is 4 weeks and the exercises were performed from 5 sets of 10 repetitions to 26 sets of 15 repetitions. The maintenance phase exercise is the same as in the improvement phase without any progression in intensity and frequency. The maintenance phase exercise duration is 2 weeks. In the intervention group, the participants were instructed that they would not conduct any extra exercise at home. They were instructed to maintain proper posture. The control group were asked to do the usual daily activities and not to participate in any exercise program.

Fig 2. The Initial Phase exercises





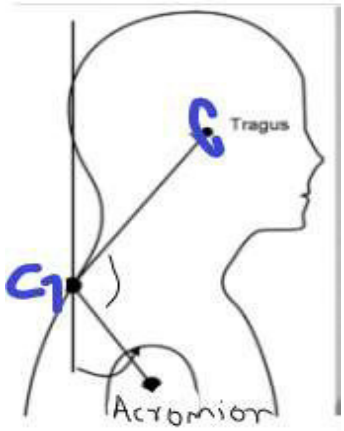


Fig 3 – measurement of shoulder angulation

3. STATISTICAL ANALYSIS

Most of the data fell into a group of mean and standard deviation: The student t test was used to find the level of significance and a p value of less than 0.05 was considered significant.

4. RESULT

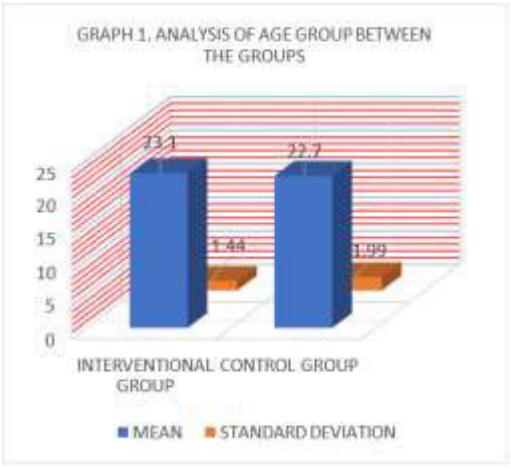
4.1 Analysis of demographic variables

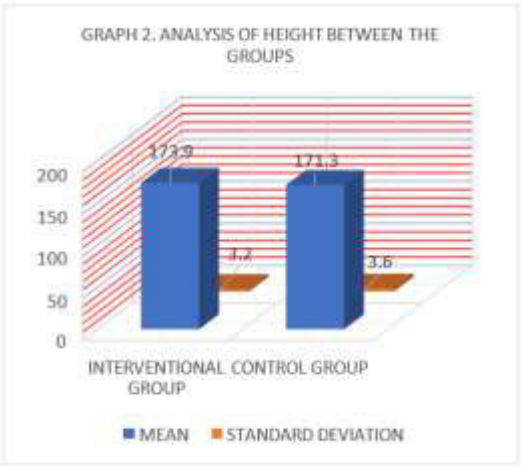
The study consists of 18 participants and was randomised into interventional and control groups with 9 in each group. The mean age of participants from both groups was 23 and 22, respectively. Table 1 shows the baseline demographic and all variables' characteristics from each group. Subjects in both groups were comparable in terms of age, weight, and height.

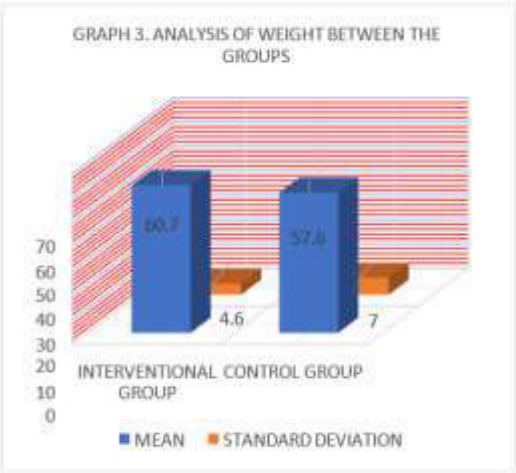
Table 1. Analysis of demographic variables

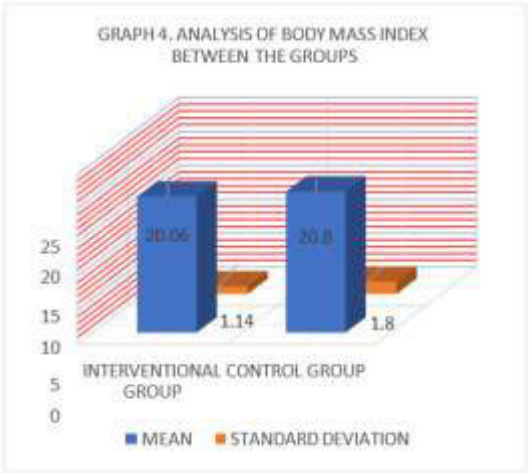
Variables	Group	Mean ± Standard Deviation	T Value	P Value
Age (Year)	Interventional Group	23.1±1.44	0.490	0.63
	Controlled Group	22.7±1.99		
Height (Cm)	Interventional Group	173.9±3.2	1.619	0.12

	Controlled Group	171.3±3.6		
Weight (Kg)	Interventional Group	60.7±4.6	1.110	0.28
	Controlled Group	57.6±7.0		
BMI (Kg/m^2)	Interventional Group	20.06±1.14	1.138	0.27
	Controlled Group	20.8±1.8		









4.2 Analysis of Visual Analogue Scale

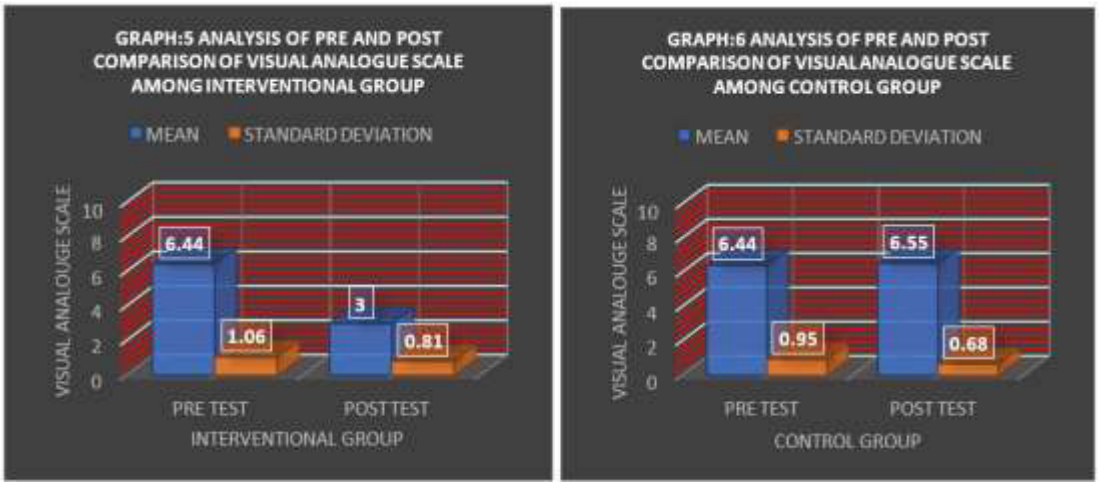
Table 2 displays the analysis of pain obtained through the visual analogue scale, whereas the mean value before intervention was 6.44±1.06 and the mean value obtained after the intervention was 3±0.81. The obtained t-value is 7.73 and the p value is 0.0001, which shows significance. Graph 5 displays the pre and post values of the interventional group, and through this it has been observed that pain values have been reduced after intervention.

Table 2. Analysis of pre and post comparison of visual analogue scale among interventional groups

Sl. No	Test	Mean±Standard deviation	T – value	P - value
1	Pre – test	6.44±1.06		
2	Post - test	3±0.81	7.73	0.0001

Table 3 shows the analysis of pre and post-test values of the control group. The pre-test values are 6.44±0.95 and the post-test value is 6.55±0.68, whereas the obtained t value is 0.28 and the p value is 0.78, which shows no significance level.

Table 3. Analysis of pre and post comparison of visual analogue scale among control group				
Sl. No	Test	Mean±Standard deviation	T – value	P - value
1	Pre – test	6.44±0.95		
2	Post - test	6.55±0.68	0.28	0.78



Graph 7 displays the significantly improved forward head posture correction after a comprehensive corrective exercise program.

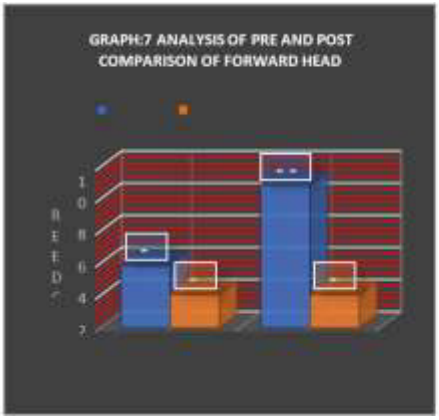
4.3 Analysis of Reedco Scale

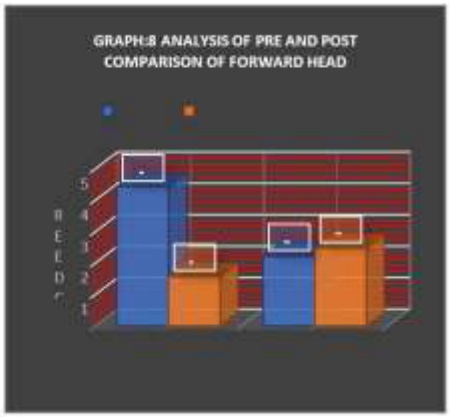
4.3.1 Analysis of Forward Head

The below table 4 describes the analysis of pre and post comparison of forward head posture among interventional group participants with a comprehensive corrective exercise program. The obtained pre-test value with the help of the REEDCO scale was 3.88±2.07 whereas the post test was 8.888±2.07. The t value noted as 5.124 and the significant value of p.0001, which proves that there is a more significant effect on forward head posture correction after a comprehensive corrective exercise program. On the other hand, table 5 shows the analysis of the pre and post comparison of the control group. The obtained pre-test values are 4.44±1.57 whereas the post-test value is 2.22±2.48. The obtained t value is 2.269 and the p value is 0.0375.

Table 4. Analysis of pre and post comparison of forward head posture among interventional group				
Sl. No	Test	Mean±Standard deviation	T – value	P - value
1	Pre – test	3.88±2.07		
2	Post - test	8.888±2.07	5.124	0.0001

Table:5 analysis of pre and post comparison of forward head posture among control group				
Sl. No	Test	Mean±standard deviation	T – value	P - value
1	Pre – test	4.44±1.57		
2	Post - test	2.22±2.48	2.269	0.0375





4.4 Analysis of Thoracic Kyphosis

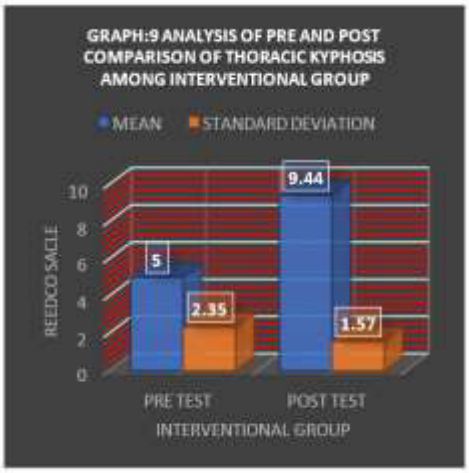
The study of thoracic kyphosis in the interventional and control groups is shown in Tables 6 and 7. The pre-test values in the interventional group were 5±2.35, and the post-test values were 9.44±1.57. 4.713 is the t value, while 0.0002 is the p value. It displays the amount of relevance. The pre-test values in the control group are 5.55±1.57, whereas the post-test value is 2.77±2.48. The t value found is 2.841, with a p value of 0.01.

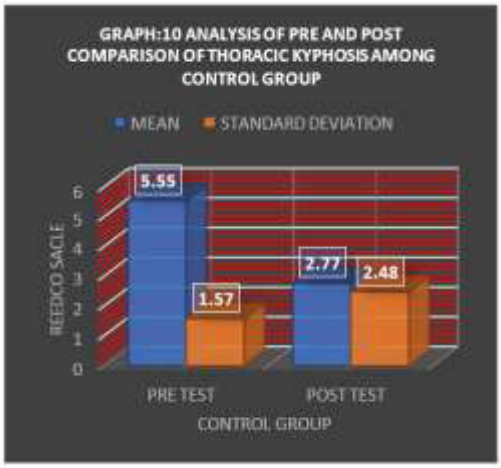
Table 6. Analysis of pre and post comparison of thoracic kyphosis among interventional group

Sl. No	Test	Mean±Standard deviation	T – value	P - value
1	Pre – test	5±2.35		
2	Post - test	9.44±1.57	4.713	0.0002

Table 7. Analysis of pre and post comparison of thoracic kyphosis among control group

Sl. No	Test	Mean±Standard deviation	T – value	P - value
1	Pre – test	5.55±1.57		
2	Post - test	2.77±2.48	2.841	0.01



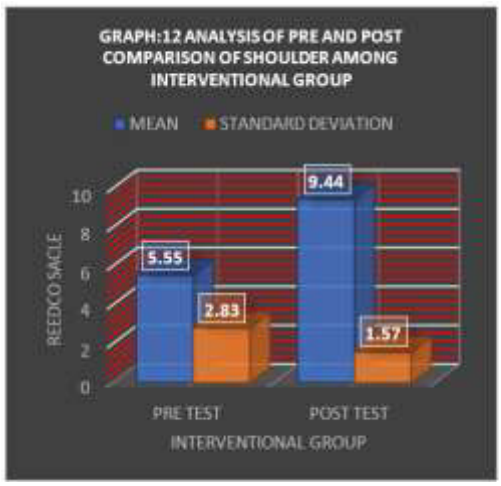


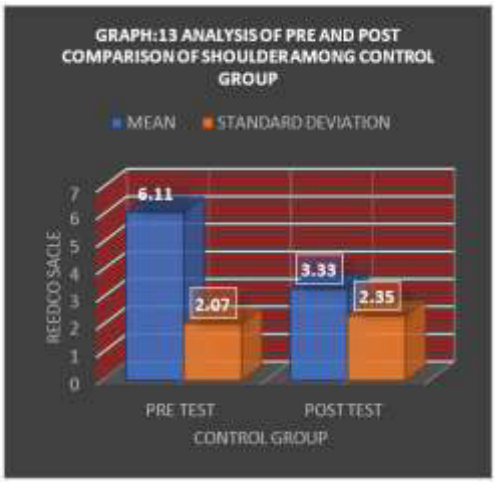
4.5 Analysis of Shoulder

In the analysis of shoulder posture among interventional group the pre-test value are 5.55±2.83 whereas the post-test value is 9.44±1.57. the t value noted as 3.606 and the p value shows significance level that is p<.0001. In the control group shows the pre-test value are 6.11±2.07 and the post value is 3.33±2.35. the obtained t value is 2.663 and the p value is 0.017.

Table 8. Analysis of pre and post comparison of shoulder among interventional group				
Sl. No	Test	Mean±Standard deviation	T – value	P - value
1	Pre – test	5.55±2.83		
2	Post - test	9.44±1.57	3.606	0.0024

Table 9. Analysis of pre and post comparison of shoulder among control group				
Sl. No	Test	Mean±Standard deviation	T – value	P - value
1	Pre – test	6.11±2.07		
2	Post - test	3.33±2.35	2.663	0.017





5. DISCUSSION

The number of patients presenting to dentists with musculoskeletal pain in the upper limb is increasing. We propose to access the effectiveness of a randomised controlled trial of a comprehensive corrective exercise program in the gathering of men and women aged 18 to 25 years with upper cross syndrome in terms of postural alignment. Clinicians agree that it's important to measure head, shoulder, scapula, and spinal posture behaviour because they affect or are affected by many biomechanical motor control and execution factors. At baseline (pre- test) and week 8 (post-test), mean values for head, shoulder, scapula, and spinal posture behaviour were as follows: ligament factors including forward head angle, forward shoulder angle, and thoracic kyphosis angle were measured for both the comprehensive corrective exercise program (intervention group) and control group at baseline (pre-test). It has been assumed that exercise can correct postural malalignment, but an earlier review found little evidence to support this assumption. Besides, notwithstanding the boundless consideration of postural correction in practice intercession, there is restricted exact information to help its adequacy and little is known about the best exercise mediations. As currently referenced, it appears to be the main explanation is the other ends of the underlying methodology in the past investigations. The forward head angle, the shoulder forward angle, and the thoracic kyphosis angle of the intervention group fundamentally diminished after participating in the comprehensive corrective exercise program. Along these lines, it may very well be presumed that the comprehensive exercise program utilized in the current review had a good impact. This finding is in accordance with the consequence of studies, for example, Harman et al. and Lynch et al. Moreover, the findings of the present study are in line with the results of a 2010 study by Lynch et al., which doubts the optimal effectiveness of comprehensive corrective exercise introducing head and shoulder forward angle in patients [25]. Therefore, planning and executing an exact and international program of corrective movements, including stretching, resistance, and stabilization exercises for the neck, shoulder, and thoracic regions, which is performed routinely and under the immediate oversight of the examiner, can actually decrease the angle of the head and shoulder forward and thoracic kyphosis of the affected individual. Such features should be present in the comprehensive corrective exercise program of the current study. The program was planned so particularly that as much as could be expected in all activities. We want to conduct a randomized controlled trial based on the comprehensive approach, which is adequately powered and utilizes validated outcome measurement of upper cross syndrome, to investigate the effect of the comprehensive corrective exercise program on both primary and secondary outcomes. Cools et al. also noted the importance of the correct alignment of the head and spine during scapula rehabilitation exercise. The author stated that this strategy of simultaneous correction of the posture should be noted in all phases of the rehabilitation program [27]. Mirzare et al. showed that the utilization of activities essentially worked on special postural anomalies in students. Shoulder angle might prompt shoulder extension, the shortness and stiffness of the anterior shoulder girdle muscle, and the thickness and elongation of the posterior muscle. Likewise, it appears to cause the shoulder position to move forward, anterior scapular deviation, and the incomplete rotation of the scapula upwards during the shoulder lift, as well as pain in the shoulder region. Hence, doing practices upholds the spine due to reinforcing the

muscles, likewise, prompts the moved along static and dynamic equilibrium of individuals. In the head forward complexity, the focal point of gravity of the head is pushed ahead and the flexural force increments. Furthermore, as a rule, the length and measure of muscle activity change in the head and neck regions. Typically, the collaboration between the four fundamental muscles on both the front and back sides of the head and neck region keeps up with ideal equilibrium and posture. However, in anterior head deformity, the equilibrium between these muscles is upset and a lot of stress is applied to them. It appears that the current training protocol of a comprehensive corrective exercise program increases the length of the shortened muscles of the upper neck toward the back and strengthens the muscles of the front of the neck. Subsequently, adjusting the upper muscle group, the conventions prompted the correction of the head forward complication. The outcomes showed significant changes in the curvature of kyphosis in the intervention group. After the comprehensive corrective exercise program, the curvature was decreased. Nonetheless, the progress in the control group was not significant.

5.1 Limitation

The findings of the present study showed the optimal effectiveness of comprehensive corrective exercise program reducing the head forward angle, kyphosis, and forward shoulder in individuals with upper cross syndrome. Our study has a few limits including the enrolment of 18 to 28 years of age. Consequently, the result of this study was generalizable to all individuals (e.g., women and men aged ≥ 25 years) with Upper Cross Syndrome. Another limit is that this study is certifiably not a double-blind design.

6. CONCLUSION

`This study showed that the comprehensive corrective exercise program for people with upper cross syndrome is achievable and brings about postural arrangement. The Comprehensive Corrective Exercise Program significantly improves the angles of the head forward, shoulder forward, and thoracic kyphosis of dental students. Nonetheless, our outcomes might have restricted generalizability to all people with UCS.

7. AUTHOR CONTRIBUTION STATEMENT

Communication and text prepareation by Murugaraj. Hemalatha.R has done the data collection, data collection and analyses by Sabarish Hariharan Nandini Eshwari has done the concept and data collection. Overall supervision and design suggestion by Shanmugananth.E

8. CONFLICT OF INTEREST

Conflict of interest declared none.

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