The effect of cervical spine manual therapy on normal mouth opening in asymptomatic subjects

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Abstract

Objective: Temporomandibular disorders are a group of disorders affecting the temporomandibular joint and/or masticatory muscles. One of the signs associated with temporomandibular disorders is a reduction in mouth opening. During normal mouth opening, extension occurs at the cervical-cranial junction. The purpose of this investigation was to determine if manual therapy applied to the cervical-cranial junction would significantly improve mouth-opening capacity.

Methods: One hundred one participants were randomly assigned to either an Active Release Technique (ART) group; high-velocity, low-amplitude manipulation (HVLA) group; or control group. A blinded investigator measured mouth opening using a TheraBite range of motion scale (TheraBite Corporation, West Chester, PA). Participants received ART to the suboccipitals or HVLA to the cervical spine at C1 or sat with an investigator for 3 minutes with no treatment. After the treatment session, mouth opening was remeasured. A repeated-measures analysis of variance was used to compare the group mean values. The a priori α level was .05.

Results: The repeated-measures analysis of variance showed no significant difference between the ART, HVLA, and control groups' pretreatment and posttreatment measurements ($F = 0.41$, $P > .05$).

Conclusion: Manual therapy to the cervical spine did not significantly improve mouth opening in this asymptomatic population. Future trials using participants with restricted mouth-opening measures are warranted.

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Introduction

Temporomandibular disorders (TMD) are a group of disorders affecting the masticatory muscles and/or

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temporomandibular joint (TMJ).^{1,2} The prevalence of TMD in the general population has been reported at 25%, with signs including muscle tenderness, joint tenderness, popping or clicking, and limitation of jaw movement.^{2,3} The 3 main categories of TMD are myofascial, internal derangement, and degenerative.⁴ The myofascial category is the most prevalent and involves pain in the masticatory muscles, neck, and shoulders.

One of the signs often associated with TMD is a reduction in mouth-opening capacity.⁵ The reference range of mouth opening reported in the literature ranges from 41 to 50.7 mm, although Cox and Walker reported a reference range of 38.7 to 67 mm during their work screening for submucous fibrosis.⁶⁻⁸ Mouth-opening measurements are generally greater in men, in tall patients, and in young patients.⁹ A mouth-opening measurement less than 40 mm is considered restricted.⁷ During normal mouth opening, extension occurs at the cervical-cranial junction; and restriction in the upper cervical spine may decrease a patient's mouth-opening capacity.¹⁰ De Laat et al¹¹ found that segmental limitations in the upper cervical spine (C0-C3) were significantly more present in patients with TMD than controls.

The most common treatments for improving mouth opening include posture retraining, exercise, occlusal splint therapy, electrophysical modalities, and acupuncture.¹² A qualitative systematic review by McNeely et al found that oral opening improvements may result from muscular awareness relaxation therapy, biofeedback, and low-level laser; however, they concluded that most studies in this area have poor methodological quality.¹² There are no reports in the current literature on treatments applied to the upper cervical spine for improving mouth-opening measurements.

The purpose of this investigation was to determine if cervical-cranial joint manipulation and cervical-cranial soft tissue manipulation would significantly improve mouth-opening measurements in an asymptomatic population. Our hypothesis was that both treatments would improve mouth opening significantly greater than the control group.

Methods

Participants

Participants were recruited from university solicitation and volunteered to participate in the study without remuneration. The inclusion criteria included being 18 years or older with ability to read and understand the

informed consent form. Exclusion criteria were previous jaw and/or neck surgery; previous or current TMJ or cervical pain; and any contraindications for cervical high-velocity, low-amplitude (HVLA) manipulation including acute fracture, vascular insufficiency, or cervical spine instability. One hundred one individuals (mean age, 24.6 ± 2.6 years; 64 women and 37 men) met the inclusion and exclusion criteria and signed the informed consent form to participate. The participants were randomly assigned to one of 3 groups: Active Release Technique (ART) ($n = 34$), HVLA ($n = 34$), or control ($n = 33$). The Institutional Review Board of Logan College of Chiropractic approved this study.

Measurement

Mouth opening was measured using a TheraBite range of motion scale. Each participant's mouth opening was measured before and immediately after the designated treatment. The participants were positioned supine on a flat therapy table in an examination room. The investigator performing the measurement was blinded to the participant's treatment allocation. The investigator instructed the participants to slowly and comfortably open their mouths as wide as possible. The investigator used a TheraBite range of motion scale to measure mouth opening in millimeters (Fig 1). Three measurements were taken, and the average score was recorded.

Treatment protocol

The ART group was treated by a physician with 2 years of clinical experience. Active Release Technique is a soft tissue technique developed by Dr Michael Leahy and is widely used in rehabilitative and sports medicine for myofascial pain syndromes.¹³ Participants were positioned supine while the investigator palpated the suboccipital muscles. The investigator determined which side (right or left) of the suboccipitals held more tension and proceeded to treat that side. Three passes of ART therapy were applied to the suboccipitals. An ART treatment pass involves taking the tissue from a shortened position to a lengthened position while maintaining a manual contact.¹³ The investigator applying the ART treatment was blinded to the participants' mouth-opening measurements.

The HVLA group was treated by a physician with 4 years of clinical experience. Participants were positioned supine while the investigator palpated the upper cervical spine. The investigator determined which side (right or left) had greater fixation and delivered an HVLA thrust manipulation to the fixated side. The

Fig 1. Measurement of mouth opening using a range of motion ruler.

manipulation involved laterally bending the head toward and rotating away from the side of fixation. The thrust was applied from posterior to anterior at the level of C1. A cavitation was not required, and only one thrust was used on each participant. The investigator applying the HVLA manipulation was blinded to the participants' mouth-opening measurements.

The control group entered the examination room and sat with the investigator for 3 minutes and received no treatment. This gave the participants the same amount of time with the investigator as the experimental groups. In addition, it ensured the measuring investigator was blinded to the participants in the control group.

Statistical analysis

A repeated-measures analysis of variance was used to compare the group mean values. The a priori α level was set at .05.

Results

The repeated-measures analysis of variance showed no significant difference between the control, ART, and

Table 1 Mean Values and SDs for the Pretreatment and Posttreatment Mouth-Opening Measurements (in Millimeters) for the Control, ART, and HVLA Groups

	n	Pretreatment Mean (SD) (mm)	Posttreatment Mean (SD) (mm)
Control	33	48.6 (6.0)	47.9 (6.3)
ART	34	49.1 (8.4)	49.2 (8.1)
HVLA	34	49.5 (7.5)	49.6 (7.5)

HVLA groups' pretreatment and posttreatment measurements ($F = 0.41$, $P > .05$). The mean values and SDs for the pretreatment and posttreatment measurements are listed in Table 1.

There were 8 participants with mouth-opening measurements <40 mm before treatment (2 control, 3 ART, 3 HVLA). Pre- and posttreatment measurements for these cases are listed in Table 2. The 2 control participants' mean improvement was 0.25 ± 0.36 mm, the 3 ART participants' mean improvement was 2.63 ± 1.76 mm, and the 3 HVLA participants' mean improvement was 5.4 ± 1.80 mm.

Discussion

There were no significant improvements in mouth-opening measurements in our population after treatment to the upper cervical spine when comparing group mean values. There are several possible explanations for this lack of improvement. The current population was asymptomatic and had mean mouth-opening measurements within the reference range. Thus, their ability to demonstrate improvement may be limited. There were 8 participants who had initial mouth-opening measurements below the reference range. The participants in the HVLA group seemed to have greater improvements in mouth opening compared with those in the control and ART groups; however, there were not enough cases to draw conclusions on cause and effect.

Table 2 Pretreatment and Posttreatment Mouth-Opening Measurements for Participants With an Initial Range of Motion of <40 mm

Control		ART		HVLA	
Pre	Post	Pre	Post	Pre	Post
38.6	38.5	39.6	40.6	36.5	43.4
38.9	39.4	37.3	41.8	39.5	42.9
		36.8	39.2	38.7	44.6

The participants in the current study received only one treatment application between measurements. Several sessions of manual therapy may be necessary for improvements to occur. In addition, treatments to the upper cervical spine may not alter extension at the cervical-cranial junction sufficiently to significantly alter mouth-opening capacity. Other methods of treatment or possibly combining methods of treatment may be necessary or more appropriate to improve this measure. Finally, without measuring cervical spine extension before and after the treatments, we are unable to determine whether the manual therapy applied altered extension in the upper cervical spine.

Previous studies have demonstrated improvements in mouth-opening measurements with various treatment approaches. Nunez et al¹ compared low-level laser therapy and transcutaneous electrical neural stimulation and found significant improvements in mouth opening with both interventions. Their study included 10 participants with a large age range, 18 to 56 years, with several forms of TMD; thus, their results are tentative. Komiyama et al¹⁴ found significant improvements in mouth opening after 1 month of posture training when compared with a cognitive intervention or control. Posture exercises are theorized to improve the alignment of the craniomandibular system and allow for greater opening.¹⁵ Carmeli et al¹⁶ used passive manual range of motion techniques to significantly improve oral opening; however, their population was limited to patients with anterior displaced temporomandibular disks.

Limitations to the results of the current study included the method of assessment and treatment technique. The treating investigators used their clinical experience to determine the side of greatest tension or restriction. Errors in their assessment could have occurred and lead to treatment to the incorrect side. Furthermore, in a clinical setting, tension or restriction is sometimes found bilaterally; and the investigators were limited to a unilateral treatment application. The method of treatment technique was a study limitation. There are a myriad treatment techniques that are used for improving cervical spine restrictions, and only 2 were used in the current study. Our study was focused on asymptomatic subjects; thus, findings may have been different with a symptomatic population.

As stated previously, opening and closing of the jaw have been demonstrated to be initiated by extension of the head.¹⁰ In addition, in symptomatic patients with whiplash, head extension was absent in opening and closing of the participants' jaw.¹⁷ Our results support

these findings of differentiation of symptomatic and asymptomatic populations and suggests that no significant change in jaw opening reflects the absence of alterations often seen in symptomatic populations. This study provides a normative data set to compare with symptomatic subjects with TMJ-related problems.

Conclusion

Manual therapy applied to the upper cervical spine did not significantly improve mouth-opening measurements in our asymptomatic population. Future trials using these and possibly other manual therapy techniques on populations with measured mouth-opening restrictions are needed to determine if manual interventions for the cervical spine are a viable intervention for improving mouth opening.

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