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A COMPARISON OF BOWEN AND GRASTON TECHNIQUE IN PATIENTS OF TENSION NECK SYNDROME

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ABSTRACT

Visual display terminal syndrome (VDTS) is increasingly common, with tension neck syndrome (TNS), characterized by myofascial pain and muscle adhesions causing localized hypoxia, being a prevalent manifestation. This randomized single-blinded trial compared the effects of Graston versus Bowen's soft tissue techniques on pain, cervical range of motion (ROM), and disability in 30 participants (aged 20–45, both genders) with VDTS-induced TNS and device usage >2 hours/day. Excluding those with radiculopathy, malignancy, surgery, or systemic conditions, participants received treatment three times weekly for two weeks, with outcomes assessed via NPRS (pain), NDI (disability), and goniometry (cervical ROM). Mixed ANOVA showed significant time interactions for disability and cervical ROM, but not pain (p<0.05); within-group analysis revealed both techniques equally reduced neck pain, while the Graston group demonstrated markedly greater gains in cervical flexion (mean difference: 10.0°) and disability reduction (mean difference: 9.133). In summary, although both interventions improved pain, function, and mobility in TNS patients, Graston technique proved more effective than Bowen's for enhancing cervical range of motion and reducing functional disability

Keywords: *Instrument-assisted soft tissue mobilization; Neck disability; Neck pain; Tension neck syndrome; Visual display terminal syndrom*

Introduction:

Cervical pain is a complex condition prevalent in modern life, particularly among frequent computer users, carrying significant financial costs related to medical expenses and lost productivity (Kazeminasab et al., 2022). Visual Display Terminal Syndrome (VDTS) encompasses a cluster of ocular and extra-ocular symptoms resulting from extended device usage, including neck pain, which is the most common musculoskeletal complaint (Parihar et al., 2016). Systematic reviews indicate a strong association between screen work and increased risks of neck and upper extremity symptoms (Coenen et al., 2019). Understanding these risk factors is crucial for early detection and prevention, as neck discomfort often progresses to chronic issues if left unmanaged (Verhagen, 2021).

Tension Neck Syndrome (TNS) is specifically defined as myofascial pain localized to the neck and shoulder regions without prior trauma or degenerative disease (França et al., 2008). It is characterized by pain, fatigue, stiffness, and muscle spasms induced by movement or palpation, often leading to decreased cervical proprioception (Koskimies et al., 1997). Distinct from neurological or articular conditions, TNS is frequently categorized as an occupational cervicobrachial syndrome linked to Visual Display Terminal (VDT) usage (Mekhora et al., 2000). This condition represents a work-related constellation of symptoms often described in literature as repetitive strain injuries or cumulative trauma disorders. The epidemiology of TNS highlights a higher prevalence among women, with studies showing a female-to-male ratio of approximately 5.9:1 (Mekhora et al., 2000). Estimates suggest that between 4% and 42% of VDT users suffer from TNS, with lifetime prevalence in the general population reaching up to 70% (Navarro-Santana et al., 2020). The condition affects office workers, students, and professionals, with recent data indicating that online learning during the pandemic has exacerbated risk factors like prolonged sitting and uncomfortable positions (Mandagi et al., 2022). Furthermore, middle-aged women report the highest prevalence rates, making it a significant global cause of disability (Javaid et al., 2022).

Biomechanically, forward head posture significantly increases the weight load on the cervical spine, with stress doubling at just 15 degrees of flexion (David et al., 2021). Maintaining focus on devices below eye level leads to anterior deviation of the head, decreased cervical lordosis, and abnormal postural changes (Fiebert et al., 2021). This posture is associated with hyper kyphosis and restricted ribcage motion, potentially contributing to broader health issues beyond musculoskeletal pain (David et al., 2021). Long-term maintenance of such positions, often called "turtle neck posture," affects the thoracic spine and shoulder blades, leading to conditions like upper crossed syndrome (Kang et al., 2012). The pathophysiology of TNS involves muscle overwork and metabolic end-product buildup, resulting in sustained contraction and hypoxia (Mekhora et al., 2000). Another proposed model suggests that repetitive movements cause micro-lesions in musculoskeletal structures, primarily affecting the upper trapezius, sternocleidomastoid, and levator scapulae (Klussmann et al., 2008). Risk factors are both individual and workplace-related, including ergonomics, psychosocial stress, and sedentary lifestyles (Jun et al., 2021). These stressors can lead to premature wear, degeneration, and various physical and psychological difficulties if not addressed (Parihar et al., 2016).

Differential diagnosis for neck pain is wide-ranging, often overlapping with myofascial pain syndrome characterized by trigger points in the upper trapezius (Javaid et al., 2022). Other conditions include cervicogenic headache, cervical joint dysfunction, and text neck syndrome, which is particularly concerning in pediatric populations due to mobile device usage (Navarro-Santana et al., 2020). Distinguishing TNS from these entities is challenging but necessary, as symptoms like occipital pain, dizziness, and radiating headaches may indicate different underlying pathologies (Barmherzig & Kingston, 2019). Myofascial trigger points remain the most common finding, contributing to pressure pain sensitivity and referred pain sensations (Charles et al., 2019).

The economic burden of neck pain is substantial, ranking fourth in global disability measures and impacting healthcare systems and productivity (Navarro-Santana et al., 2020). Costs include medical expenses, prescription medicines, and disability claims, with neck pain second only to low back pain in financial toll on employees (Safiri et al., 2020). Prevention strategies emphasize maintaining neutral spine positions and limiting device usage, though breaking habitual postures remains difficult (David et al., 2021). General treatment options range from pharmacological interventions like NSAIDs and muscle relaxants to physiotherapy, though drug use is often restricted due to side effects (Galasso et al., 2020). Bowen Technique is a non-invasive myofascial therapy involving gentle rolling moves on muscles and fascia to promote self-healing and restore equilibrium (Sivakumar & Dhinakaran, 2022). Studies indicate it effectively reduces pain and improves range of motion in conditions like acute trapezitis and text neck syndrome, often requiring few sessions for success (Nitsure & Kothari, 2015; Seemal et al., 2022). The technique works by stimulating mechanoreceptors to deliver neurological messages that relax the body and enhance blood flow (Ying et al., 2023). Comparative trials suggest Bowen therapy may offer superior improvements in functional status and pain reduction compared to other soft tissue methods (Dalal, 2017; Aslam et al., 2023).

The Graston Technique is an instrument-assisted soft tissue mobilization (IASTM) approach that uses stainless steel tools to detect and treat soft tissue injuries (Haq & Riaz, 2022). It functions by creating controlled micro-trauma to trigger an inflammatory response, promoting collagen synthesis and breaking down scar tissue to restore flexibility (McKivigan & Tulimero, 2020). Research demonstrates its effectiveness in improving hemodynamics, range of motion, and pain levels in patients with myofascial neck pain and cervicogenic headaches (Harris, 2020; Mahgoub et al., 2022). Systematic reviews support IASTM as a successful intervention for reducing pain and enhancing function within three months, providing a basis for comparing it against Bowen technique in treating TNS (Lambert et al., 2017; Karmali et al., 2019).

Research Objective:

- To compare the effects of Bowen and Graston technique in Tension neck syndrome for neck pain management.
- To compare the effects of Bowen and Graston technique in Tension neck syndrome for improvement in neck ROM.
- To compare the effects of Bowen and Graston technique in Tension neck syndrome for disability.

Literature Review:

Neck pain is a pervasive condition in modern society, particularly among individuals who frequently use computers and mobile devices. Kazeminasab et al. (2022) identify neck discomfort as a complex issue with significant financial implications, including medical expenses and lost productivity. This condition is often linked to Visual Display Terminal Syndrome (VDTS), which encompasses both ocular symptoms like eye strain and extra-ocular musculoskeletal complaints such as cervical pain (Parihar et al., 2016). Systematic reviews have confirmed a statistically significant association between screen work and an increased risk of neck and upper extremity symptoms (Coenen et al., 2019). Understanding these risk factors, including inactivity and perceived stress, is essential for early detection and prevention strategies (Kazeminasab et al., 2022).

Tension Neck Syndrome (TNS) is specifically defined as myofascial pain localized to the neck and shoulder regions without a history of trauma or degenerative disease (França et al., 2008). It is characterized by symptoms such as fatigue, stiffness, and muscle spasms that are induced by movement or palpation (Koskimies et al., 1997). TNS is distinct from neurological conditions and is frequently categorized as an occupational cervicobrachial syndrome associated with Visual Display Terminal (VDT) usage (Mekhora et al., 2000). Epidemiological data suggests a higher prevalence among women, with some studies indicating a female-to-male ratio of 5.9:1 (Mekhora et al., 2000). Furthermore, the shift to online learning during the pandemic has exacerbated risk factors like prolonged sitting among students (Mandagi et al., 2022).

The biomechanics of neck pain are heavily influenced by posture, particularly forward head posture, which significantly increases the weight load on the cervical spine. David et al. (2021)

note that stress on the neck more than doubles at just 15 degrees of flexion. This posture is associated with hyper kyphosis and restricted ribcage motion, potentially leading to broader health issues beyond musculoskeletal pain (David et al., 2021). Pathophysiologically, TNS may result from the buildup of metabolic end-products causing muscle hypoxia (Mekhora et al., 2000). Alternatively, the neuroplastic RSI model suggests that repetitive movements cause micro-lesions in muscles like the upper trapezius and sternocleidomastoid (Klussmann et al., 2008). Differential diagnosis for neck pain is broad and often overlaps with other conditions such as Myofascial Pain Syndrome, which is characterized by trigger points in the upper trapezius (Javaid et al., 2022). Text Neck Syndrome is another relevant condition, particularly concerning in pediatric populations due to increased mobile device usage (Chu et al., 2023). Other differentials include cervicogenic headache and cervical joint dysfunction, which may present with symptoms like dizziness and occipital pain (Barmherzig & Kingston, 2019). Distinguishing TNS from these entities is challenging but necessary for effective clinical management (Barmherzig & Kingston, 2019).

The economic burden of neck pain is substantial, ranking fourth in global disability measures according to the Global Burden of Disease Study (Navarro-Santana et al., 2020). Costs associated with the condition include medical expenses, prescription medicines, and disability claims, with neck pain second only to low back pain in financial toll on employees (Safiri et al., 2020). The condition impacts household income and productivity due to extended absences from work (Siddiqui et al., 2022). Consequently, prevention strategies emphasizing neutral spine positions and limited device usage are critical, though breaking habitual postures remains difficult (David et al., 2021). General treatment options for neck discomfort range from pharmacological interventions to physiotherapy. Nonsteroidal anti-inflammatory medications (NSAIDs) and muscle relaxants are commonly used, though their long-term use is often restricted due to side effects (Galasso et al., 2020). Physiotherapeutic rehabilitation includes therapeutic exercises, manual therapy, and modalities like transcutaneous electrical nerve stimulation (TENS) (Galasso et al., 2020). Non-invasive approaches are preferred, as untreated TNS can deteriorate over time, leading to altered cervical curvature and entrapment neuropathies (Chu, 2022). Various myofascial release therapies have been developed to restore function and reduce tension points (Félix et al., 2017).

The Bowen Technique is a non-invasive myofascial therapy involving gentle rolling moves on muscles and fascia to promote self-healing. Sivakumar and Dhinakaran (2022) describe it as a method that restores bodily equilibrium by stimulating neurological messages to relax the body. Research indicates it effectively reduces pain and improves range of motion in conditions like acute trapezitis and text neck syndrome (Nitsure & Kothari, 2015; Seemal et al., 2022). Comparative trials suggest Bowen therapy may offer superior improvements in functional status and pain reduction compared to other soft tissue methods (Dalal, 2017). It is considered a cost-effective supplemental method for improving health (Hansen & Taylor-Piliae, 2011).

The Graston Technique is an instrument-assisted soft tissue mobilization (IASTM) approach that uses stainless steel tools to detect and treat soft tissue injuries (Haq & Riaz, 2022). It functions by creating controlled micro-trauma to trigger an inflammatory response, promoting collagen synthesis and breaking down scar tissue (McKivigan & Tulimero, 2020). Research demonstrates its effectiveness in improving hemodynamics, range of motion, and pain levels in patients with myofascial neck pain (Harris, 2020). Systematic reviews support IASTM as a successful intervention for reducing pain and enhancing function within three months (Lambert et al., 2017). It has also shown benefits when combined with exercise programs for cervicogenic headaches (Abdel-Aal et al., 2021). While both Bowen and Graston techniques have demonstrated efficacy in treating musculoskeletal pain, comparative data specific to Tension Neck Syndrome remains limited. Existing literature supports the use of IASTM for improving shortterm range of motion and pain intensity (Cheatham et al., 2016; Karmali et al., 2019). Similarly, Bowen therapy has shown promise in reducing disability and improving cervical mobility (Aslam et al., 2023). Therefore, further research is required to directly compare these interventions to determine which offers superior outcomes for pain, disability, and cervical range of motion in patients with VDT-induced TNS.

Hypothesis:

- H_1: There was a difference in effects of Graston and Bowen's technique in terms of pain management.
- H_2: There was a difference in effects of Graston and Bowen's technique in terms of ROM.
- H_3: There was a difference in effects of Graston and Bowen's technique in terms of disability.

Methodology

This randomized, single-blinded clinical trial (ClinicalTrials.gov: NCT05751070) was conducted at WeCare Physical Therapy Clinic, Islamabad (October 2022–May 2023). Thirty participants aged 20–45 years with Visual Display Terminal Syndrome (VDTS)-induced Tension Neck Syndrome (TNS) were randomly allocated via sealed envelope method into two groups (n=15 each): Group A received Graston technique plus conventional therapy, and Group B received Bowen's technique plus conventional therapy.

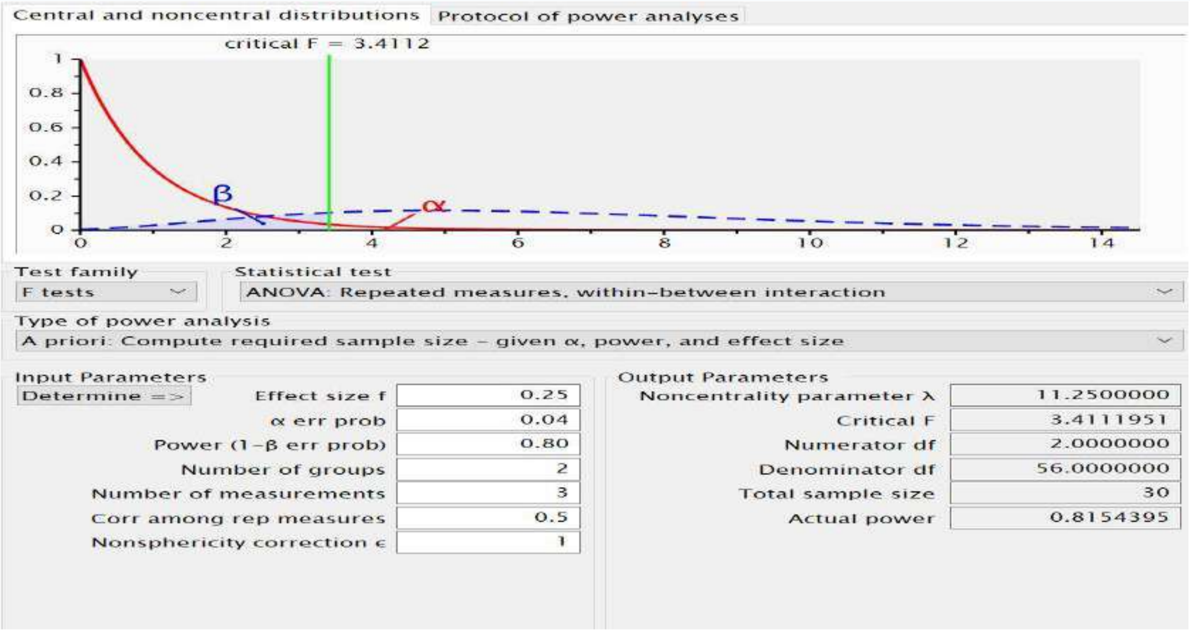
Inclusion criteria: (1) age 20–45 years; (2) both genders; (3) clinical diagnosis of VDTS-induced TNS affecting upper trapezius, sternocleidomastoid, and levator scapulae; (4) ≥3 VDTS symptoms (neck pain/stiffness, musculoskeletal discomfort, or ocular symptoms) within 7 days; (5) VDT usage >2 hours/day, ≥5 days/week with static posture.

Exclusion criteria: cervical radiculopathy, uncontrolled systemic disease, trauma/fracture/infection-related neck pain, prior neck/shoulder surgery, analgesic use, or malignancy.

Interventions: Both groups received conventional therapy (hot pack 10 min, TENS 10 min, cervical isometrics: 10 reps × 5-sec hold). Group A received Graston technique: lubricated stainless-steel instrument applied with pain-free strokes (60/min) from muscle origin to insertion for 20 minutes. Group B received Bowen's technique: gentle thumb-induced "rolling" moves (15–20 per session) on affected muscles with 2-minute rest intervals between sets; therapist exited during rests to facilitate relaxation. Sessions were delivered 3×/week for 2 consecutive weeks (6 total sessions).

Outcome measures: Pain (Numeric Pain Rating Scale), disability (Neck Disability Index), and cervical range of motion (universal goniometer) were assessed at baseline, post-intervention (week 2), and follow-up (week 4) by a blinded assessor. Data were analyzed using SPSS v25 with mixed-design ANOVA (α=0.05)

Outcome Measures and Assessment Primary and secondary outcomes were assessed at baseline, post-3 sessions, and post-6 sessions using validated tools. Pain intensity was measured via the Numeric Pain Rating Scale (NPRS; 0–10), a reliable instrument for neck pain (ICC = 0.67) (MacDermid et al., 2022). Cervical range of motion (flexion, extension, rotation, lateral flexion) was evaluated using a universal goniometer with excellent reliability (ICC = 0.89–0.99) and validity against radiographic standards (Youdas et al., 1992). Functional disability was quantified using the Neck Disability Index (NDI), a 10-item questionnaire with excellent test-retest reliability (ICC = 0.88) for neck pain populations (MacDermid et al., 2022). Demographic and clinical data were collected via a self-structured questionnaire to confirm eligibility and document VDT usage patterns.



Study Procedures and Ethics

A sample of 30 participants (15 per group) was determined using G*Power software. Non-probability purposive sampling was employed, with random allocation to Graston or Bowen's technique groups via the sealed envelope method. This single-blinded trial masked participants to group assignment. Following ethical approval from the Riphah College of Rehabilitation and Allied Health Sciences Ethics Committee (Ref# Riphah/RCRS/REC 01396) and written informed consent, data were collected from October 2022 to May 2023. Each participant received six 20-minute treatment sessions over two weeks, with outcome assessments conducted at baseline, mid-intervention (session 3), and post-intervention (session 6) by a blinded assessor. All data were maintained confidentially per ethical guidelines.

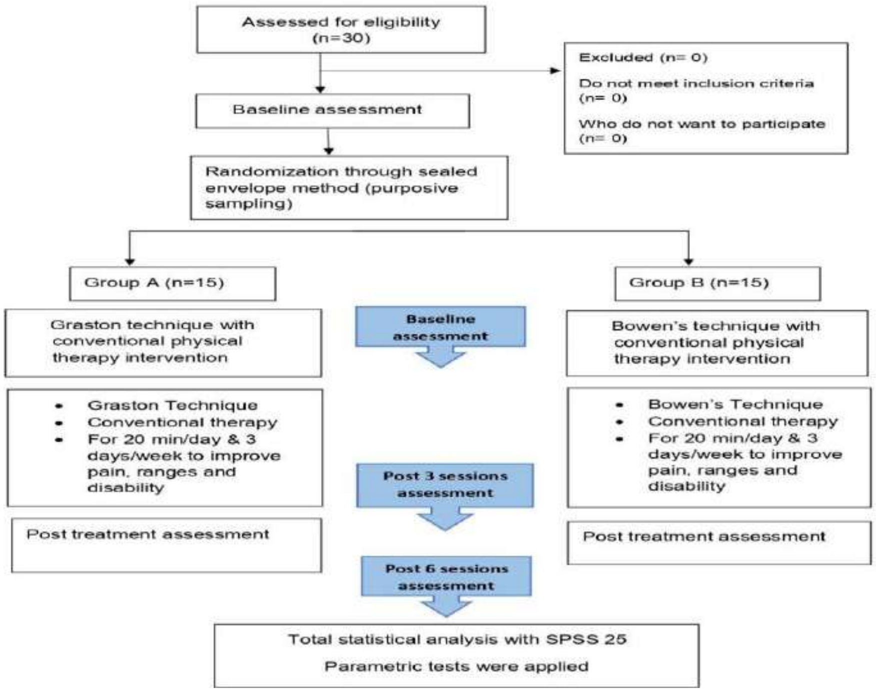
Data Analysis Procedure:

Data were analyzed using SPSS version 25, with descriptive statistics presented as mean ± SD for continuous variables and frequencies for categorical variables. Normality was assessed via Shapiro-Wilk test ($p < 0.05$), indicating non-normal distribution; thus, mixed-design ANOVA was used to evaluate between-group time-interaction effects. Within-group comparisons across assessment points (baseline, post-3, and post-6 sessions) were performed using repeated-measures ANOVA with post-hoc testing.

TABLE 2:

Normality of Data		
S.NO	Variable	Shapiro Wilk (p-value)
1	Flexion	.000
2	Extension	.037
3	Rotation Right	.065
4	Rotation Left	.065
5	Lateral Flexion Right	.000
6	Lateral Flexion Left	.000
7	NPRS	.000
8	NDI	.014

CONSORT Diagram:



Result:

Demographics Attribute

Data presented as mean ± SD for continuous variables and n (%) for categorical variables. Groups were comparable at baseline for age and gender distribution. Most participants were computer users with bilateral neck pain, used devices 4–6 hours/day, and reported pain onset of 3–6 months duration. Minor variations in occupation and pain laterality were observed between groups but were not statistically tested due to the exploratory nature of demographic reporting.

Table 1: Demographic and Baseline Characteristics of Participants (N=30)

Variable	Group A (Graston) n=15	Group B (Bowen's) n=15	Overall (N=30)
Age (years), Mean ± SD	33.2 ± 6.56	33.7 ± 5.61	33.5 ± 6.00
Gender, n (%)			
Female	9 (60%)	9 (60%)	18 (60%)
Male	6 (40%)	6 (40%)	12 (40%)
Occupation, n (%)			
Student	4 (26.7%)	2 (13.3%)	6 (20%)
Computer user	8 (53.3%)	6 (40%)	14 (46.7%)
Banker	1 (6.7%)	5 (33.3%)	6 (20%)
Teacher	2 (13.3%)	2 (13.3%)	4 (13.3%)
Pain Location, n (%)			
Left unilateral	1 (6.7%)	3 (20%)	4 (13.3%)
Right unilateral	4 (26.7%)	4 (26.7%)	8 (26.7%)
Bilateral	10 (66.7%)	8 (53.3%)	18 (60%)
Daily Device Usage, n (%)			

Variable	Group A (Graston) n=15	Group B (Bowen's) n=15	Overall (N=30)
2–4 hours	7 (46.7%)	4 (26.7%)	11 (36.7%)
4–6 hours	8 (53.3%)	11 (73.3%)	19 (63.3%)
Pain Onset Duration, n (%)			
<3 months	3 (20%)	1 (6.7%)	4 (13.3%)
3–6 months	11 (73.3%)	14 (93.3%)	25 (83.3%)
6–12 months	1 (6.7%)	0 (0%)	1 (3.3%)

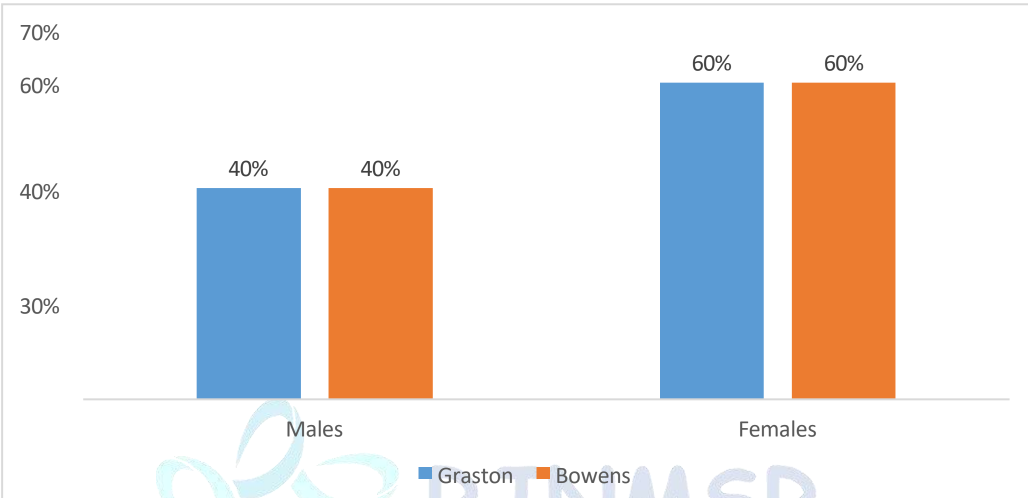


Figure 5:Genderofparticipants

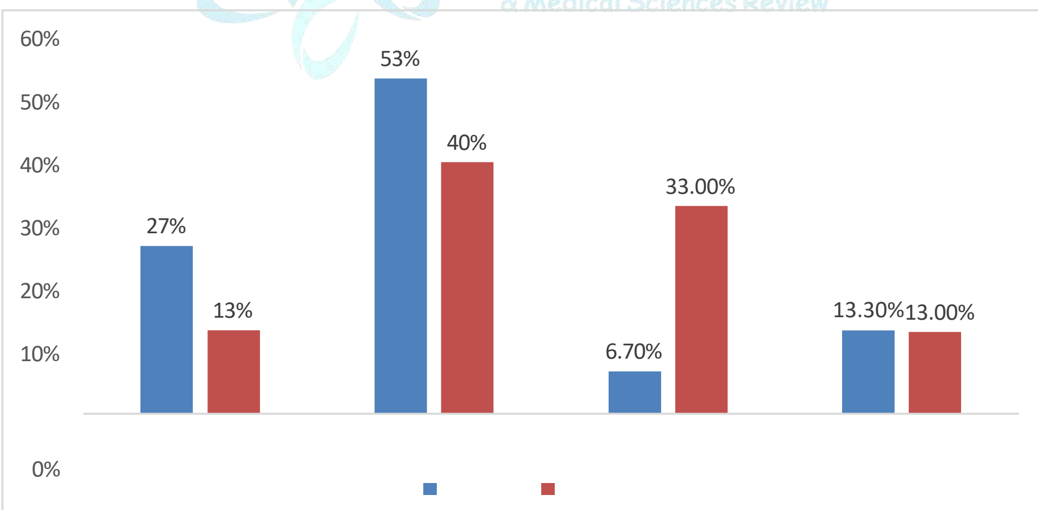


Figure6: Occupation frequency

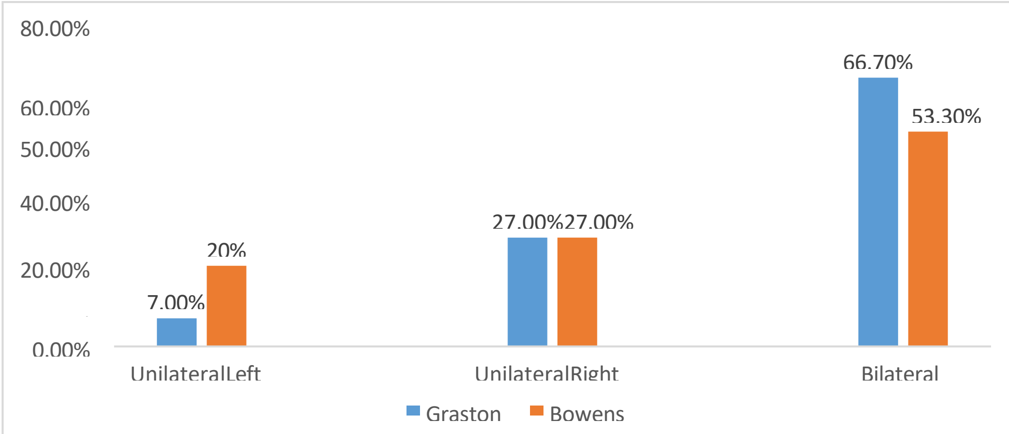


Figure7:Side of neck pain

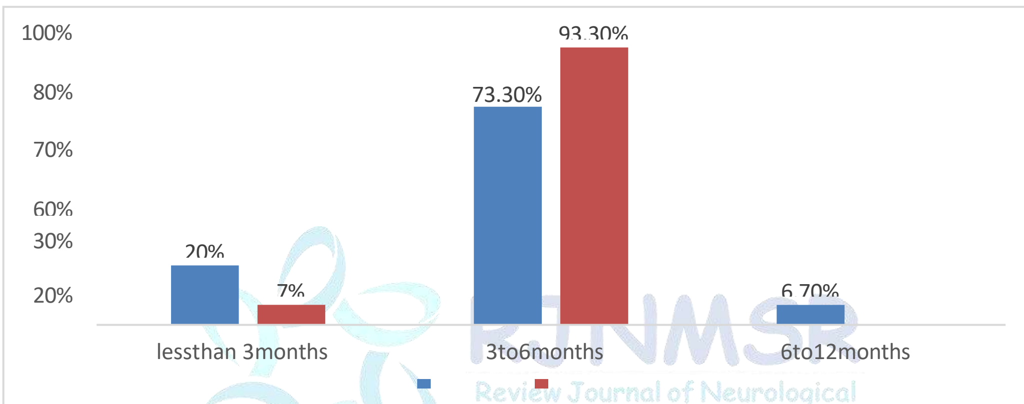


Figure 8:Pain on set

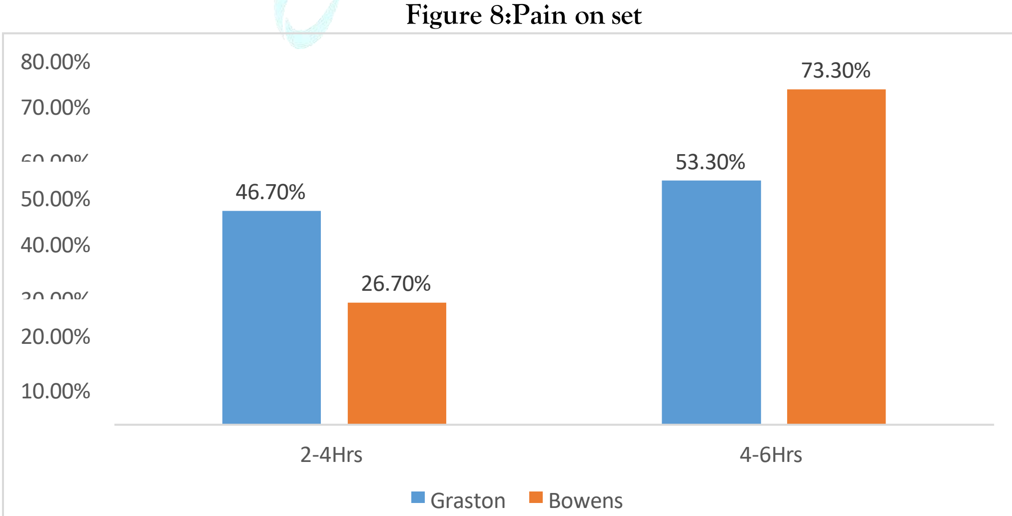


Figure9:Duration of device usage

Between Group Analysis

Two Way Mixed ANOVA Results:

A two-way mixed ANOVA was employed to evaluate time-by-group interaction effects across three assessment points (baseline, post-3 sessions, and post-6 sessions) for all continuous dependent variables. The between-subjects factor consisted of the two independent intervention groups

(Graston and Bowen's). Data screening confirmed the absence of significant outliers, and Box's test indicated that the assumption of homogeneity of covariance matrices was met for all variables. For functional disability (NDI), Mauchly's test indicated a violation of sphericity; therefore, Greenhouse-Geisser corrections were applied. The analysis revealed a statistically significant time-by-group interaction effect, $F(2, 27) = 5.90$, $p = .015$, $\eta p^2 = .174$. In contrast, pain intensity scores (NPRS) did not demonstrate a significant interaction effect, $F(2, 27) = 1.09$, $p = .330$, $\eta p^2 = .037$, despite applying the Greenhouse-Geisser correction for sphericity violation. Regarding cervical range of motion (ROM), significant interaction effects were observed for flexion, $F(2, 27) = 26.78$, $p < .001$, $\eta p^2 = .489$, and extension, $F(2, 27) = 10.23$, $p = .002$, $\eta p^2 = .268$, with Greenhouse-Geisser corrections applied due to sphericity violations. Rotational movements also showed significant interactions for both right, $F(2, 27) = 41.13$, $p < .001$, $\eta p^2 = .753$, and left rotation, $F(2, 27) = 18.02$, $p < .001$, $\eta p^2 = .572$, where sphericity was assumed. However, neither right lateral flexion, $F(2, 27) = 1.00$, $p = .353$, $\eta p^2 = .034$, nor left lateral flexion, $F(2, 27) = 1.76$, $p = .186$, $\eta p^2 = .059$, demonstrated significant between-group differences over time.

As sphericity was assumed for cervical right rotation{F=41.13(2,27),p=.000, ηp2=.753}andleftrotation{F=18.02(2,27),p=.000,ηp2=.572}withasignificanttime interaction effect (p<0.05).

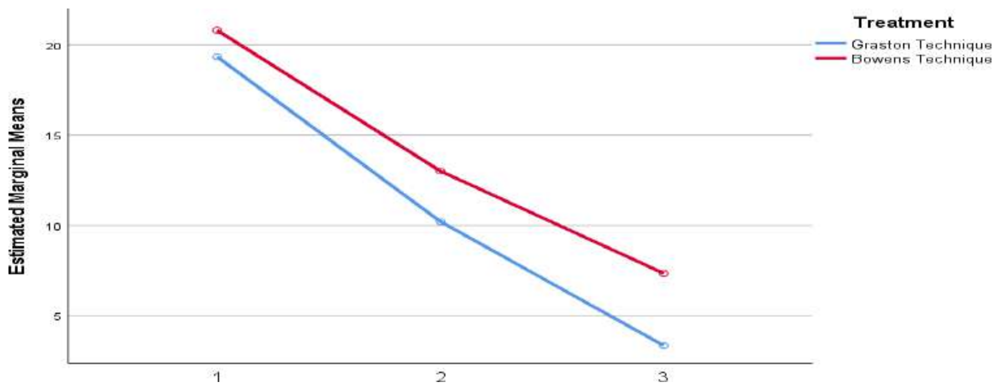


Figure10: Neck disability index (NDI)

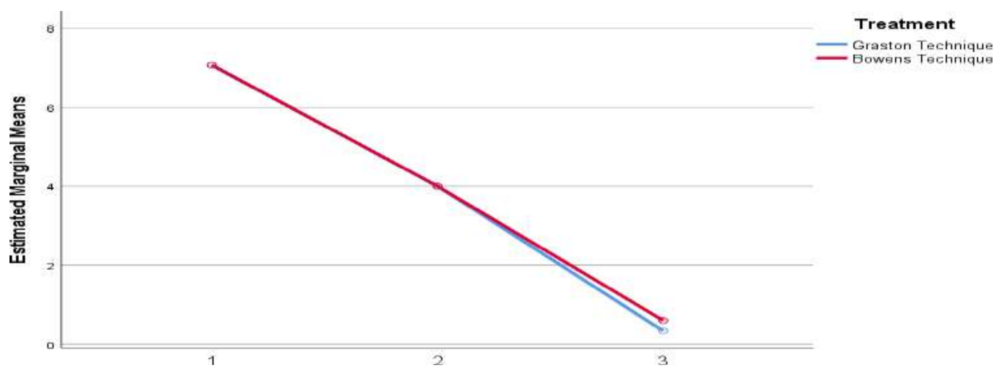


Figure11:Numeric pain rating scale(NPRS)

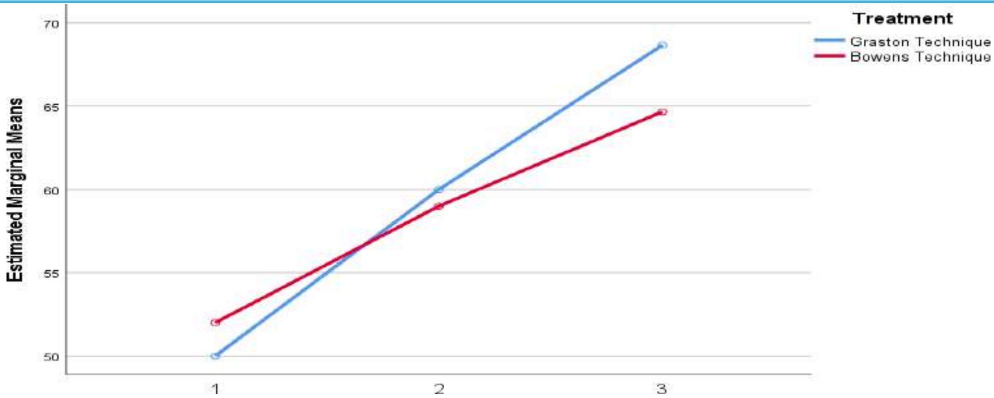


Figure12: Cervical Flexion

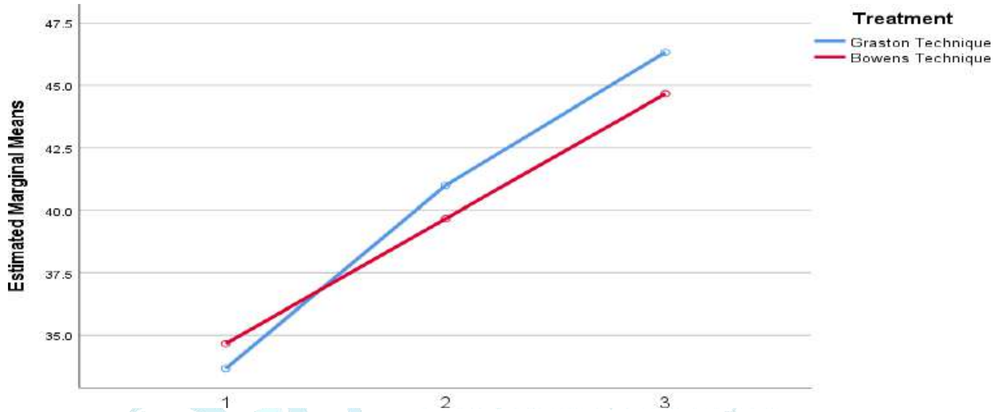


Figure13:Cervical Extension

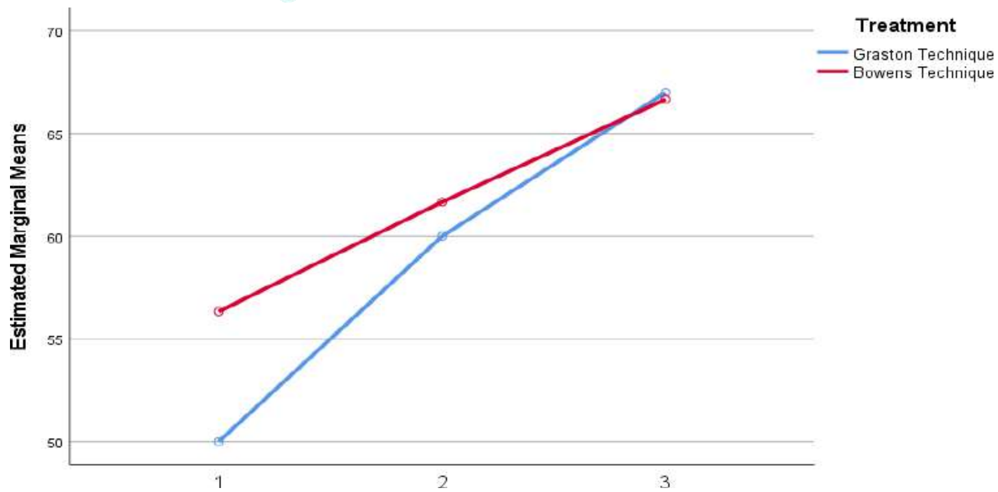


Figure14:Cervical Left Rotation

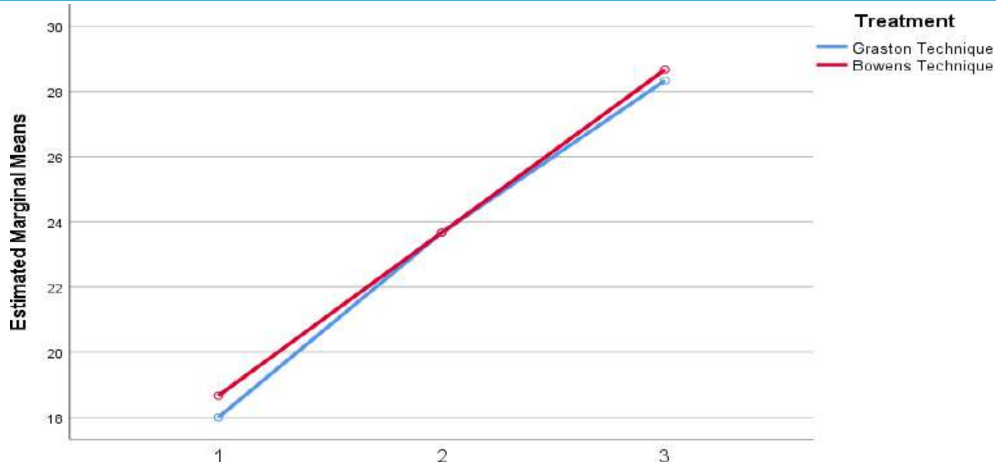


Figure15:Cervical Right Lateral Flexion

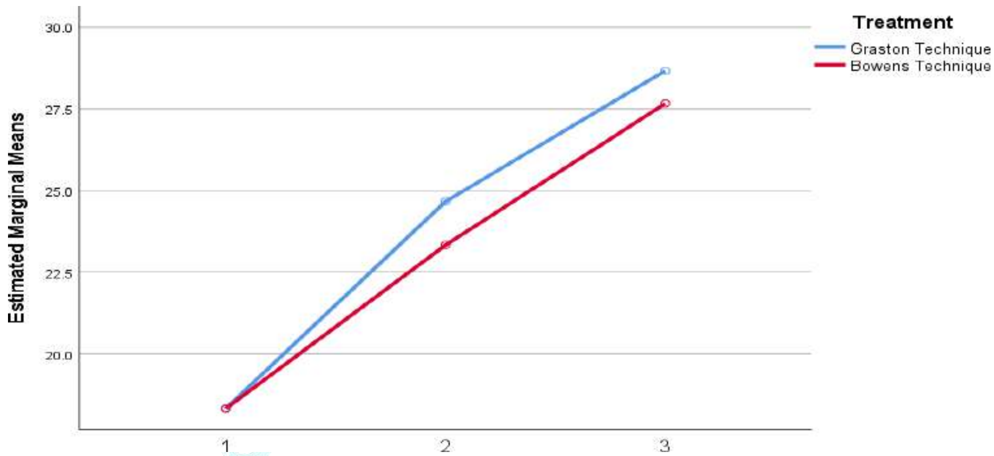


Figure16: Cervical Left Lateral Flexion

Table4: Mixed way ANOVA

Varia ble	GrastonGroup			Bowen'sGroup			F(df)	P value	np 2
	Baseline	Post3rdsession	Post6thsession	Baseline	Post3rdsession	Post6thsession			
NDI Totalscore	19.33±4.20	10.20±2.45	3.33±1.23	20.80±2.62	13.00±2.69	7.33±2.32	5.90(2)	.015	.174
NPRS	7.07±0.79	4.00±0.75	0.33±0.48	7.07±0.79	4.00±0.84	0.60±0.50	1.08(2)	0.33	.037
Cervicalflexion	50.00±4.62	60.00±4.62	68.67±3.51	52.00±3.68	59.00±3.38	64.67±3.51	26.78(2)	0.000***	.489
Cervical extension	33.67±2.28	41.00±3.38	46.33±3.99	34.67±4.41	39.67±4.41	44.67±4.41	10.23(2)	0.002	.268
Cervicalrightrotation	48.33±6.17	57.67±5.62	66.33±4.80	55.67±5.93	61.33±6.67	66.33±6.67	41.13(2)	0.000***	.753
Cervicalleftrotation	50.00±6.54	60.00±4.22	67.00±5.91	56.33±5.49	61.67±5.23	66.67±5.23	18.02(2)	0.000***	.572
CervicalrightL	18.00±3	23.67±3	28.33±3	18.67±4	23.67±4	28.67±4	1.00(2	0.353	.03

F	.16	.51	.61	.80	.80	.80	)		4
CervicalleftLF	18.33±3 .61	24.67±3 .99	28.67±3 .99	18.33±3 .08	23.33±3 .08	27.67±3 .20	1.76(2)	0.186	.05 9

Significancevaluesp<0.05,p<0.01**,p<0.001****

Between Group Analysis

Two Way Mixed ANOVA Results

A two-way mixed ANOVA was conducted to examine time-interaction effects between the Graston and Bowen's technique groups across three assessment points (baseline, post-3 sessions, post-6 sessions) for disability (NDI), pain (NPRS), and cervical range of motion (ROM). Assumptions were verified: no significant outliers were detected, Box's test confirmed homogeneity of covariance matrices, and sphericity was assessed for repeated measures. Where Mauchly's test indicated violation of sphericity, Greenhouse-Geisser corrections were applied. Results revealed a statistically significant time × group interaction effect for functional disability measured by the NDI, $F(2, 27) = 5.90$, $p = .015$, $\eta p^2 = .174$, indicating differential improvement between groups over time. For pain intensity (NPRS), no significant interaction was observed, $F(2, 27) = 1.09$, $p = .330$, $\eta p^2 = .037$, suggesting both interventions produced comparable pain relief trajectories. Regarding cervical ROM, significant interaction effects favoring one intervention over time were found for flexion, $F(2, 27) = 26.78$, $p< .001$, $\eta p^2 = .489$; extension, $F(2, 27) = 10.23$, $p = .002$, $\eta p^2 = .268$; right rotation, $F(2, 27) = 41.13$, $p< .001$, $\eta p^2 = .753$; and left rotation, $F(2, 27) = 18.02$, $p< .001$, $\eta p^2 = .572$. However, lateral flexion movements (right: $p = .353$; left: $p = .186$) did not demonstrate significant between-group differences across time. These findings indicate that while both techniques similarly reduced pain, the Graston technique produced greater improvements in functional disability and most planes of cervical mobility over the intervention period.

Table5:Descriptive analysis (Repeated measures ANOVA)

Variables		GroupA(Graston)				GroupB(Bowens)			
		Mean± SD	F(df)	Pvalue (main effect)	np2	Mean± SD	F(df)	Pvalue (main effect)	np2
NDI	Baselin e	19.33±4.2 0	341.8 (2)	0.000***	.96 1	20.80±2.6 2	546.1(2)	0.000***	.975
	Post 3rd session	10.20±2.4 5				13.00±2.6 9			
	Post 6th session	3.33±1.23				7.33±2.32			
NPRS	Baselin e	7.07±0.79	832.5 (2)	0.000***	.98 3	7.07±0.79	1284.1 (2)	0.000***	.989
	Post 3rd session	4.00±0.75				4.00±0.84			
	Post6thsession	0.33±0.48				0.60±0.50			
Cervical Flexion	Baselin e	50.00±4.6 2	749.6 (2)	0.000***	.98 2	52.00±3.6 8	183.3(2)	0.000***	.929
	Post 3rd session	60.00±4.6 2				59.00±3.3 8			

	Post 6th session	68.67±3.51				64.67±3.51			
Cervical Extension	Baseline	33.67±2.28	196.0 (2)	0.000***	.933	34.67±4.41	256.5(2)	0.000***	.975
	Post 3rd session	41.00±3.38				39.67±4.41			
	Post 6th session	46.33±3.99				44.67±4.41			
Cervical Right Rotation	Baseline	48.33±6.17	383.5 (2)	0.000***	.983	55.67±5.93	414.07 (2)	0.000***	.967
	Post 3rd session	57.67±5.62				61.33±6.67			
	Post 6th session	66.33±4.80				66.33±6.67			
Cervical Left Rotation	Baseline	50.00±6.54	118.9 (2)	0.000***	.948	56.33±5.49	721.0(2)	0.000***	.981
	Post3rd session	60.00±4.22				61.67±5.23			
	Post 6th session	67.00±5.91				66.67±5.23			
Cervical RightLF	Baseline	18.00±3.16	241.0 (2)	0.000***	.945	18.67±4.80	544.08 (2)	0.000***	.975
	Post 3rd session	23.67±3.51				23.67±4.80			
	Post 6th session	28.33±3.61				28.67±4.80			
Cervical LeftLF	Baseline	18.33±3.61	161.9 (2)	0.000***	.961	18.33±3.08	317.1(2)	0.000***	.958
	Post 3rd session	24.67±3.99				23.33±3.08			
	Post 6th session	28.67±3.99				27.67±3.20			

Repeated-measures ANOVA with pairwise comparisons was conducted to evaluate within-group improvements across assessment points (baseline, post-3 sessions, post-6 sessions). For pain intensity (NPRS), Mauchly's test indicated violation of sphericity; therefore, Greenhouse-Geisser corrections were applied. Both the Graston group, $F(2, 13) = 832.5$, $p < .001$, $\eta p^2 = .983$, and Bowen's group, $F(2, 13) = 1284.1$, $p < .001$, $\eta p^2 = .989$, demonstrated statistically significant reductions in pain at each assessment interval, with large effect sizes indicating substantial clinical improvement.

Regarding cervical range of motion, within-group analyses revealed significant improvements across all movement planes for both interventions ($p < .001$, large effect sizes). In the Graston group, sphericity was assumed for right rotation, left rotation, and left lateral flexion, while Greenhouse-Geisser corrections were applied to flexion, extension, and right lateral flexion due to sphericity violations. In the Bowen's group, sphericity was assumed only for extension; corrections were applied to all other movements. Although both techniques produced significant week-wise gains in mobility, the Graston group exhibited greater mean improvements in cervical flexion, extension, and rotational movements compared to Bowen's technique, as detailed in Table 6.

Table6:Posthoc analysis(Repeated measures ANOVA)

Variables		GroupA(Graston)		GroupB(Bowens)	
		Mean Difference	P-value (pairwise)	Mean Difference	P-value (pairwise)
NDI	Baselineto Post 3rd session	9.133	0.000***	7.80	0.000***
	Baselinetopost 6th session	16.00	0.000***	13.4	0.000***
	Post 3rd toPost 6th session	6.86	0.000***	5.67	0.000***
NPRS	Baselineto post 3rd session	3.06	0.000***	3.06	0.000***
	Baselineto Post 6th session	6.73	0.000***	6.46	0.000***
	Post3rd session to Post 6th session	3.66	0.000***	3.40	0.000***
Cervical Flexion	Baselineto Post 3rd session	10.0	0.000***	7.00	0.000***
	Baselineto Post 6th session	18.6	0.000***	12.6	0.000***
	Post3rd session to Post 6th session	8.66	0.000***	5.66	0.000***
Cervical Extensio n	Baselineto Post 3rd session	7.33	0.000***	5.46	0.000***
	BaselinetoPost 6th session	12.6	0.000***	10.8	0.000***
	Post 3rd toPost 6th session	5.33	0.000***	5.33	0.000***
Cervical Right Rotation	Baselineto Post 3rd session	9.33	0.000***	5.66	0.000***
	Baselineto Post 6th session	18.0	0.000***	10.66	0.000***
	Post 3rd toPost 6th session	8.66	0.000***	5.00	0.000***
Cervical Left Rotation	Baselineto Post 3rd session	10.0	0.000***	5.33	0.000***
	Baselineto Post 6th session	17.0	0.000***	10.3	0.000***
	Post 3rd toPost 6th session	7.0	0.000***	5.0	0.000***
Cervical RightLF	BaselinetoPost 3rd session	5.66	0.000***	5.46	0.000***
	Baselineto Post 6th session	10.3	0.000***	10.4	0.000***

	Post 3rd to Post 6th session	4.6	0.000***	5.0	0.000***
Cervical LeftLF	Baseline to Post 3rd session	6.33	0.000***	5.0	0.000***
	Baseline to Post 6th session	10.33	0.000***	9.33	0.000***
	Post 3rd to Post 6th session	4.0	0.000***	4.33	0.000***

Significance values p<0.05,p<0.01**,p<0.001****

Conclusion:

This study examined the effectiveness of Graston and Bowen's techniques for improving cervical range of motion (ROM), pain, and disability in patients with Tension Neck Syndrome (TNS). The results indicated significant improvements in all outcome measures for both groups; however, between-group analysis revealed that the Graston technique yielded superior outcomes in cervical flexion, extension, rotation, left lateral flexion, and Neck Disability Index (NDI) scores compared to Bowen's technique. No significant differences were observed between the groups regarding pain scores on the Numeric Pain Rating Scale (NPRS) or right lateral flexion. These findings suggest that while both soft tissue interventions are beneficial, the Graston technique may offer enhanced benefits for functional mobility and disability reduction in patients with Visual Display Terminal Syndrome (VDTS)-induced TNS.

The efficacy of Bowen's technique observed in this study aligns with existing literature supporting its role in myofascial pain management. Seemal et al. (2022) reported significant improvements in pain, disability, and ROM when combining Bowen's therapy with muscle energy techniques for text neck syndrome, though the current study found no significant interaction for pain between groups. Similarly, Ying et al. (2023) and Nitsure and Kothari (2015) documented enhanced cervical ranges and reduced dysfunction following Bowen's intervention, attributing success to increased blood flow and holistic fascial release. Furthermore, Aslam et al. (2023) found Bowen's technique equally effective as conventional therapy for postural neck pain in dentists, supporting the current findings regarding pain reduction, potentially due to the interruption of pain receptors through sensory stimulation.

Conversely, the Graston technique demonstrated marked improvements in ROM and disability, corroborating previous research on Instrument-Assisted Soft Tissue Mobilization (IASTM). Mahgoub et al. (2022) found Graston technique superior to soft tissue release for pain, ROM, and functional impairment, mirroring the significant time interaction effects observed in the current study's Graston group. Harris (2020) and Haq and Riaz (2022) also reported enhanced hemodynamics and ROM following Graston application, suggesting that breaking muscular adhesions facilitates nutrient delivery and muscle relaxation. Additionally, Doeringer et al. (2022) noted significant differences in pain and ROM with IASTM, supporting the mechanism of inducing microtrauma to stimulate the healing cascade, fibroblast proliferation, and collagen synthesis.

Regarding pain outcomes, the lack of significant between-group differences in NPRS scores aligns with studies suggesting comparable hypoalgesic effects of soft tissue techniques. Shewail et al. (2023) reported insignificant differences in pain and function with IASTM, similar to the current study's findings on pain equivalence between groups. El-Hafez et al. (n.d.) also found IASTM effective for pain reduction despite statistical nuances. Both techniques likely operate through vasodilation mechanisms; Graston technique promotes blood flow by breaking adhesions, while Bowen's technique encourages lymphatic flow and tissue repair through gentle pressure. Consequently, while Graston technique excels in mechanical improvements, both modalities effectively mitigate pain perception in TNS patients.

Despite these positive outcomes, several limitations must be acknowledged. The study employed a single-blinded design, which may introduce confounding variables regarding participant expectations or therapist bias. Additionally, the research was conducted in a single clinical setting, which may limit the generalizability of the findings to broader populations or different healthcare environments. The sample size was relatively small, and the follow-up period was limited to the immediate post-intervention phase, restricting insights into the long-term sustainability of the treatment effects.

In conclusion, both Bowen's and Graston techniques significantly improve disability and cervical ROM in patients with Tension Neck Syndrome, with both being equally effective for pain reduction. However, the Graston technique demonstrates marked superiority in enhancing cervical range of motion and reducing functional impairment. Future research should incorporate long-term follow-ups to assess sustained effects and utilize objective measures like electromyography (EMG) to identify microscopic physiological changes. Furthermore, subsequent studies should investigate additional factors influencing TNS, such as ocular strain, headache frequency, and psychological stress, to develop comprehensive management strategies.

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