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THE EFFECTIVENESS OF BRUEGGER'S EXERCISE WITH BRUEGGER'S SELFCARE TECHNIQUE VERSES KENDALL EXERCISE FOR FORWARD HEAD POSTURE IN COMPUTER USER"- A COMPARATIVE STUDY

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ABSTRACT

This randomized controlled trial compares the effects of Bruegger's exercise with self-care technique versus Kendall exercise in male and female computer users. Out of 83 participants meeting inclusion criteria (CVA angle < 52 degrees, NDI index > 10, NPRS score = 3, age 30-40, and daily computer usage > 4 hours), 60 were selected. Measures included CVA angle, NDI index, cervical range of motion (CROM), and NPRS score. Participants were divided into four groups: A1/A2 (15 male/female each) received Bruegger's exercises and self-care techniques for 20 sessions over 4 weeks. B1/B2 (15 male/female each) received Kendall exercises and ergonomic advice for 24 sessions over 4 weeks. SPSS 26.0 was used for analysis with a significance level of $p<0.05$. Due to significant non-normality ($P<0.05$), non-parametric tests were employed: Mann-Whitney U for between-group and Wilcoxon Signed-Rank for within-group analysis. Significant differences were found for CVA angle (P=0.007* and 0.004* for A1 [MALE] and A2 [FEMALE]), NDI index (P=0.02* and 0.03* for A1 [MALE] and A2 [FEMALE]), and NPRS score (P=0.0001* for both groups). Males showed greater improvement in CVA angle and NDI index, females exhibited higher improvement in NPRS. Similar trends were observed across different measures and groups. Both interventions effectively corrected forward head posture in male and female computer users. Males showed greater improvement with Bruegger's

exercises, while females showed more improvement with Kendall exercises. Ergonomic guidance complements these methods in preventing future postural issues.

Keywords: Forward Head Posture, Bruegger's Exercise, Kendall Exercise, CVA, Computer Users, Crom

INTRODUCTION:

The spine, a central support structure, enables movement and provides vital support, connecting different skeletal parts. Comprising cervical, thoracic, lumbar, sacral, and coccygeal vertebrae, along with ligaments and disks, it allows essential movements like flexion, extension, rotation, and side flexion **[1]**. However, this balance between rigidity and mobility, especially in the cervical and lumbar regions, can lead to issues like misalignments, herniated disks, and nerve impingements, highlighting the need to maintain spinal health. The cervical spine's lordotic curve typically permits flexion, extension, protraction, and retraction movements. Prolonged protraction may cause forward head posture (FHP), known as "text neck" or "ihunch," characterized by deviation from neutral posture. Contributing factors include elevated head positions during sleep, prolonged device use, weak back muscles, and nutrient deficiencies **[1]**.

Numerous professions involve prolonged fixed positions, leading to sustained muscle contractions in the head and neck region. The head, constituting 6% of body weight, is intricately connected to cervical vertebrae through multiple muscles, facilitating bodily coordination **[2]**. Office workers, especially heavy computer users, face heightened risks of chronic musculoskeletal issues, with FHP prevalence ranging from 52% to 68% in teenagers and 11.4% to 67% in young adults. Prolonged computer use often leads to musculoskeletal issues, potentially resulting in a "turtle neck posture" due to exaggerated posterior curves in the thoracic vertebrae. In non-ergonomically constructed workplaces, long-term computer use exacerbates the problem, leading to sedentary behavior and affecting all physiological systems in IT professionals. Inattention to posture during work contributes to improper neck and head positioning, with altered posture prevalent among frequent computer users, ranging from 40% among college students to over 70% among university employees and learners **[3]**.

Due to forward head posture (FHP), surrounding cervical spine muscles weaken, impacting respiratory function by weakening auxiliary muscles like scalene, upper trapezius, pectoralis major (PM), and levator scapula. FHP also weakens deep cervical flexors, midthoracic rhomboids, mid and lower trapezius, while shortening

pectoralis major and neck extension muscles. Increased upper trapezius activity in FHP often causes muscle overuse pain, highlighting the importance of stretching and strengthening for posture maintenance. Both deep and superficial cervical flexor and extensor muscles, including sternocleidomastoid, scalene, longus colli, longus capitis, upper trapezius, levator scapulae, semispinalis cervicis, and multifidus muscles, are affected **[4]**.

Initially, restricted mobility of muscle, connective tissue, or vertebral segment may hinder good spinal posture. However, patient awareness of balanced posture and its effects should begin early in the treatment program, along with stretching and muscle-training maneuvers. Traditionally, therapists isolate each body segment during posture training and train patients accordingly. Misalignment in one region often leads to compensatory deviations throughout the spine. Many new studies have been conducted in which new approaches for forward head have been given to the population having FHP and those techniques have shown significant improvements **[5]**.

Mainly for the correction of the FHP there should be strengthening of the weak muscles and tight muscles should be given stretch. One of the new technique for correcting FHP is Bruegger's exercise which is a holding technique using theraband. Other latest approach is kendall exercises is a promising therapy generating interest as a means of accurately improving posture. This study aims to assess the impact of Bruegger's exercise along with Bruegger's self-care technique and Kendall exercise on forward head posture (FHP) in male and female computer users. It involves 20 sessions over 4 weeks (5 days/week) for Bruegger's exercise and self-care technique, and 24 sessions over 4 weeks (6 days/week) for Kendall exercise. Additionally, the study aims to compare the effects of these interventions for correcting FHP in male and female computer users, considering the limited evidence regarding their effectiveness.

MATERIALS AND METHODS:

In this study the following materials were utilized assessment and consent forms, a goniometer, a medium-resistant band (Green), a heat pack, and stationery items. Data were gathered from computer users at D-FIX (Prahladnagar, Ahmedabad), Shivohm Soft Tech Ltd (Business Park, Adalaj), and Dada Bhagwan Foundation Behno Office (Trimandir, Adalaj) through a randomized controlled trial involving 60 subjects, evenly split between males and females. Simple random sampling was employed, aided by a "postural awareness camp" conducted at Shivohm Soft Tech Ltd. The study spanned 20 sessions over 4 weeks for Bruegger's exercise groups (A1 & A2)

and 24 sessions over 4 weeks for Kendall exercise groups (B1 & B2).

There were four outcome measures taken in this study craniovertebral angle, Numerical pain rating scale, neck disability index scale and cervical range of motion was taken pre and post **[6-9]**. Inclusion criteria included individuals aged 30 to 40, consenting to research interventions, using computers for at least 4 hours daily, with a craniovertebral angle below 52 degrees, NPRS score above 3, and Neck Disability Index score above 10 **[6]**. Exclusion criteria encompassed various health conditions and recent neck injuries. Following ethical clearance, eligible participants were randomly assigned to groups A1, A2, B1, and B2 for Bruegger's and Kendall exercises, respectively, with sessions conducted accordingly **[6]**.

INTERVENTION GIVEN TO GROUP A1(15-MALES) & A2(15-FEMALES):

BRUEGGERS'S EXERCISE WITH BRUEGGER'S SELF CARE TECHNIQUE

Groups A1 and A2 followed Bruegger's exercise protocol with self-care techniques, as per established literature. They sat in a high position during sessions, starting with a 10-15 minute heat pack application. Using a medium resistance band, they performed various exercises, including thumb extension, wrist extension, forearm supination, elbow extension, shoulder abduction, shoulder external rotation, and scapular retraction with chin tucking. The intervention progressed from 10-second holds to 30-second holds with 2-second increments per session, with 30-second rests between sessions. Participants completed 4 sets of 12 repetitions over 20 sessions in 4 weeks, 5 sessions per week **[5, 6]**. The Bruegger's self-care technique, recommended every 30 minutes during work, involves sitting on the chair edge, feeling "sit bones," maintaining a high head position with an imaginary string pulling upward, legs slightly apart and turned out, relaxed abdomen, evenly distributed weight, forward tilted pelvis, lifted breastbone, squeezed shoulder blades, palms forward, and outward rotation. Slow, deep breaths are taken for 10-20 seconds. In standing, an upright stance is maintained, head held high with a string anchored at the crown pulling upward, legs slightly apart and feet slightly outward, abdomen engaged, forward-leaning pelvis, lifted breastbone, upward and outward rotated hands, and slow, deep breaths for 10-20 seconds **[10]**.

KENDALL EXERCISE WITH ERGONOMIC ADVISE B1(15-MALES) & B2(15-FEMALES):

GROUP B1 and B2 performed Kendall exercises, which included pectoral and cervical extensor muscle stretches and shoulder retractor (lower trapezius and rhomboids) strengthening using a theraband and deep cervical flexors. The regimen consisted of 1) Pectoralis muscle stretch:

Hands placed behind the head, elbows pulled backward, followed by arm abduction and external rotation. Three sets held for 30 seconds each. 2) Shoulder retraction strengthening: Using a TheraBand, pull back both hands to bring the shoulder blades together while standing. Start with 10 repetitions, increasing gradually to 20 repetitions for two sets.3) Deep cervical flexor strengthening: Lie flat on the back with the chin tucked, lift the skull, and hold the chin tuck for 5-10 seconds. Perform 10 repetitions for two sets. 4) Cervical spine extensor stretch: Hands at the back of the head while seated, adopt a forward head posture with the head downwards, holding the stretch for 30 seconds, repeated for three sets **[11]**. Ergonomic advice included: 1) Chin tuck exercises: Perform 10-12 repetitions every 2 hours, especially during neck muscle fatigue. 2) Shoulder retraction exercises: Execute 10-12 repetitions every 2 hours **[12]**.

STATISTICAL ANALYSIS:

Data analysis was conducted using SPSS 26.0, with a significance level set at $p<0.05$. Descriptive statistics determined the mean and standard deviation for each group, while the Shapiro-Wilkinson test assessed data normality. Within-group differences were analyzed using the Wilcoxon signed-rank test, and between-group comparisons were made using the Mann-Whitney U test.

RESULTS:

Table 1 shows that mean age of bruegger's and kendall group Shapiro wilkinson test for normality reported significant difference($P<0.05$), Hence Non Parametric tests was used for the analysis. Regarding Mean age analysis of between group using Mann Whitney U Test didn't Show significance difference - $P>0.05$.

Table 2 suggests following Shapiro-Wilk tests showed non-normality ($p < 0.05$) for CVA angle/NDI index and NPRS data, leading to non-parametric analysis. Between Bruegger's and Kendal groups, a significant difference ($p < 0.05$) in post-CVA angle values was found among males, per Mann-Whitney U test.

Table 3 denotes that Shapiro-Wilk tests revealed non-normality ($p < 0.05$), prompting non-parametric analysis for ROM data. Between Bruegger's and Kendal groups, Mann-Whitney U tests found significant differences ($p < 0.05$) in extension and flexion, but only among males.

Table 4 describes that Shapiro-Wilk test ($P<0.05$) necessitated non-parametric tests; significant differences observed between groups A1 & A2 versus B1 & B2 for CVA ANGLE/NDI INDEX & NPRS, with higher mean differences in Bruegger's class.

Table 5 describes that Shapiro-Wilk test ($P<0.05$) prompted non-parametric tests; no significant difference in ROM between

groups A1&A2 versus B1&B2, but significant within-group differences in males & females, particularly in Bruegger's A1 & A2, with males showing significant differences in extension/flexion/lateral flexion - right side & rotation - right side ($P<0.05$).

Table 1: Mean Age of GROUP A1, A2 & B1 B2

	Bruegger's		KENDALL	
	A1 [MALE]	A2 [FEMALE]	B1 [MALE]	B2 [FEMALE]
MEAN	34.66	34.66	35.26	35
SD	2.89	3.27	2.95	2.58
Z VALUE	0.23		0.17	
P VALUE	0.78		0.82	

Table 2: Comparison of Pre and Post Means 'CVA Angle /NDI Index/NPRS'-Post (Between Group) A1-B1 Versus A2-B2

		MALE	FEMALE
CVA ANGLE	BRUEGGER'S	50.06±2.56	49.2±2.37
	KENDALL	47.93±2.21	50.2±1.86
	Mann Whitney U TEST	2.43	0.61
	P VALUE	0.02*	0.45
NDI INDEX	BRUEGGER'S	22.67±4.61	19.53±5.47
	KENDALL	19.86±3.36	17.66±4.15
	Mann Whitney U TEST	1.90	1.05
	P VALUE	0.06	0.3005
NPRS	BRUEGGER'S	2.4±1.2	2.86±1.35
	KENDALL	2.86±1.08	2.66±1.24
	Mann Whitney U TEST	1.10	0.42
	P VALUE	0.27	0.67

Table 3: Comparison of Pre and Post Means Crom (Between Group) A1-B1 Versus A2-B2s

		MALE	FEMALE
FLEXION	BRUEGGER'S	41.6±1.78	40.86±2.89
	KENDALL	40.06±2.21	39.6±4.69
	Mann Whitney U TEST	2.10	0.88
	P VALUE	0.04*	0.38
EXTENSION	BRUEGGER'S	55.86±2.21	52.26±2.69
	KENDALL	54.06±1.91	52.06±4.44
	Mann Whitney U TEST	2.38	0.14
	P VALUE	0.02*	0.88
LAT FLEXION -RIGHT	BRUEGGER'S	42.4±1.71	41.53±1.41
	KENDALL	41.8±2.29	40.8±3.31
	Mann Whitney U TEST	0.81	0.78
	P VALUE	0.42	0.43
LAT FLEXION -LEFT	BRUEGGER'S	42.2±1.72	41.13±2.15
	KENDALL	41.6±1.59	41±3.17
	Mann Whitney U TEST	0.99	0.13
	P VALUE	0.32	0.89
ROTATION-RIGHT	BRUEGGER'S	54.6±1.99	52.73±2.59
	KENDALL	53.47±2.06	51.06±5.59
	Mann Whitney U TEST	1.52	1.04
	P VALUE	0.13	0.302
ROTATION-LEFT	BRUEGGER'S	54.26±1.56	53.33±2.72
	KENDALL	53.86±2.47	51.8±4.99
	Mann Whitney U TEST	0.53	1.04
	P VALUE	0.6001	0.306

Table 4: Comparison of 'CVA Angle /NDI Index/NPRS'-Between Group (A1&A2 Versus B1 & B2)

		PRE	POST	WILCOXON SIGN RANK TEST	P VALUE	DIFFERENCE
CVA ANGLE	BRUEGGER'S	46.96±2.49	49.63±2.50	2.93	0.006*	2.67±2.49
	KENDALL	46.63±2.27	47.57±2.07	1.18	0.24	0.94±2.09
	Mann Whitney U TEST	0.37	2.45			
	P VALUE	0.707	0.02*			
NDI INDEX	BRUEGGER'S	25.33±5.06	21.1±5.3	2.23	0.03*	4.23±5.21
	KENDALL	21.8±4.63	18.76±3.93	1.93	0.06	3.04±4.38
	Mann Whitney U TEST	1.99	1.37			
	P VALUE	0.05*	0.18			
NPRS	BRUEGGER'S	5.3±1.18	2.63±1.30	5.89	0.0001*	2.67±1.22
	KENDALL	4.67±1.37	2.76±1.17	4.10	0.0003*	1.91±1.23
	Mann Whitney U TEST	1.34	0.28			
	P VALUE	0.18	0.77			

Table 5: Comparison of 'ROM'-(Between Group)-A1 & A2 Versus B1&B2

		PRE	POST	WILCOXON SIGN RANK TEST	P VALUE	DIFFERENCE
FLEXION	BRUEGGER'S	38.23±2.87	41.23±2.43	3.08	0.004*	3±2.31
	KENDALL	38±3.67	39.83±3.67	1.36	0.18	1.83±3.67
	Mann Whitney U TEST	0.19	1.23			
	P VALUE	0.84	0.22			
EXTENSION	BRUEGGER'S	50.87±3.13	54.06±3.05	2.82	0.008*	3.19±3.09
	KENDALL	51.2±3.83	53.06±3.56	1.37	0.17	1.86±3.61
	Mann Whitney U TEST	0.25	0.82			
	P VALUE	0.79	0.41			
LAT FLEXION -RIGHT	BRUEGGER'S	39±1.73	41.96±1.63	4.82	0.0001*	2.96±1.69
	KENDALL	39.23±3.11	41.3±2.89	1.88	0.06	2.07±3.05
	Mann Whitney U TEST	0.25	0.77			
	P VALUE	0.804	0.44			
LAT FLEXION -LEFT	BRUEGGER'S	38.33±2.52	41.66±2.02	3.99	0.0004*	3.33±2.31
	KENDALL	39.27±2.71	41.3±2.52	2.12	0.04*	2.03±2.6
	Mann Whitney U TEST	0.98	0.43			
	P VALUE	0.33	0.66			
ROTATION-RIGHT	BRUEGGER'S	51.06±2.71	53.67±2.49	2.74	0.01*	2.61±2.53
	KENDALL	50.56±4.67	52.27±4.38	1.03	0.309	1.71±4.42
	Mann Whitney U TEST	0.35	1.07			
	P VALUE	0.72	0.29			
ROTATION-LEFT	BRUEGGER'S	51.07±2.52	53.8±2.28	3.11	0.004*	2.73±2.31
	KENDALL	50.83±4.02	52.83±4.07	1.35	0.18	2±4.04
	Mann Whitney U TEST	0.19	0.80			
	P VALUE	0.84	0.42			

DISCUSSION:

In 2020, Peeyoosha Gurudut *et al.* introduced two self-care exercises: Bruegger's exercise (BE) and the cervical brace exercise in quadruped position. These exercises aim to prevent forward head posture by targeting muscular imbalances. Bruegger's exercise focuses on

strengthening scapular retractors and deep cervical flexors while stretching protractors. Incorporating an elastic resistance band enhances its effectiveness. Providing ergonomic guidance, including these exercises, empowers individuals to manage their well-being, reducing the need for frequent healthcare visits and associated costs. The cervical brace exercise also promotes scapular and cervical stability, supporting overall musculoskeletal health **[13, 14]**. Hamna Afzal *et al*. conducted a case study on a 22-year-old individual with forward head posture (FHP) and neck discomfort due to excessive mobile phone use. The patient underwent three weeks of Bruegger's exercise treatment, resulting in improvements in NPRS, NDI, CROM, and CVA. Each session, held five times per week, included four sets of 12 repetitions **[5]**. Sun Min Kim, Sang Hun Jang *et al*. conducted a single-subject research study on pregnant women at 28 weeks gestation experiencing low back pain (LBP) for four weeks. The intervention included ten prenatal exercise sessions incorporating Bruegger's exercise and other exercises. Results showed reduced VAS scores from 5 to 2, decreased ODI scores from 54% to 19%, and improved static balance post-intervention. The study concludes that the prenatal exercise program effectively reduces LBP and enhances static balance in pregnant women **[15]**.

In an RCT by Aliaa Diab and Ibrahim Moustafa, subjects with lower cervical spondylotic radiculopathy underwent a posture correction program akin to Kendall exercises alongside conventional treatments. Assessments before treatment, after 10 weeks, and at a six-month follow-up revealed improvement in forward head posture (FHP) in the exercise group, indicating program effectiveness. Strengthening activities restored muscular balance and corrected FHP, while stretching eased tight muscles, potentially relieving discomfort by reducing stress on surrounding tissues and nerves **[16]**. Ki-Hyun Kim and Seong-gil Kim found horse-riding simulator exercises more effective than Kendall exercises in improving FHP. Their study combining Mackenzie and Kendall movements, done five times a week for four weeks, showed significant improvement in FHP across all groups, particularly in those exercising three times daily. These findings underscore the potential of modified cervical posture exercises in managing FHP and related chronic conditions, offering an alternative to traditional approaches **[17]**. In a study by Zahra Heydari, Rahman Sheikhhoseini *et al*., 103 second-grade boys with forward head posture (FHP) were divided into two groups: one received a special exercise program, while the other didn't receive any exercise. Using photogrammetry, neck

(CVA) and shoulder (SA) angles were measured before and after an 8-week exercise regimen. The exercise group underwent Selective Corrective Exercises (SCEs) three times a week for 30 minutes per session, focusing on strengthening and stretching activities. The study found that specific corrective exercises could improve posture, with an increase of at least 1.40 degrees in CVA and 1.34 degrees in SA suggesting favourable alterations in neck and shoulder angles **[18]**. To reverse forward head posture (FHP), participants used Bruegger's exercise, emphasizing scapular retraction and protractor stretching. The protocol involved shoulder retraction with a theraband and chin tuck in supine position to strengthen cervical flexors. Elastic resistance bands aided scapular muscle correction and pectoral muscle stretching. These exercises effectively corrected FHP and prevented future postural issues, especially with ergonomic advice.

CONCLUSION:

In summary, the RCT evaluated Bruegger's exercise with self-care technique (A1 and A2) and Kendall exercise with ergonomic advice (B1 and B2) on 15 males and 15 females in each group. Both interventions led to significant improvements in various outcomes. Males generally showed greater improvements in CVA angle, flexion ROM, extension ROM, lateral flexion to the right, and rotation to the left, whereas females exhibited higher improvements in NPRS score, lateral flexion to the left, and rotation to the right. Significant differences were observed between genders in lateral flexion to the left and rotation to the left, with males also showing significant improvements in extension and lateral flexion to the right. Overall, females tended to demonstrate higher improvements across all range of motion variables.

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REFERENCES:

[1] Bullock-Saxton J. Normal and abnormal postures in the sagittal plane and their relationship to low back pain. Physiotherapy Practice. 1988 Jan 1;4(2):94-104.

[2] Naz A, Bashir MS, Noor R. Prevalance of forward head posture among

university students. Rawal Med J.2018 apr 1;43(2):260-

[3] Singla D, Veqar Z. Association between forward head, rounded shoulders, and increased thoracic kyphosis: a review of the literature. Journal of chiropractic medicine. 2017 sep 1;16(3):220-9.

[4] Kim SY, Koo SJ. Effect of duration of smartphone use on muscle fatigue and pain caused by forward head posture in adults. Journal of physical therapy science. 2016;28(6):1669-72.

[5] Afzal H, Dalawar I, Dalawar A, Murtaza A, Tanveer S, Ahsan A. Effect of Bruegger s relief exercise on forward head posture among electronic gadget users. Rawal Medical Journal. 2022 Nov 12;47(4):1042-.

[6] Dalawar A, Afzal H, Dalawar I, Murtaza A, Ghafoor A, Fiaz S. Effects of Muscle Energy Technique vs Bruegger's Relief Exercise on Forward Head Posture among electronic gadget users. Pakistan Journal of Medical & Health Sciences. 2022 May 26;16(05):51-.

[7] Jeong ED, Kim CY, Kim SM, Lee SJ, Kim HD. Short term effects of suboccipital muscle inhabitation technique and cranio-cervical flexion exercise on hamstring flexibility, cranio-vertebral angle, and range of motion of the cervical spine in subjects with neck pain: A randomized controlled trial. Journal of Back and Musculoskeletal Rehabilitation. 2018 Jan 1;31(6):1025-34.

[8] Vernon H. The neck disability index: patient assessment and outcome monitoring in whiplash. Journal of Musculoskeletal Pain. 1996 Jan 1;4(4):95-104.

[9] Childs JD, Piva SR, Fritz JM. Responsiveness of the numeric pain rating scale in patients with low back pain. Spine. 2005 Jun 1;30(11):1331-4.

[10] https://www.joestrunkmassage.com/bruggers-relief-position.html BRUEGGER'S SELF CARE TECHNIQUE

[11] Do YL, Nam CW, Sung YB, Kim K, Lee HY. Changes in rounded shoulder posture and forward head posture according to exercise methods. Journal of physical therapy science. 2017;29(10):1824-7.

[12] THERAPEUTIC EXERCISE-foundation and techniques, 7th edition, Carolyn kisner, lynn allen Colby, john borstad.

[13] Gurudut P, Welling A, Chodankar A. Effect of self-care exercises in forward head posture on craniovertebral angle and craniocervical flexion endurance: A pilot study. Indian Journal of Physical Therapy and Research. 2020 Jan 1;2(1):25-30.

[14] Muscolino JE. Advanced Treatment Techniques for the Manual Therapist: Neck. Lippincott Williams & Wilkins; 2013.

[15] Kim SM, Jang SH. Effect of prenatal exercise program combined with Brugger's exercise on low back pain and balance in pregnant women: A single-subject study. Journal of Korean Physical Therapy Science. 2021;28(1):85-96.

[16] Diab AA, Moustafa IM. The efficacy of forward head correction on nerve root function and pain in cervical spondylotic radiculopathy: a randomized trial. Clinical rehabilitation. 2012 Apr;26(4):351-61.

[17] Kim KH, Kim SG, Hwangbo G. The effects of horse-riding simulator exercise and Kendall exercise on the forward head posture. Journal of physical therapy science. 2015;27(4):1125-7.

[18] Heydari Z, Sheikhhoseini R, Shahrbanian S, Piri H. Establishing minimal clinically important difference for effectiveness of corrective exercises on craniovertebral and shoulder angles among students with forward head posture: a clinical trial study. BMC pediatrics. 2022 Dec;22(1):1-1.