



Clinical Case Report Competition

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Second Place Winner

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Therapeutic and intra-oral massage for treatment of post unilateral sagittal split osteotomy temporomandibular joint dysfunction: a case study

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Abstract

Purpose: The objective of this case study was to evaluate the effectiveness of therapeutic massage and intra-oral massage for treatment of post unilateral sagittal split osteotomy (USSO) temporomandibular joint dysfunction.

Participant: A 20-year-old woman who received USSO eighteen months prior to the case study, whose symptoms included numbness around the mouth, pain, decreased pain free range of motion, and clicking at the temporomandibular joints in addition to mandibular misalignment.

Intervention: Six 90-minute massage therapy treatments which included five 20-minute intra-oral massage treatments were administered over an eight-week period. The client's progress was monitored by an initial assessment, five post-treatment re-assessments and a final assessment, using range of motion testing, personal interview, various orthopedic tests, and postural analysis. A daily journal was designed and provided to the client in order to monitor her stress and general food intake. The client participated in a home care routine consisting of stretches, self-massage, postural training and hydrotherapy.

Results: Results included an increase in pain-free mouth opening from 1 cm to 1.2 cm, an increase in maximal opening from 2.3 cm to 2.9 cm, and a decrease in

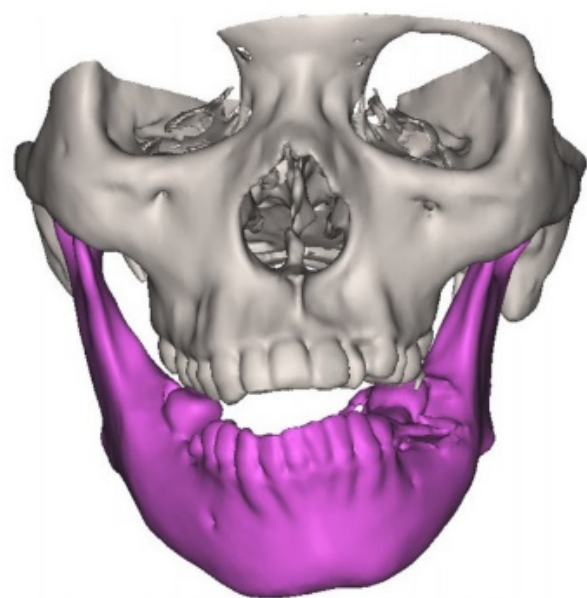
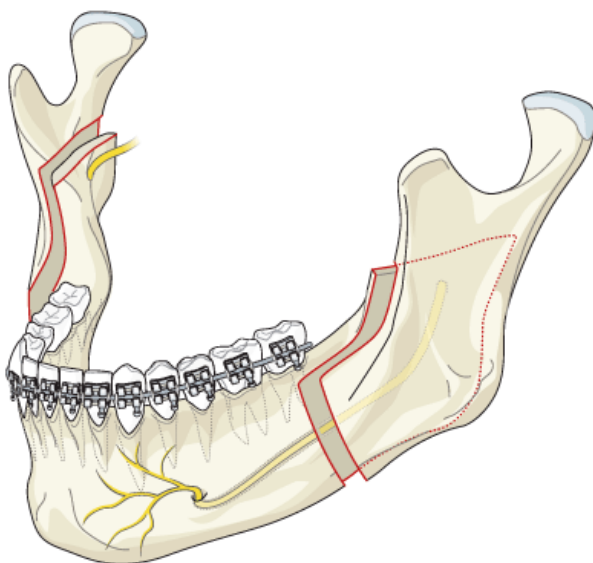
frequency of pain onset and jaw clenching from very often to only when aggravated by activities. Mandibular misalignment was unchanged.

Conclusion: Despite the positive results found in this case study, more extensive studies are needed to further understand effects of therapeutic massage and intra-oral massage on post unilateral sagittal split osteotomy temporomandibular joint dysfunction.

Introduction

Unilateral Sagittal Split Osteotomy (USSO)

USSO is one of the most common surgeries for treating mandibular prognathism – overgrown or protracted mandible – and laterognathism – cross bite [See Figure 2] (Chang, Tseng, & Chang, 2006)¹. USSO removes a small segment of the mandible on one side of the mandibular ramus on the sagittal plane, and then the mandible can be moved forward or set back to achieve a facial symmetry. Removing a segment of mandible bone on each side of the mandibular ramus is known as Bilateral Sagittal Split Osteotomy (BSSO). The biggest advantage of USSO is a fifty per cent reduction of the possible surgical complications such as neurosensory disturbances commonly caused by BSSO (Wohlwender, Daake, Weingart, Brandstätter, Kessler, & Lethaus, 2011)². [See Figure 1]



Temporomandibular Joint Dysfunction (TMD)

TMD is a disorder of the mastication muscles, the temporomandibular joint (TMJ) and the surrounding structures. TMD is the second most common cause of orofacial pain, affecting 10 to 12% of the general population (Sarhani, Balciunas, & Grace, 2005)³. There are two TMJs in a human being, located approximately 1 to 2 cm anterior to the left and right external auditory meatus (EAM). They can be readily palpated by placing the pad of 3rd and 4th fingers just anterior to the EAMs, while opening and closing the mouth. The TMJ is a synovial joint that consists of the mandibular condyle, articular surface of temporal bone and a biconcave-shaped hypo-vascular articular disc that allows the mandibular condyle to position itself in the articular surface of the temporal bone. The joint is stabilized by the temporomandibular ligament, the stylomandibular ligament, and the oto-mandibular ligaments. Posteriorly, the articular disc attaches to a highly vascularized and highly innervated connective tissue known as retrodiscal tissue, which is often a contributor to the pain of TMD (Loughner, Larkin, & Mahan, 1989)⁴. Anteriorly, the articular disc attaches to the superior fiber of the lateral pterygoid muscle whose primary function is to bring the mandibular condyle anteriorly out from the mandibular fossa in order to open the mouth.

TMD is dominantly diagnosed in people between fifteen to forty-five years old and is more common in women by a ratio of 5:1 (Rattray, Ludwig, & Beglin, 2002)⁵. Its symptoms include one or more of the following: TMJ clicking or popping sounds occurring during jaw movement; TMJ pain during jaw movement; headaches on frontal or temporal aspects of the head; spasm in the mastication muscles; a decrease in TMJ range of motion; hearing impair (Rattray, et al. 2002).

Factors contributing to TMD are predisposition, tissue alteration, and stress (Gelb, 1985)⁶. Predisposition can be genetic mal-development of muscles, ligaments and bones, or external trauma to the face, the neck or the mandible (Rattray, et al. 2002). Displacement of the articular disc is another factor that leads to TMD. The mandibular condyle rests on a thicker portion of the articular disc instead of the thinner middle portion which displaced the articular disc, which causes the condyle to inevitably ride over the thicker portion of the disc and creates a popping sound and pain during the initial jaw movement (Rattray, et al. 2002). According to Magee (2013)⁷, the clicking sound may be caused by uncoordinated lateral pterygoid muscle contraction. The superior head of the lateral pterygoid muscle pulls the articular disc forward in a healthy TMJ; however, if the disc does not move forward first, a clicking sound is created

when the condyle is pulled forward by the inferior head of the lateral pterygoid muscle and rides over the disc (Magee, 2013).

Surgical approach to TMD includes disc repositioning via arthroscopy, discectomy and total joint replacement; however, osteoarthritis development is a common complication of discectomy (Souza, 1997)⁸. Non-surgical approaches include dental splints, physical therapy and medications such as non-steroidal anti-inflammatory drugs (NSAIDs) and muscle relaxants (Rattray, et al. 2002).

Research

USSO and TMD

The etiology of TMD is complex, and the causes of the symptoms can be traced back to a combination of factors including anxiety, stress and depression, trauma involving local tissues, spasms of the muscles of mastication, chronic malocclusion, repetitive chronic bruxism, un-accustomed jaw use, occlusal disharmony, referred pain from neck and shoulder muscles, as well as sacral dysfunction (Eisensmith, 2007)⁹. Another possible factor is post-maxillofacial surgery complications. Currently, vast amounts of research have been conducted to ensure such surgical procedures are safe and not the major causes for TMD. Min, Lai, & Xin (2008)¹⁰ conducted research to explore the changes in the masseter muscle after curved osteotomy of the prominent mandibular angle.

Results showed that there is no significant difference between the preoperative and postoperative thicknesses of the masseter muscle (Min, L., Lai, G., & Xin, L., 2008). Egermark, Blomqvist, Cromvik, & Isaksson (2000)¹¹ conducted research regarding “TMD in patients treated with orthodontics in combination with orthognathic surgery”, and the results showed that the surgical treatment not only had a beneficial effect on the aesthetic appearance and chewing ability, but also resulted in an improvement in signs and symptoms of TMD, including headaches.

Nonetheless, the research conducted by Wohlwender, Daake, Weingart, Brandstätter, Kessler, & Lethaus (2011), showed that specific surgical procedure such as USSO may be a cause of TMD. As a result of USSO, an inevitable rotational movement of the condyle [See Figure 3] would automatically change its position in the glenoid fossa, its relationship to the disk and its translational movement; hence, the functional aspects of the TMJ could be directly influenced (Wohlwender, Daake, Weingart, Brandstätter, Kessler, & Lethaus, 2011).

Although no clinically significant results were shown in this research, questions regarding post-USSO complications arose.

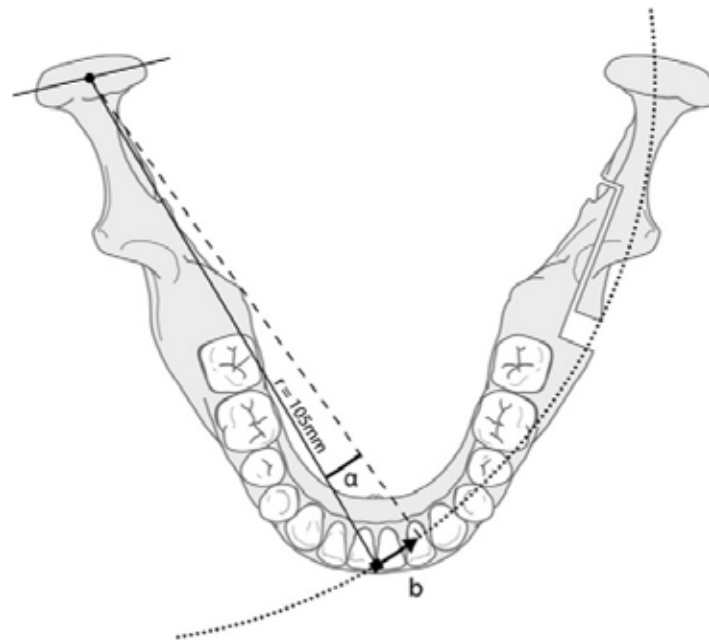


Figure 4 Rotational condyle movement in USSO

Introduction to Case Study

Case Study Objective

The lack of research supporting therapeutic massage and intra-oral massage for post-orthognathic surgery TMD, calls for further exploration of the effectiveness of TM and IOM techniques on TMD and its symptoms. The objective of this case study is to monitor the changes in TMD symptoms and pain-free mouth opening in a client following six massage therapy treatments and remedial home care exercises.

Participants – Profile of Client

The case study involved a 20-year-old, female student with TMD that began eight months post USSO, and ten months prior to the therapeutic massage treatment series. Laterognathism and skeletal class III malocclusion – a type of malocclusion caused by overgrown mandible – idiopathically developed at the age of eleven. From a frontal view, the client presented with a deviated mandible to the right side as her left mandible was larger than her right. She sought help from orthodontics treatments and had orthodontic braces for three years, and eventually was advised to receive orthognathic surgery to improve the mandibular misalignment by her orthodontist. USSO was operated at her left mandible, and the misalignment was corrected. Six months after the operation, her mandible gradually began to deviate to the left side when at rest and elicited a dull and achy pain on her left TMJ, with a clicking sound during mouth opening, tension headaches, migraines, numbness around the mouth and awake bruxism – unconscious teeth clenching while awake. She was then diagnosed with TMD by her medical doctor. She consciously contracted mastication muscles in order to retain a normal alignment of her mandible as she was self-conscious of her appearance.

Her activities of daily living included going to school eight hours a day, five days a week, studying for two to three hours with her books and computer each evening, and occasionally working in a spa as a receptionist four to six hours a day. Despite being right-side dominant, she tended to lean her head and body toward the left side during writing. She avoided some diet choices that required an excessive mouth movement or mastication strength, such as chewing gum, eating hard food, and eating large amounts of food, which increased the client's TMD symptoms. Talking also caused pain; however she was not able to refrain from talking due to her talkative personality. She took Tylenol to manage her TMJ pain and headaches when they were unbearable. She also indicated that her pain increased along with her stress and vice versa. The client's long term goal for this massage therapy series was to restore her mandibular alignment, with short-term goals which included a decrease in pain on her left TMJ, stress, and frequency of tension headaches, migraines and awake bruxism.

Intervention

Treatment Plan

The massage therapy series consisted of an initial assessment followed by six 90-minute massage therapy treatments which included five 20-minute intra-oral massage treatments over an eight-week period. The client's progress was

monitored by an initial assessment, five post-treatment re-assessments and a final assessment. The initial treatment was two days prior to the second treatment, and the rest of the treatments were scheduled to occur once a week, altered once due to the client's holiday for a week during the case study.

Massage Intervention

The massage therapy intervention carried out fairly consistently, with minor changes being made during every section according to the client's condition. The massage therapy sections were performed in a dimly lit room with relaxation music playing in a fairly low but audible volume. She was positioned supine on a massage table with a pillow placed under her knees, and was draped with linens and a blanket up to approximately 2 to 3 cm below her clavicles to keep her body in a comfortable temperature throughout the treatments. [See table 1]

The treatment began with general compression throughout the body to introduce the sense of touch, followed by myofascial release performed to the superficial fascia of the anterior neck, the posterior neck and upper back to reduce cervical fascial tension. No massage lotion was used in this part of the treatment in order to retain appropriate friction with client's skin and fascia. After this, effleurage was used with the 2nd and 3rd fingers in a circular motion

over the masseter muscles to encourage relaxation of the muscles before intra-oral massage.

In the intra-oral portion of the treatment, which was not introduced until the 2nd treatment, one gloved finger was inserted to the buccal cavity of the right side just inferior to the zygomatic arch, with the pad of the finger facing towards the cheek (Delany, 1997)¹². The client was then asked to clench the teeth for the therapist to confirm the location of the masseter muscle. After locating the masseter muscle, a static compression was applied with a pincer grip for ten seconds, using the thumb and 2nd finger of the same hand. The compression was re-applied three times at finger-width intervals along the entire length of the masseter (Delany, 1997). Placing the fingers between the upper last molars and the cheek while applying static superior and posterior pressure, the lateral pterygoid muscle was compressed for ten seconds (Pierson, 2011)¹³. The medial pterygoid muscle was reached and compressed statically for ten seconds by placing the finger medial to the teeth, sliding posteriorly between the upper and lower molars. The above technique was subsequently performed once again on the mentioned mastication muscles respectively while the client slowly clenched and relaxed her teeth ten times during the static compression, with an exception on medial pterygoid muscle in which the client slowly deviated her mandible to

the left and the right ten times each. A thirty second break was given to the client before moving onto the each next muscle. The above procedures were re-conducted in the client's left buccal cavity with cautions due to the hypersensitivity to pain, and the pressure of the compressions were reduced.

TMJ mobilization and proprioceptive neuromuscular facilitation (PNF) stretching were introduced in the third treatment to assist in realigning client's deviated mandible. These specific techniques were respectively the joint distraction of TMJ, whose goal was to decrease pain and increase overall ROM of TMJ, and the Contract-relax stretching for the mastication muscles, whose objective was to increase lateral deviation and unilateral jaw opening (Dixon, 2003)¹⁴. First, using the thumbs to apply counter pressure on the frontal bone and a grade two anterior glide of the mandible was provided (Dixon, 2003). After this, the client was asked to deviate her mandible to the left side, and then to try to push her mandible from the deviated position towards the neutral position for seven second while the therapist' hand was resisting her force by placing a hand on her right mandibular ramus (Dixon, 2003). These techniques were performed immediately prior to intra-oral massage section and were repeated three times, accordingly.

After the intra-oral massage, the treatment was focused on reducing hyper-tonicity of the upper trapezius, the levator scapulae, the splenius capitis, the splenius cervicis, the sternocleidomastoid (SCM), the semi-spinalis cervicis, the suboccipital and the anterior, middle and posterior scalenes muscles, bilaterally, utilizing effleurage techniques. Muscle stripping was also performed on the above muscles immediately after warming up with effleurage techniques.

Myofascial trigger point release was then performed on the anterior, middle and posterior scalenes, the SCM, and the upper trapezius muscles followed by gentle passive static stretching held in the direction of the barrier restriction for ten to fifteen seconds to alleviate tension headache. Finally, the 2nd and 3rd fingers were placed to the client's suboccipital region and then the client's relaxed head was allowed to sink toward the fingers with the force of gravity. This was to release the suboccipital and semi-spinalis cervicis muscles.

The treatment concluded with applying gentle pressure and circular motion on the galea aponeurotica, the occipitofrontalis muscles, and the temporalis muscles to further induce parasympathetic nerve firing. The client was asked to clear her mind and to concentrate on her own breathing for sixty seconds while her ears were covered by the therapist's palms before the treatment ended.

Table 1 Treatment Protocol

Section	Technique	Muscles/Structure	Note
<i>Introduction of touch 1 minute</i>	-Gentle compression	-Overall body	-No lotion used
<i>Myofascial 10 minutes</i>	-Myofascial release	-Anterior neck -Posterior neck -Upper back	-No lotion used
<i>Warm-up 2 minutes</i>	-Effleurage Slow circular kneading	-Masseter	-No lotion used
<i>(Joint mobilizations 10 minutes)</i>	-Joint mobilization technique TMJ distraction 3 times -PNF Contract-relax stretching for the mastication muscles 3 times	-TMJ -Mastication muscles	-Not introduced until the 3 rd treatment
<i>(Intra-oral 20 minutes)</i>	-Pressure point release Static compression 10 seconds each with 30-second intervals -Contractile myofascial release Static compression while client clenching teeth 10 times each with 30-second intervals	-Masseter (superior, middle, inferior portion) -Lateral Pterygoid -Medial Pterygoid	-Not introduced until the 2 nd treatment -Full hand vinyl glove used -Client express pain scale via standing her fingers 1 finger = okay 2 fingers = painful, but still okay 3 fingers = stop immediately
<i>Cervical Region</i>	-Effleurage Kneading, muscle	-Upper trapezius -Levator scapulae	-Lotion used -Cooling pad

<i>30 minutes</i>	stripping -Pressure point release -Myofascial trigger point release	-Splenius capitis -Splenius cervicis -SCM -Semi-spinalis cervicis -Suboccipitals -Scalenes	used to decrease the pain and soreness from the intra-oral section
<i>Stretches 10 minutes</i>	-Passive stretch -Suboccipital release	-Scalenes -SCM -Upper trapezius -Suboccipitals -Semi-spinalis	
<i>Cranial Region 6 minutes</i>	-Scalp massage	-Occipitofrontalis -Galea aponeurotica -Temporalis	
<i>Meditation 1 minute</i>		-Ears	Client focuses on breathing and thinks nothing while ears being cover by therapist's hands

Home Care and Life Style Changing

A routine of self-massage and self-stretching on the mastication and neck muscles were recommended to the client. The client was also advised to utilize a cooling pad wrapped with a dry towel on the sore or painful spot on the TMJ to decrease the discomfort as needed, and that the intensity of the coldness could be increased by wetting the towel with tap water. She was also advised to be

cautious of the food she ate, especially to avoid chewing gum and eating hard food such as nuts and crunchy bread. [See table 2]

Table 2 Home Care Exercise Protocol

Area	Muscle/Structure	Procedure	Frequency
<i>Mouth – self-massage</i>	-Temporalis -Masseter	-massage in a circular motion with the pads of fingers, pressing into the muscles on the side of the jaw and the head. -gently open and close the jaw to increase the effect.	3 times per day
<i>Mouth – self-stretching</i>	-Temporalis -Masseter	-relax and slightly open the mouth -place both hands on the side of the cheek bones -gently apply inward and downward until a stretch is felt -hold for 30 seconds	3 times per day
<i>Neck – self-stretching</i>	-Levator scapulae -Posterior scalene	-look towards the left side -look down towards the armpit on the same side -place the left hand on the back of the top opposite side of the head, and then relax the hand until a stretch is felt -hold for 30 seconds -repeat on the right side with right hand.	3 times per day
<i>Neck –</i>	-Upper	-look forward	3 times per day

<i>self-stretching</i>	trapezius -Middle scalene	-side bend the head to the left side -place the left hand on the top opposite side of the head, and then relax the hand until a stretch is felt -hold for 30 seconds -repeat on the right side with right hand.	
<i>Mouth - Hydrotherapy</i>	-TMJ	-apply a cooling pad wrapped with a dry towel to painful or sore TMJ -Hold for no longer 20 minutes, or stop when start to feel numb -wet the towel if a cooling sensation is not felt to intensify the effect	After eating, talking for a long period of time, or as needed
<i>Mouth – Life style changing</i>	-Mastication	-be cautious of what to eat -avoid eating nuts, hard food, chewing food, crunchy breads, hard candy and chewing gums	Always

Contraindications

Although a heat pad or a hydrocollator should be applied the muscles that underwent myofascial trigger point release, it was avoided due to the client's high frequency of migraine headaches. This was to avoid causing painful vasodilation, which would aggravate migraine symptoms (Rattray, et al. 2002).

Precautions

The left side of the client's TMJ, mandible and muscular structures in the buccal area were extremely sensitive to pain. Extra care and a more gentle touch were utilized throughout the entire massage therapy series to avoid fatiguing the client and increasing apprehension.

Intervention – measurement

Assessment Overview

Progress was documented by an initial assessment prior to the first massage treatment, re-assessments after the second to the fifth treatments, and a final assessment after the sixth treatment. Each assessment included a personal interview, postural assessment, measures of active pain-free and maximum mouth opening, and various orthopedic tests. A daily journal was provided to the client to complete every day. It was to track the client's daily activities, stress levels, symptoms, general diet and compliance of performing home care exercises.

Personal Interview

Questions regarding the onset and frequency of symptoms, location and area of discomfort, types of pain, pain referral pattern, intensity and duration of pain, aggravating and relieving factors, and home care performed in the week prior the treatment was asked.

Postural Assessment

The client was asked to stand without shoes in a relaxed anatomical position in order to assess postural asymmetry and distortion. This was observed in an anterior, lateral and posterior view. Deviation of the mandible was also measured by the angle of deviation – the angle between a straight line drawn from nasal septum to the neutral chin position and a straight line drawn to the deviated chin position. [See figure

4]

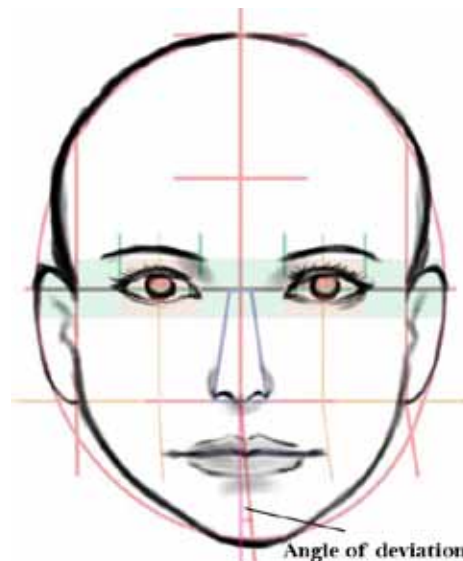


Figure 4

Range of Motion Assessment

TMJs were assessed using active, pain-free mouth opening and active maximum mouth opening. They were measured with a tape measure from the upper vermilion border to the lower vermilion border. Opening and closing of the mouth were also observed to determine an S-curve or C-curve opening, which indicated muscular imbalance or medial displacement as the condyle “walks around” the disc on the affected side; or a displaced disc without reduction or unilateral muscle hypo-mobility, respectively (Magee, 2013).

Orthopedic Assessment

Functional opening knuckle test was performed by having the client try to place two or three flexed proximal interphalangeal joints within the mouth opening. This was performed in active pain free mouth opening and active maximum mouth opening (Magee, 2013).

Chvostek test was used to rule out pathology involving the seventh cranial nerve.

Transverse ligament stress test and vertebral artery test were used to rule out transverse ligament instability and vertebral artery impingement to gain clearance to manipulate the client’s neck and head.

Daily Journal

The client's progress was documented through a daily journal in a questionnaire format that she completed every night before she went to bed, from the initial treatment to the final treatment. Questions on the journal included: Stress level from one to ten; the suspected cause of stress; the number of quizzes and tests in school; the quality of sleep from one to ten; the location and intensity of pain from one to ten; the number of TMJ clicking or popping, the frequency of teeth clenching; home care exercises that she performed; the activities that she did such as homework, computer, exercises that were not administered, etc.; general details of what was eaten for breakfast, lunch and dinner, and whether she experienced pain during meals. Numbering from one to ten provided a quantifiable measurement of stress, intensity of pain and the quality of sleep. Recording the suspected causes of stress and the number of quizzes and tests provided a clear picture of whether the stress was corresponded to schooling or other factors. Home care exercises and other activities were tracked to evaluate the client's compliance to the administered exercises, and also gave an insight of client's daily habits. General details of diet were monitored to evaluate the aggravating factors of an increase or decrease in TMJ pain and awake bruxism.

Results

Personal Interview

At the initial assessment, the client described her symptoms as numbness around the mouth, constant dull and achy pain on left TMJ, sharp pain when yawning, feeling hot on the left cheek, constant headaches which included a migraine once every two weeks and tension headaches two to three times per week, clicking and popping sound from the left TMJ when opening her mouth.

At the final assessment, the client remarked that a decrease of numbness around the mouth, a decrease in tension headache, and that she could only feel pain at her left TMJ when it was aggravated by activities such as eating hard food and yawning. She noticed that she tended to have an increase in pain on her left TMJ immediately after intra-oral massage, but the pain usually subsided after one and half days. She also noted that performing home care exercise following the home care exercise helped her TMD symptoms.

Postural Assessment

At the initial assessment, the client's left shoulder was higher than her right, and presented a mild head forward posture.

At the final assessment, the client's left shoulder was higher than her right as at the initial assessment, but no longer demonstrated a head forward posture.

Range of Motion Assessment

Active pain-free mouth opening was measured 1cm at the initial assessment, and 1.2cm at the final assessment, with a magnitude of 0.2cm improvement.

Active Maximum mouth opening was measured 2.3cm at the initial assessment, and 2.9cm at the final assessment, with a magnitude of 0.6cm improvement.

[See table 4] Angle of deviation of the mandible was measured six degree at the initial assessment, and four degree at the final assessment, with a magnitude of two degree improvement. [See Figure 5]

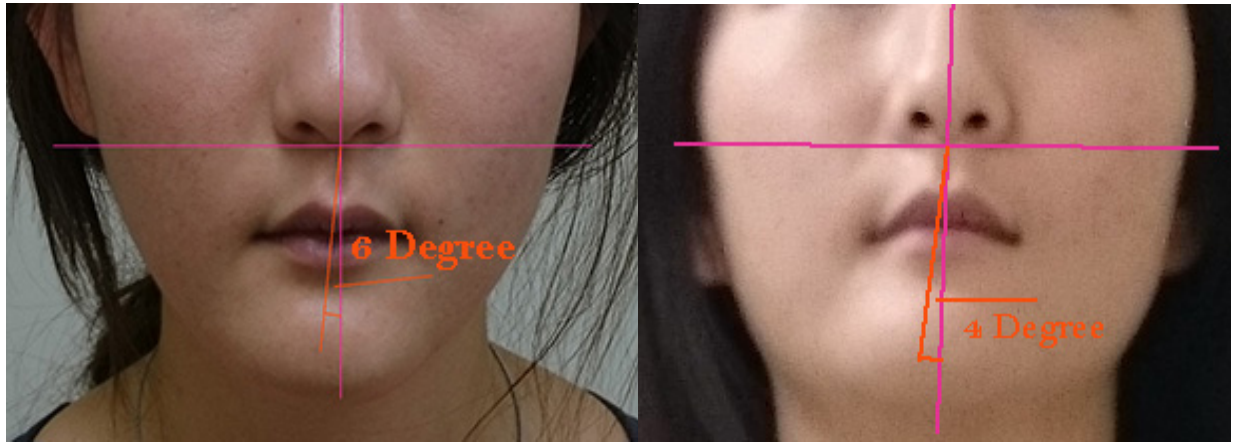
Table 3

	1 st treat ment	2 nd treatm ent	3 rd treatm ent	4 th treatm ent	5 th treatm ent	6 th treatm ent	Magnitu de of change
Active pain-free mouth opening	1cm	2cm	1.3cm	1.1cm	1.9cm	1.2cm	0.2cm
Active maximu m mouth opening	2.3cm	2.5cm	2cm	2.5cm	3.4cm	2.9cm	0.6cm

Figure 5

Initial Assessment

Final Assessment



Orthopedic Assessment

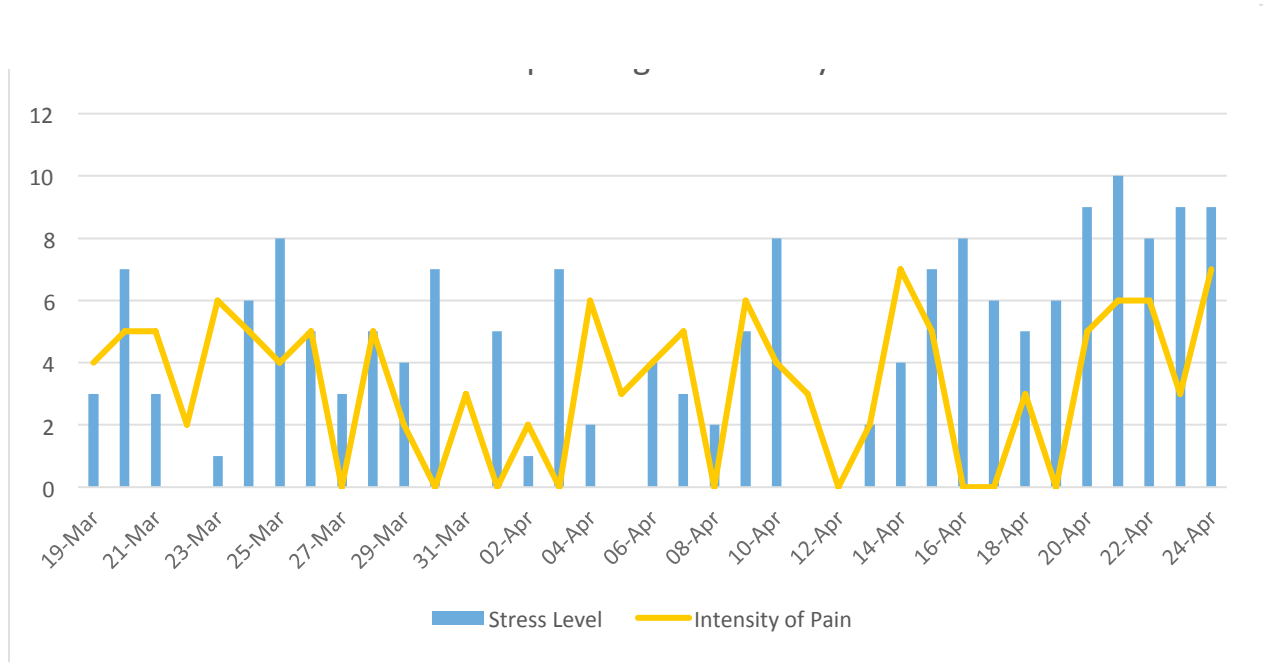
The results of the functional knuckle test remained the same throughout the entire massage therapy series, which were two knuckles in active pain-free mouth opening and three knuckles in maximum mouth opening.

Daily Journal

Upon examining the client's daily journal, correlations were noticed between stress, and intensity of pain [See chart 1]. When the client had less stress, her intensity of pain on TMJ tended to decrease. There was a correlations between Quality of sleep and intensity of pain as well [See chart 2]. The client tended to have less pain when she had a good quality of sleep. The date gathered from the daily journal also demonstrated that the client tended to have increased pain on

TMJ when she was experiencing awake bruxism, and clicking and popping sound

Chart 1



from her TMJ [See chart 3].

Chart 2

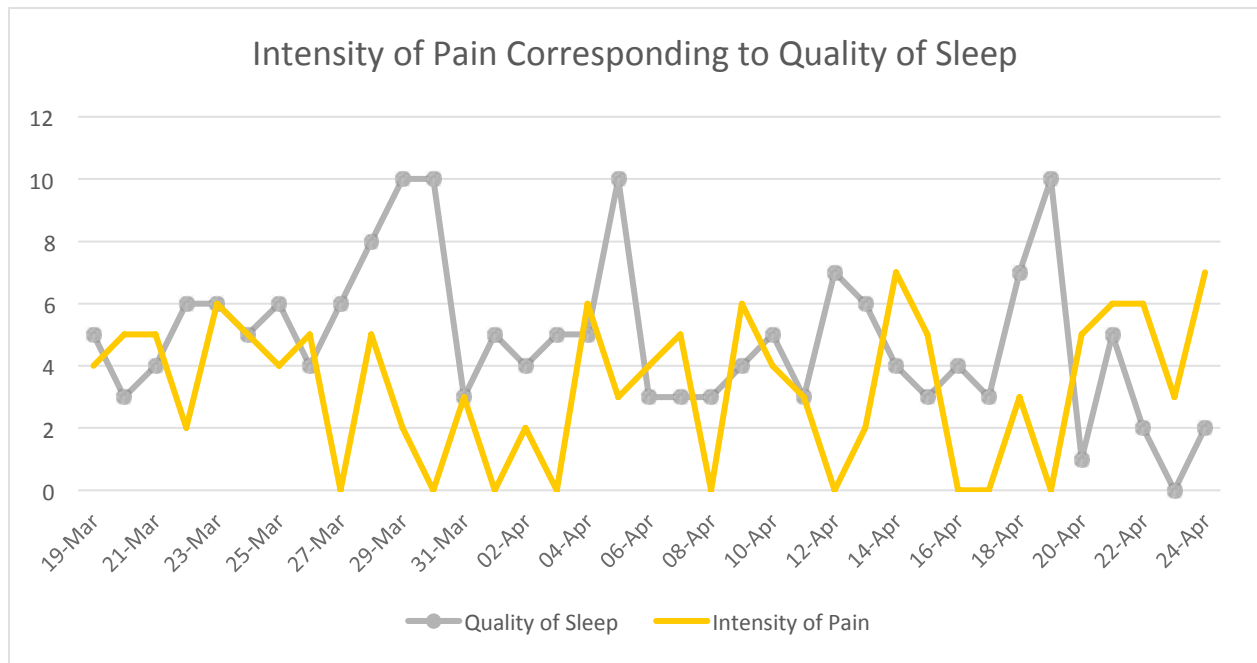
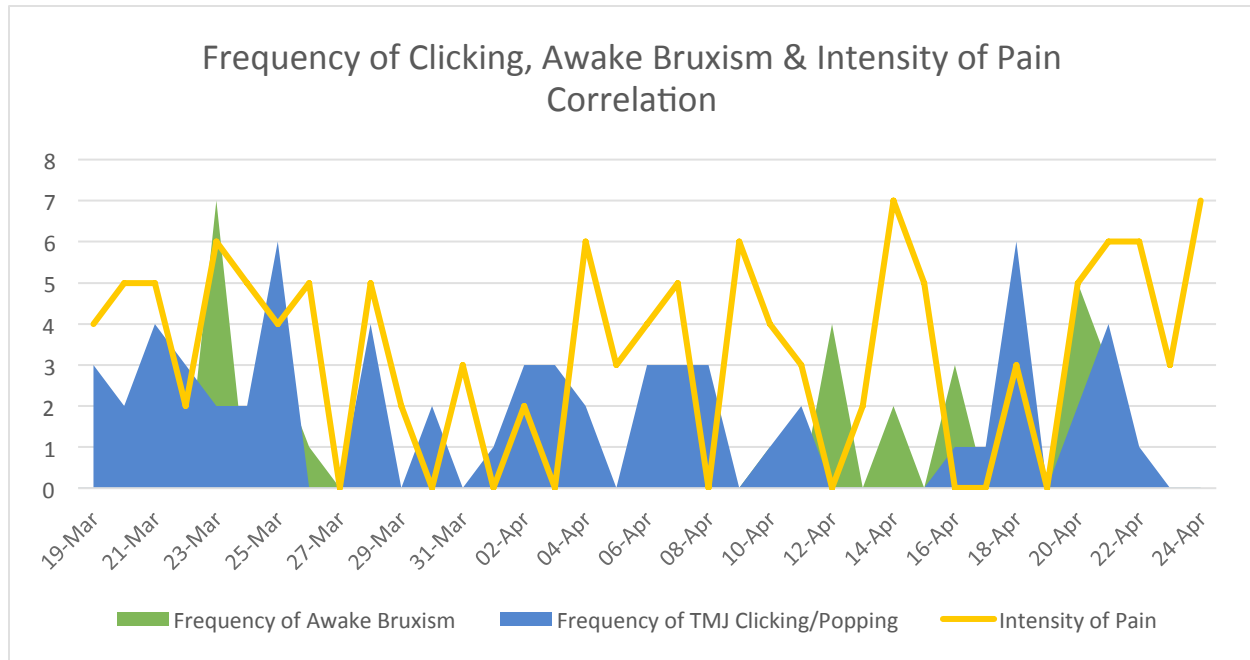


Chart 3



Discussion

Overall results

The data collected from this case study showed that the client's TMD symptoms – pain, awake bruxism, and joint clicking and popping – correlated with various external factors that increased the client's emotional stress. On the contrary, good sleeping quality, weekends, and holidays decreased her TMJ pain. Although the range of motion results showed a magnitude of improvement in TMD, it lacks clinical significance to prove therapeutic and intra-oral massage had an impact on post-USSO TMD.

Effectiveness of Case Study

As this case study was carrying out, a number of errors were noted. Pre-treatment assessments were not conducted in each treatment except the initial treatment because the case study was designed to monitor the client's progress throughout the entire treatment series. This lacks the capability to monitor the client's changes before and after each individual treatment. Future study should implement pre-treatment assessments. Due to miscommunication between the therapist and the client, the daily journal that was used to record patient's progress was discontinued on April 24th, whereas the final treatment was conducted thirteen days after, on May 7th. Using a tape measure as the measuring tool for active pain-free and maximum mouth opening was not ideal, due to the softness of the tape. Inaccurate data could had resulted when the tape was bent. In addition to this, the measurement points were the upper vermilion border and the lower vermilion border, which were soft tissue that could be altered by muscle contractions. Proper tools to measure TMJ range of motion such as caliper and TheraBite System is recommended for similar future research. [See Figure 6 & 7]

Figure 5 Caliper



Figure 6 TheraBite System



Recommendations for Future studies

Due to the lack of research regarding the correlation between USSO and TMD, further exploration in this area should be conducted. It would be intriguing to see research utilizing massage therapy and intra-oral massage in preventing post-maxillofacial, post-orofacial surgery complications and TMD. This case study

carried out positive results to the client; however, due to a number of errors occurred during the process further research in this aspect is needed in order to prove the effectiveness of utilizing massage therapy and intra-oral massage to post-USSO TMD.

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