Treatment of Temporomandibular Joint Disorder
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Temporomandibular Joint Disorders (TMD, TMJ) affects an integral joint in the human body, which it is the jaw that integrates the temporal bones and the skull that is in the front of each ear (Mayo Foundation for Medical Education and Research, 1998-2015). This paper examines how patients have experienced symptoms, and how they have sought treatment. Could simple, cost efficient treatments like store bought night guards alleviate the symptoms caused by TMJ disorders as efficiently as more expensive appliances such as laboratory made night guards on patients living in New York City during the summer of 2015? Most patients use some type of dental splint or night guard, in order to alleviate pain. This has the additional benefit of reducing or eliminating the impact of grinding, which commonly occurs during sleep. These night guards can be purchased over the counter at most locations that sell dental appliances. However, many patients are encouraged to obtain a more expensive customized device. Unfortunately, many remain unsatisfied, feeling that the device offers little relief, and requires excessive cleaning. Therefore, this study examines several alternative means of addressing TMD, concluding with an original idea that may address the concerns of several patients and improve the cost efficiency of treatment.

Symptoms and Causation

Pain in the jaw is the most common symptom of TMD, and this is most noticeable when chewing. Anyone who has chewed an excessive amount of gum has some idea what this feels like, as similar pain is generated from overuse of the jaw and its muscles. In particular, excessive chewing or grinding can damage the masseter, disrupting function of the temporomandibular joint. The most common issue is a muscle knot, causing prolonged aches and pains, which can radiate throughout the body (Ingram, 2015). Also known as trigger points (TrPs), these knots are often overlooked by clinicians, leading to misdiagnosis and inadequate treatment.

According to The National Institute of Dental and Craniofacial Research (2014), TMD causes an alteration of the position and structure of the jaw, leading to significant pain. This prevents patients from comfortably moving, especially while talking, yawning and chewing. TMD is often accompanied by stiffness in the neck muscles, which can further limit the overall movement of the jaw, potentially inducing lock jaw and an inability to move the head or turn it from one side to another.

According to The Academy of General Dentistry (2015), TMD is defined as a variety of conditions affecting jaw muscles, the temporomandibular joints, and the nerves associated with

chronic facial pain. Symptoms can occur on one or both sides of the face, head, or jaw, impacting women twice as often as men. TMD can be caused by trauma to the face or jaw, but frequently the actual cause is unknown.

According to the Mayo Foundation (2015), TMD occurs when discs in the jaw erode or become misaligned. In some cases, this damage can be caused by arthritis. Erosion can become so severe, that the jaw may fracture and require surgery. In extreme untreated cases, the bones will eventually splinter and penetrate the skin.

According to Marcus and Baehrisch (2013), TMD is defined as a group of biopsychosocial illnesses influenced by physical, psychological, and psychosocial factors. This definition explains why individual people appear to suffer from an identical disorder, but react differently to various forms of treatment.

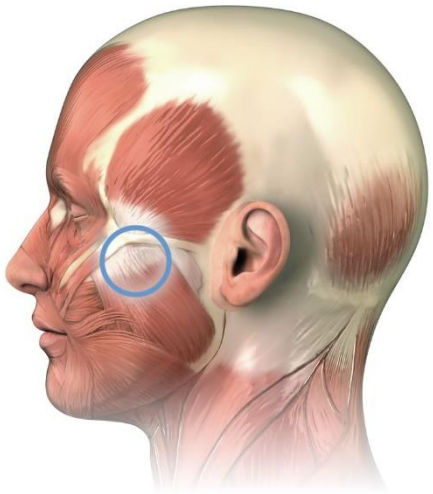
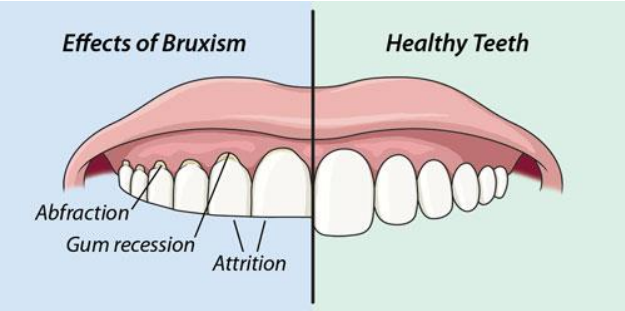


Fig. 1. Illustration of masseter muscle

TMD typically involves a TrP within the masseter muscle, located along the side of the jaw. The masseter hangs from under the cheekbone, along the side of the face, with the bottom attached to the jaw. With respect to size, the masseter is arguably the strongest muscle in the human body. Consequently, difficulties with this muscle can cause tremendous pain. If tension develops here, it can cause severe pain and several medical issues, including: TMD, tension headaches, earaches, toothaches, tinnitus (ringing of the ear), jaw clicking (popping), misalignment of the teeth, dizziness, insomnia, and bruxism (cracking of the molars, primarily via grinding). According to Brody (2009) the symptoms for TMJ vary from person to person with about 75% of Americans claiming to suffer from at least one or more symptoms, although only 5%-10% seek treatment.



Bruxism can be especially problematic, requiring extensive dental treatment and (in some cases) surgical intervention. This is generally considered a parafunctional habit, involving clenching and/or grinding of the teeth, resulting in gradual erosion and chipping. It usually occurs while patients are asleep, but can also occur when they are awake (particularly during stressful situations), and appears to be caused by misalignment of the jaw.

However, there is debate about the relationship between TMD and bruxism (Cawson, 2002). In particular, is this caused by TMD, or is it a cause of TMD? Regardless, bruxism is itself a serious medical disorder, which may affect more than thirty percent of the population, many of whom remain unaware of their condition (Manfredini, 2013, p.99-110).

The masseter can radiate pain directly to a tooth, creating pain which mimics a severe cavity. In individuals with TMD, this means that dental care may suffer, if patients believe toothaches are merely a symptom of TMD. Consequently, a visit to a dentist is necessary to determine whether pain is actually coming from a tooth. A visit to a primary care physician can be made for pain management, but once the regular doctor learns that the pain seems to come from a tooth, they should refer the patient to a dentist for further investigation. Unfortunately, this does not always happen, as physicians may wrongly presume that the pain is merely a symptom of TMD. Routine dental visits can allow dentists to evaluate a patient's TMD (American Dental Association, 2014). However, globally accepted protocols defining the diagnosis and treatment of TMD do not exist (Web MD, 2015).

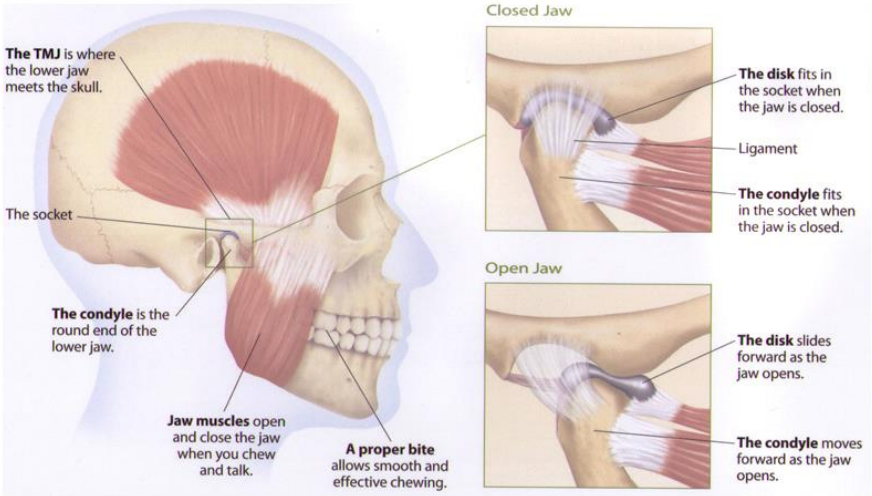
According to Inguawale and Goswami (2009), treatments for TMD include physical therapy, nonsurgical treatments, and various surgical procedures. All nonsurgical treatments should be exhausted prior to attempting any surgical procedures. Management of TMD can be broken down into four categories. These include noninvasive, minimally invasive, invasive, and surgical (Tanaka, Detamore, & Mercuri, 2008). The more aggressive the treatment, the more physical and psychological discomfort it can cause for a patient. Nevertheless, during the 1990s, oral surgeons began moving away from simple treatments for temporomandibular disorders, and started utilizing more invasive and costly procedures and surgeries (Sidebottom, 2009). Not only does this appear to be inefficient, but it may actually be counterproductive.

Unfortunately, dentists may prescribe only treatments within their field of expertise, ignoring psychological aspects. They often prescribe expensive customized night guards, failing

to inform patients that cheaper generic devices may be more cost efficient. Indeed, as noted by Olsen (2015), "when people profit from other people's illness, disease becomes more profitable than wellness. It doesn't take a brain surgeon to understand sickness perpetuates wealth..." Tragically, many medical practitioners are unconsciously affected by an unethical profit incentive, which encourages them to offer ineffective treatments and ignore cheaper yet more efficient options. Disputes over which treatment is preferred stems from debate concerning the causes of TMJ, of which there is no known specific cause. Treatments that are rejected by the patient, even when prescribed, should be considered unsuccessful, particularly because it can lead to situations where treatments such as required intake of soft foods, for example, are seen as excessively restrictive and ignored by the patient.

Psychological well-being is essential in the healing process of any part of the human body, which indicates the preferred treatment to any illness or discomfort is the one that causes the least mental discomfort. Research will prove how stress and sleeping disorders can be main facilitators for temporomandibular joint disorders, which allows for acceptable treatment through over the counter pharmaceuticals, store bought dental appliances, and stress management (Lawson, 2014).

There are many hypotheses on the cause of TMD, but the most common issue appears to be chronic stress. This can originate from social life, financial instability, a lack of education, sleep disorders, or a difficult career (Lawson, 2014). Unfortunately, this vague mechanism of causation can make treatment difficult, and results may vary considerably from patient to patient. Stress cannot be easily assessed, but happiness is usually a sign that an individual's life is fulfilling and less stressful. Consequently, individuals with TMD may benefit from increased socialization. However, TMD is often accompanied by dental problems, and individuals with TMD often become socially withdrawn, which simply exacerbates the problem. Therefore, psychological therapy may prove beneficial in some cases.



Happiness and overall psychological well-being is a critical part of the treatment process, as this can determine whether or not the treatment is successful (Wolfram, 2015). Happiness results from a variety of biological, religious, psychological and philosophical approaches. However, it has difficult to measure or determine the exact source of happiness in individuals (Vulcan, 2011).

Indeed, what makes a person happy varies depending on the values and norms of their community and family. Furthermore, some cultures are more inclined to focus on alternative medicine, which rarely involves modern medical treatment. According to Alves (2011), traditional medicine is still the preferred form of healthcare in low-income countries, because it is more cost effective to utilize natural remedies. Even in modern industrial nations, many impoverished individuals simply cannot afford expensive treatment.

Patient Interviews

Seven individuals suffering from TMD were asked to discuss their symptoms and describe their treatment:

G. Burgos (personal communication, July 7, 2015), has been in treatment for 16 years and has only used a lab made night guard, worn nightly. His symptoms include pain, grinding of teeth, limited range of motion of mandible, pain in masticatory muscles, temporomandibular joint pain, and headaches. His mother also has symptoms. These issues affect his ability to socialize and his professional productivity. His symptoms were constant prior to treatment, and he notes that he was under an excessive amount of stress, but acknowledges improvement since starting treatment. Price was not a factor in his decision for treatment, and he was presented with several alternative treatment options.

The only time Burgos does not use his guard is when travelling or sleeping away from home. He cleans his guard daily with water and cleaning tablets, drying and storing the device in a box. He states that he would not use a single use night guard to replace his current treatment because he is satisfied with his existing treatment, but he would be willing to spend around eleven to twenty dollars for a package containing thirty single use guards. What this tells us is that although he finds existing single-use guards to be inadequate, he may consider purchasing a slightly more expensive and effective device.

Burgos has severe symptoms that impact his daily life, stressing that the worst symptom is chronic pain. Meanwhile, the lack of jaw motion makes simple tasks like, speaking and eating almost impossible. He would benefit from a stress management session to see if a reduction in stress will minimize the effect TMJ has on his daily life. Pharmaceutical treatments may also be utilized to directly address his concern for the pain. He has been an ongoing sufferer, but seems

satisfied with the results of his treatment, and wants to continue his treatment as long as it keeps his pain at a manageable level.

B. Alicea (personal communication, July 7, 2015), has been in treatment for four years and uses a lab made night guard. The price of $300 was not a factor in her treatment decision, but she was not presented with any alternative treatment options. Her symptoms include clenching of jaw, popping of jaw, pain in teeth, and headaches. No one else in her family has any symptoms. Her symptoms do not affect her ability to socialize or her professional productivity. Her symptoms were constant prior to treatment and there is no discomfort during treatment.

Alicea uses her night guard every night, unless she is being intimate with a man. She cleans her guard daily with toothpaste, and then lays it on the counter to dry and store. She would not be interested in a single use night guard, but would be willing to pay twenty to thirty dollars for a thirty-count package. She has not seen any improvement and is not satisfied with her results. Once again, we can see that she is dissatisfied with existing single use options, but would consider an improved model.

Alicea does not have serious symptoms, but has not seen an improvement in her condition during the four years she has been using a custom guard. Fortunately, her symptoms are not disrupting her daily life, but she should consider additional treatment options. In particular, over the counter pain relievers may be sufficient to curb moderate pain, accompanied with stress management techniques (including massage).

P. De Leon (personal communication, July 7, 2015), has been in treatment for as long as he can remember. He claims to be under an excessive amount of stress. He uses an over the counter night guard, because he was presented with treatment alternatives and could not afford a custom guard. His symptoms include grinding of teeth, joint noise that sounds like a clicking. No one else in is family has symptoms.

De Leon is often embarrassed to use the guard or for anyone to see him with it in his mouth. Consequently, he often fails to wear the guard. Nevertheless, he has seen some improvement in his symptoms. He cleans his night guard about once a month with water and then leaves on the counter to dry and store. He is not completely satisfied with his results, and would be willing to spend between eleven and twenty dollars for an improved disposable device. De Leon has been in treatment for a long time, but does not feel it is working. He rarely uses his device, failing to remember it because he does not find it beneficial. Stress management and pain relievers may help reduce his moderate pain.

M. Cruz (personal communication, July 7, 2015), has only been in treatment for about a year, and has used a lab made night guard from his dentist. Price was not a factor in his decision and this is the only treatment he has received. His symptoms include grinding while sleeping, and damage to his teeth. His wife also has symptoms, but is not currently being treated. Cruz does not consider himself to be stressed, and his symptoms do not affect socialization or productivity. He does not suffer from any discomfort during his treatment.

Initially, Cruz felt very uncomfortable using the guard, so he did not use it often. Consequently, he regretted the purchase. Subsequently, this regret was amplified, because the expensive device was eaten by his dog. He would rather start a new treatment, than purchase another expensive device. When he did use the guard, he cleaned it occasionally with water and laid it on the counter to dry and store. Much like the other patients interviewed, he would be willing to pay around eleven to twenty dollars for a thirty count disposable package.

Cruz may be suffering from a sleep disorder, causing him to grind his teeth. Issues with breathing while sleeping can be the main culprit. Since his symptoms do not affect his personal or professional life, the discomfort experience does not appear to justify great expense. Consequently, he is enthusiastic about the possibility of single use disposable guards, because he can wear them as needed.

M. Matthews (personal communication, July 7, 2015), has only been in treatment for eighteen months. He uses an over the counter guard, after he was presented with more expensive treatment options. He claimed the price was a decisive factor in his decision. His symptoms include grinding and clenching of teeth and jaw, with a limited amount of motion of the mandible. No one in his family has any symptoms and his symptoms were not constant prior to treatment.

Matthews states he does not feel discomfort during treatment. He uses the guard about every other night, cleaning it with water and cleansing tablets after use. The guard is dried and wrapped in tissue for storage. He has seen an improvement of his symptoms and is satisfied with results. However, he would consider using a single use night guard as a replacement for what he currently uses. Once again, he would be willing to pay between eleven and twenty dollars for a thirty count package. Over the counter medication may also help alleviate discomfort.

P. Vison (personal communication, July 7, 2015), has been experiencing symptoms for around ten years, using a custom night guard and also employing acupuncture. He noted that alternative treatments were never suggested, but he decided to try acupuncture as the night guard was ineffective. He notes considerable pain, and states that his jaw often locks and he has to forcibly move the joint. Ultimately, since adding acupuncture to his treatment regiment, he describes less stress and considerable improvement. He continues to wear the guard nightly, and feels that disposable guards would be a waste of money. However, when asked if he would consider purchasing a monthly supply between a range of $5 and $50, he selected a median of $20. This tells us that he has little faith in a cheap device, but recognizes the possibility that a slightly more expensive (and higher quality) disposable may be useful.

N. Thompkins (personal communication, July 7, 2015), has been in treatment for a while, but is not quite sure how long, suggesting considerable time. She also uses a custom guard, and notes that she was never offered any alternatives. Her primary symptom is popping and clicking of the TMJ, and has not seen any improvement, even though she wears the guard nightly, which she cleans with toothpaste and water. Emphatically, she is not satisfied with the results, and

would very much like to try an alternative. When asked how much she would pay for a disposable device, she selected the highest value of $50. Although such cost may be excessive on a monthly basis, this indicates how frustrated she is with her existing treatment.

Discussion of Interviews

"THE Heart asks pleasure first,
And then, excuse from pain;
And then, those little anodynes
That deaden suffering;

And then, to go to sleep;
And then, if it should be
The will of its Inquisitor,
The liberty to die".
-by Emily Dickinson

Dickenson once observed that humans seek pleasure first, and then escape from pain. If relief is not available, one desires to sleep. If this does not suffice, then death is ultimately sought. This grim view highlights the importance of treating pain, before it triggers severe depression. Indeed, according to Hoover, (2014), hopelessness hits many patients because they feel their health and wellbeing is out of their direct control. In particular, appears to be the case with Thompson and Pedro.

Most of the patients interviewed used a custom lab made night guard, and price was not a major factor in their decision. This suggests that if people are able to pay for professional treatment, they prefer it over something they can buy over the counter. However, this does not mean they are using their money wisely, and they appear to be motivated be a desire to escape their symptoms. Unfortunately, expensive professional treatment often fails to adequately address their concerns.

There was one married couple in the results, and that individual said his wife had similar symptoms, but was not under treatment because he did not experience any relief. This reminds us that ninety percent of individuals with TMD do not even seek treatment, primarily because they lack faith that treatment will be effective. However, some patients do benefit and pain can be relieved by a night guard, which effectively reduces pressure upon the temporomandibular joint. Unfortunately, most of the patients did not experience relief. Indeed, they may not even require a costly night guard, and may instead benefit more alternative treatments.

Treatment Options

In order to properly treat a patient, a proper line of questioning should be developed. These questions can uncover personal feelings towards health, family history, mental state, and other relevant factors. This can help determine the precise nature of a patient's TMD, and can help doctors determine what form of treatment will be most effective.

1. Are you currently in treatment for TMD?
2. How long have you had this issue?
3. Where you presented with different options to treat your condition?
4. What treatment are you currently using?
    - Over the counter night guard
    - Laboratory made night guard (from the dentist)
    - Physical therapy
    - Pharmacotherapy
    - Botox
    - Surgery
    - Other
5. Was the price a deciding factor in getting the current treatment?
6. Is the current treatment the only option you have used to treat this condition? If not, what other treatment have you used in the past?
7. Do any of your family members suffer from TMJ? If so, who and what treatments have they used?
8. What symptoms have you experienced?
    - Pain
    - Grinding
    - Clenching
    - Limited range of motion of mandible
    - Pain in masticatory muscles and TMJ
    - Joint noise (clicking, popping, or crepitus)
    - Myofascial pain
    - Other functional limitations.
9. Do any of the symptoms affect your ability to socialize or interact with others?
10. Were those symptoms constant before treatment?
11. Have you seen any improvements in your condition after using a night guard?
12. Are you happy with the results?
13. To what extent (if any) does it affect your professional productivity?
    - A lot
    - Somewhat
    - None
14. Did you experience any discomfort getting your current treatment?
    - Discomfort at the moment of taking impressions

    - Embarrassment getting a night guard from the store
    - Other.
15. How frequently do you use your night guard?
16. What factors if any, prevent you to use your night guard?
17. Are you satisfied with your night guard? If not, would you prefer another treatment method?
18. How often do you clean your night guard?
    - Every day
    - Every other day
    - Weekly
    - Monthly
    - Never.
19. What is your cleansing routine?
    - Clean it with only water
    - Clean it with mouth wash
    - Clean it with toothpaste
    - Clean it with professional cleansing tablets
    - Other.
20. How do you store it?
    - Lay it on the counter
    - Put it in storage box
    - Wrap it in tissue
    - Leave it in a glass with water or solution.
21. If it were available in the market, would you use a single use over the counter night guard?

Without a solid treatment plan, there are many possibilities for medical professionals to attempt to manage pain and TMJ damage. This is why it is important to treat the patient, rather than merely addressing the symptoms (Hanauer & Kirsner, 2012). To determine the extent of damage, joint dentists and primary care physicians can order procedures including an MRI or a cat scan (Brody, 2009). Subsequently, options can be discussed and weighed to choose the best medical treatment plan to meet the patient's needs. However, before undergoing such expensive evaluations, patients should be informed of alternative inexpensive options that may adequately address their situation.

Indeed, Voltaire once noted, “the art of medicine consists of amusing the patient while nature cures the disease” Unfortunately, patients are often offered excessively expensive solutions, which may not be necessary. Many illnesses can be treated without any medication or surgery. While there are many aggressive treatments available, irreversible surgical treatments are sometimes ineffective, and may worsen TMD. According to The National Institute of Dental and Craniofacial Research (2014), it is vital to note that simple treatments are available, and these should be attempted first.

According to The Academy of General Dentistry (2015), the least costly treatments for TMD include physical therapy, counseling, posture training, and orthopedic appliances. However, fractures caused by the grinding of teeth may require surgery to repair if severe enough. Indeed, this can be a major reason for pain, which stresses the importance of having dental x-rays taken during routine dental exams. It is important for dentists to narrow down the cause of pain, because sometimes this can be corrected by simple dental or orthodontic maintenance (Mayo Foundation, 2015). To eliminate these possibilities, dentists should consider when the pain was first noticed, its duration or intermittency, and how the jaw functions as a whole (including opening, closing, and chewing).

Pain related to TMD can often be alleviated via simple lifestyle adjustments, include eating soft foods, applying heat and ice packs, and avoiding gum (U.S. National Library of Medicine, 2015). According to the *Body-Mind Conspiracy* (2013) website, gum chewing should be completely eliminated from the patient's diet, as repetitive mastication can severely damage the masseter. Not only can this exacerbate existing TMD, but it can actually cause issues in otherwise healthy individuals. It is also recommended to eat as if there are no teeth in the mouth, in order to make the motion of chewing less intense and gentler (Ingram, 2015).

Over the counter pain relievers can also reduce pain, saving patients time and money. According to The Academy of General Dentistry (2015), stress management can also help deal with the causes of TMD. Relaxation treatments can be particularly cost effective, as they can completed from a patient's home or workplace. According to The National Institute of Dental and Craniofacial Research (2014), the symptoms of TMJ are rarely permanent and continuous, so short-term remedies are encouraged.

There are a number of simple techniques that patients should attempt before investing heavily in medical treatment. As Rawson explains, individuals suffering from pain associated with TMD should position themselves in front of a mirror, standing or sitting in a relaxed position. Subsequently, they should observe the movement of the jaw as it opens and closes, noticing if it tends to move slightly to one side more than the other. If misalignment is observed, they should then keep attempting to open and close the jaw slowly, until it is able to open and close evenly ten times in a row.

This is a simple activity that should be completed twice a day, typically after brushing and flossing teeth. In this way, patients may be able to strengthen the masseter, potentially correcting the issue without requiring further treatment. Furthermore, as noted by Ingram, patients should avoid putting themselves in awkward positions, which place pressure upon either the head or jaw. In particular, they should not sleep on their stomach or face. Nor should they rest their head upon any part of the arm or wrist, which may generate additional pain that is not associated with TMD.

The patient should also follow standard medical procedure, cataloging their pain associated with TMD in order to determine where exactly the pain appears to be located, the

intensity of this pain, and the duration of pain (Ingram, 2015). It is not unusual for a patient to have symptoms continuously, and for others to have intermittent pain that comes and goes for various reasons. In some cases, identifying this may guide treatment. For example, intermittent pain may indicate a specific cause (i.e.: chewing gum), whereas severe continuous pain may warrant surgery or indicate another underlying medical issue. For severe symptoms, that need to be dealt with before a visit to the doctor can occur, patients should consider blending their food so that it does not require chewing. Minimizing verbal communication is also recommended to limit the amount that jaw muscles are used (American Dental Association, 2014).

There should never be any contact of the teeth unless the patient is eating. Other than meal times, contact between the top and bottom teeth (gritting) is a clear sign of a stressful situation and can be unlearned through practice and constant reminding of oneself (Ingram, 2015). Some people need more reminding than others, so timers can be set, or a schedule can be planned in advance. Anyone can be trained to keep their teeth slightly parted and to check for tightness in the jaw area, especially if they remind themselves to check anytime they walk in or out a room, or (for individuals with a modern lifestyle) whenever they open or close a new web browser window, or view a commercial break on television.

It should also be noted that all patients should beware of treatment options that follow a no-pain no-gain mantra, because more pain is never good, especially for someone suffering from TMD which can easily become unbearable (Ingram, 2015). You want to properly exercise and strengthen your masseter, but you should not approach this as weight-lifting.

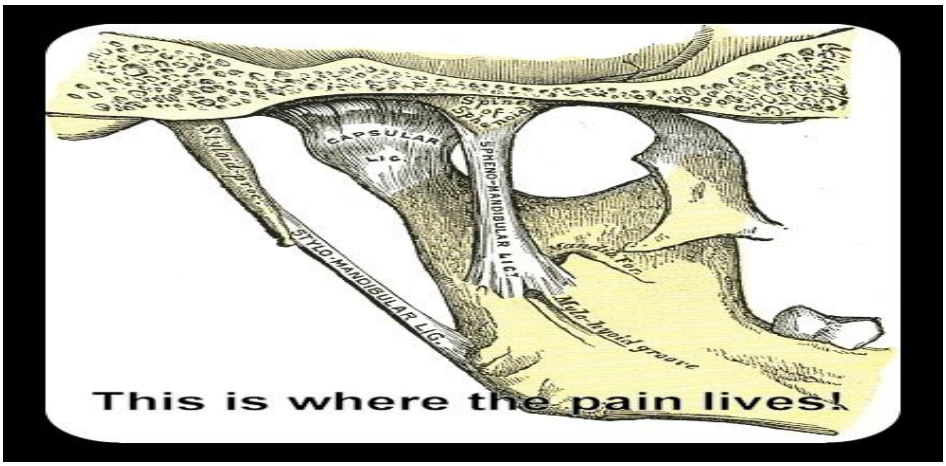


Fig. 2. Jaw pain

There are approximately thirteen trigger points that can be massaged to alleviate pain across multiple parts of the body. Unfortunately, some of these trigger points are difficult to massage alone, but if the patient is able to pay a professional masseuse (or acupuncturist) this form of treatment is highly recommended. Additionally, this is significantly less expensive

compared to more invasive treatments for TMD. However, a massage therapist may not be approved by insurance, so these visits may be an out of pocket expense.

Both patients and medical professionals often underestimate the value of massaging the jaw. Indeed, it is common to try and treat headaches by massaging the temples, but few consider that pain is actually originating from the masseter. Meanwhile, it is important to realize that there are several trigger points across the entire body, which can be massaged and exercised to alleviate pain. This can be useful alternative to massaging the masseter, which is notoriously difficult to treat since the jaw is frequently used and receives little rest.

According to the Ingram (2015), trigger point number seven is the most effective location for massage treatment of TMD. This TrP is defined as the intersection of the temple and the masseter muscle. Patients should massage this location, focusing both above and below the cheekbone. Massaging the number seven trigger point can relieve this pain if it is not associated with damage to a tooth or the gums.

The location of the number seven trigger point is the notch in the cheekbone, about one inch in front of the ears, on the bottom side of the cheekbone. Place the thumb and a fingertip into the notch and press firmly in an inward and upward motion with the thumb in the cheekbone. The sensation should feel nice and not painful. The entire muscle should be rubbed gently, but the best satisfaction occurs when the massage is focused on the upper edge of the muscle (Ingram, 2015).

As a reminder, the masseter muscle is believed to be the strongest muscle in the body, so the massage should be firm and steady. Maintain continual pressure applied via small circular kneading. In some cases, additional pressure should be applied via a knuckle, but patients must be sure not to overexert and strain the muscle. There is also a product called a positive knobble, which has a tip that fits into the cheekbone notch. This can be used while lying down on one side, applying steady pressure and then rotating to the other side. The knobble should be used on both sides of the jaw and cheek (Ingram, 2015).

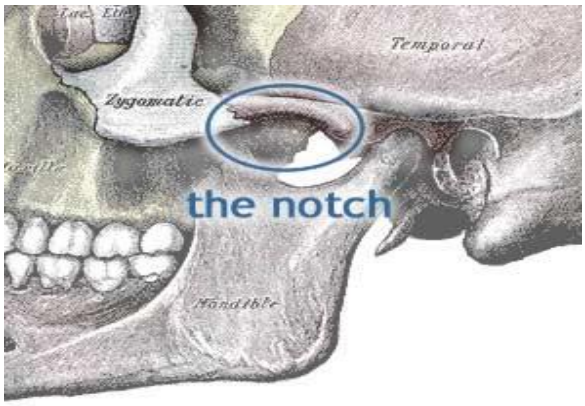


Fig. 3. Cheekbone notch

Unfortunately, although massage can be effective for many patients, it can be ineffective for others. However, even when results do not seem apparent, patients should never underestimate the potential to relieve pain by alleviating stress. Attempts to massage the masseter should be continued indefinitely, even without noticeable success, unless the condition appears to be worsening.

According to Rawson, the use of heat both before and affect a massage can enhance the effects. With the use of a warm wet towel, or hot water bottle, patients should apply gentle pressure on both sides of the face. This increases the flow of blood to the jaw muscles, promoting healing, relaxation, and flexibility. It is also advised that patients take regular warm baths, submerging their entire face under the water. While thus submerged, the jaw should be massaged on both sides with the fingers.

According to Berry (2015), TMD pain can also be caused by poor posture. Indeed, as individuals spend an increasing amount of time operating machinery and computers, posture has become an increasingly problematic health issue. It is estimated that thirty-five million people (12%) in the United States suffer from poor posture. Fortunately, there are three different exercises that can help with posture and alleviate consequent pain. Patients must recognize that the human head is supposed to sit directly on top of the shoulders, rather than at an angle. Therefore, these exercises are intended to keep the head properly aligned (Berry, 2015).

Many individuals with poor posture are unaware of their problem, which is partially due to the fact that poor posture has become so common. For those in doubt, there is a simple test to simulate the head being out alignment with the shoulders and back, which creates enough discomfort to know the exercise is worth the time and effort (Berry, 2015). Holding an eight pound weight over the head simulates the weight of the human head. The weight should be held directly overhead, in the center of gravity, and one should slowly extend the weight forward inch by inch, until it is about two feet in front of the head. As the weight moves forward, the strain in the shoulders and neck will increase significantly, and individuals with poor posture will notice mild pain. Repeating this exercise on a regular basis will help restore hip function, and reposition the head, thoracic spine, and shoulders. This process should be conducted daily, for forty-five minutes. Another quick test to determine misalignment is to stand in front of a wall, with heels and hips touching the surface. If the head is not also touching the wall, then it is likely that the individual has poor posture.

Another beneficial exercise involves sitting knee pillow squeezes. According to Berry (2015), one should sit on a chair with knees and hips at a 90 degree angle. Place a block or pillow between the knees, with hands clasped behind the back. While contracting the shoulder blades together, squeeze and release the pillow sixty times. It is important to breathe and keep the stomach relaxed. As with all of these exercises, strain should be avoided.

Berry also recommends static ankle squeezes. First, place a block or pillow between the feet, while on the ground on all fours. The shoulders should be directly over the wrists, and the

hips should be directly over the ankles. Slowly walk the hands out in front of the body, and then shift the body so the shoulders are still aligned with the wrists. At this time, the hips should be around six inches in front of the ankles. Next, allow the shoulder blades to collapse together, so the head to drops to the belly. This motion should feel like a simple stretch, relaxing the body. Once relaxed, squeeze and release the block or pillow with the inner part of the feet about sixty times, keeping the stomach relaxed. Do not lean too far forward, as this will cause pain in the lower back. The goal of this exercise is to promote extension of the pelvis and spine, allowing the head to rest in its natural place.

A third posture alignment exercise involves wall towels. One stand against a wall with feet straight ahead, about hip width apart. Next, place a towel behind the lower back region, while keeping the head, upper back, and hips against the wall. The use of a towel will stretch the back, neck, and spine. If there is pain, stop immediately. Otherwise, place the back of one's hands against the wall and step forward, about three inches. Hold for about three minutes. This exercise reestablishes the proper curvature of the spine.

According to Rawson, there are also three simple jaw exercises that can help alleviate TMD related pain. The first exercise requires the patient to place their tongue on the roof of their mouth. The mouth should be opened wide, keeping the tongue in place, while breathing slowly in for two counts, out for two counts, and release. This should be repeated ten times. Next, the patient should make a fist and place it directly under their chin. Subsequently, press the fist on the chin, and gently try to open the jaw for ten seconds. Repeat this ten times. Isometric energy should relax the jawbone, but make sure not to induce strain.

A second jaw exercise involves pressing the clenched fist on the left side of the jaw, beneath the hinge. Press the jaw against the fist, maintaining steady pressure for ten seconds, release, and repeat ten times. This process should be repeated on the right side of the jaw. The next step involves pressing against the jaw with one finger on each side evenly, and opening the jaw slowly. Once again, do not induce strain or open the jaw so far that it clicks. The pressure from the fingers should allow the jaw to open and close in its correct alignment. Finally, the jaw and mouth should be loose, holding the chin between thumb and pointer finger. Very carefully and loosely shake the chin back and forth, allowing the jaw to relax and release. If this step does not cause pain, add a repetition and complete daily.

A third jaw exercises involves stretching the jaw, opening widely. Hands can be used to assist the stretching process. Open the mouth about 95%, until it feels stretched in the left and right cheek muscles. Hold this stretch for thirty seconds. Next, close the mouth until the lips touch, with the teeth remaining apart. Maintain this, while slowly pretending to chew a piece of gum. The jaw should be kept straight, so the exercise can realign the jaw. This exercise should be repeated about three to five times a day, four times a week.

Stabilization splints and over the counter night guards are also examples of short term remedies that are cost effective, but are by no means a cure. One of the primary conservative

treatments is the application of stabilization splints for the patients. The mouth guard is a plastic device that fits over the lower and upper teeth. These are the most widely used devices for the regulation of TMD symptoms (Wilkins, 2009). Indeed, guards are commonly employed in the treatment of TMD related pain.

However, the ideal treatment methodology and consequent effectiveness of this method has not been rigorously studied by medical scientists (Web MD, 2015). Guards appear to be effective, but we don't know why or how they succeed. Research has proven some patients feel the use of a dental appliance relieves pain. However, there is no scientific evidence to explain this (Mayo Foundation, 2015). Consequently, patients utilizing expensive custom devices may be spending more money than is necessary. Patients may experience an apparent reduction in symptoms, although the condition itself is possibly worsening.

Fig. 4. Guard

It is integral that patients observe any significant changes, to prevent permanent modification of the jaw structure. Biofeedback is another way for patients to become more involved in their treatment. There are electronic devices available that can monitor the tightness of muscles, visually showing patients how their relaxation and stress management techniques are working (Mayo Foundation, 2015). It is important that they carefully control jaw movement, avoiding unnecessary stretching of the jaw muscles, including movements such as chewing, loud singing, and wide yawning (Colgate-Palmolive, 2015). Patients should keep a journal to measure their symptoms before treatment, to show themselves and their medical provider if treatments are meeting the desired results.

Additional examples of minimally invasive treatments include occlusal splints, pharmacological medication, acupuncture, and chiropractics. These options cost slightly more, but can obtain good results (Tanaka, Detamore, & Mercuri, 2008). Occlusal splints are removable and are used to stabilize the occlusal surface. According to Stephen and Kamakshi (2013), there are five types of splints available. The least invasive is a soft vacuum formed splint, which can be fabricated in the dentist office, to create a short-term relief of pain. There are also localized occlusal splints, interference splints, stabilization splints, and anterior repositionary splints.

According to Inguawale and Goswami (2009), surgery should only be necessary when there is an actual defect or damage to the temporomandibular joint from injury, overuse, or arthritis. Examples of surgical procedures include arthrocentesis, arthroscopy, discectomy, and complete joint replacement. Modern medicine has come a long way, because metal is no longer the first choice in replacements. Doctors should make use of alloplastic materials, and there are even a few labs working on growing new human tissue to replace damaged muscle (Inguawale & Goswami, 2009).

Treatment effectiveness can vary just as much as the cause of TMD. Splints are known to limit the mobility of the jaw, lowering the level of pain, but there is no scientific evidence that proves they actually resolve the issue. Prescription medication also works on a short-term basis, but medications are not meant to be taken forever, so this can become an addictive crutch which merely masks the disorder. Likewise, corticoid and Botox injections often appear to provide quick relief, but this does not last. The use of Botox is an effective method of temporarily minimizing pain (Gangarosa, 1973; Yavuzer & Demirtaş, 2003). However, there is a need for additional research to determine whether this can permanently alter the muscles and jaws, worsening TMD over the long-term (Colgate-Palmolive Company, 2015).

Allan Lokos once observed, “there is no illness that is not exacerbated by stress." This quote explains a direct correlation between mental state and the perception of physical pain. Perhaps, this is why women suffer from TMD more than men, because women report more stress. Therefore, people that suffer from TMD should take notice when they are stressed, and check if they are clenching their jaw, or grinding their teeth. Creating a conscious awareness of the particular scenarios that create stress can help an individual consciously utilize stress management and relaxation techniques. In addition, the patient may use ice packs to control any resulting pain and sensitivity from the jaw muscles. However, this may be tiresome for the patient since it demands repetitive application of the treatment. It is important that the patient control the jaw movement that may lead to extreme stretching of the jaw muscles including movements such as chewing, loud singing, and wide yawning (Colgate-Palmolive Company, 2015). This may lead to discomfort and inflammation of the jaw muscles. There are many options available throughout the world and can meet the financial and physical needs of each individual. If only 5% to 10% of Americans need any type of treatment it should make all of the invasive practices obsolete unless physical abnormalities cripple the use of the jaw in ways that need to be surgically corrected.

As noted, there are more invasive options available, which should be considered as a last resort. For example, teeth can be reshaped or adjusted to correct misalignment (American Dental Association, 2014). A popular surgical procedure is arthrocentesis, during which a surgeon inserts needles directly into the joint, to irrigate and remove debris and other inflammatory byproducts (Mayo Foundation, 2015). However, such irreversible treatments may lead to an

increase in the intensity of TMD, since they could result in a permanent alteration to jaw structure (Web MD, 2015).

Unfortunately, as Walter Cronkite stated “America’s health care system is neither healthy, caring, nor a system." This quote indicates that the health care system is often more of a 'sick care' system, because people rarely receive preventative care while they are still healthy. We know that only ten percent of individuals with some form of TMD actually seek treatment, often waiting until pain becomes severe. It would be prudent to begin treatment as early as possible, utilizing non-invasive procedures before severe complications arise.

We must remember that invasive procedures can worsen the issue they are attempting to treat. Indeed, every surgery carries the risk of disability or death. Meanwhile, the widespread use of pain medications creates an unnecessary risk for addiction. Furthermore, the use of splints can cause tenderness of the teeth, dry mouth, and extra sensitivity of the lower front teeth that are located below the splint (Stephen & Kamakshi, 2013).

Ultimately, there are many treatment options for TMD. According to Inguawale and Goswami (2009), there is often no need for surgical or invasive treatments, as most pain can be alleviated through muscle exercises, physical therapy, and over the counter pain relievers. Furthermore, eating softer foods and the use of heat and ice packs can also help alleviate pain. Treatment should be directed at decreasing joint pain, increasing joint function, reducing swelling, minimizing masticatory muscle reflex, and preventing damage to dental structure (Tanaka, Detamore, & Mercuri, 2008).

According to Psalm 32: 3-4 (King James Version) Selah stated when I kept silent, my bones waxed old through my roaring all the day long. For day and night thy hand was heavy upon me: my moisture is turned into the drought of summer. This psalm explains keeping quiet to not burden others with unnecessary information does not make anything better, and not discussing issues in the body or mental state catches up with people later in life.

After reviewing surveys filled out by patients; it appears that expensive lab manufactured night guards are no more effective than over the counter versions sold by pharmacies and other medical suppliers. Although night guards can be an effective treatment for TMJ disorders, it does not appear that the cost of custom guards is justified for most patients. Of course, there are significant benefits from this treatment, most significantly the prevention of dental fractures. However, it should be possible to achieve this with a simple non-customized guard, saving the patient considerable expense. Quite simply, medical science does not know exactly how facial structure should be aligned, and there is little reason to assume that a custom design will achieve this ideal positioning.

Night Guard Cleaning

If patients do not take proper care of their mouth guard, this can lead to significant health problems. Without regular cleaning and drying, the night guard will take on a foul smell and possibly grow mold. In extreme cases, the mouth guard can be permanently damaged. Consequently, cleaning is an important issue. However, many patients find this to be a burdensome process, and they often fail to clean properly. This is problematic when individuals are using an expensive custom guard, as they risk losing their investment if proper maintenance is not performed.

There are seven recommended cleaning methods. It is usually best to combine these, as no single method is entirely effective. The first method involves the application of toothpaste with a traditional toothbrush. This method is recommended if the wearer is in a rush, and does not have time for a more thorough cleaning methods. However, the toothbrush may be too coarse and can damage the device, leaving scratches that attract plaque and mold.

The second method involves mouthwash, and this is the most highly recommended. Most people soak the entire appliance for approximately ten minutes. However, the color of the mouthwash has the possibility to stain the guard, and the acidic liquid will eventually weaken its structure. Soap and water is also recommended, especially when the guard is new and freshly removed from packaging. However, failure to adequately clean off the soap can leave the guard with a bitter taste. Indeed, foul odors and tastes are one of the major reasons that patients wind up refusing to wear their guard.

A fourth method involves denture-cleansing tabs. These sanitize like mouthwash, and can also remove stains. Meanwhile, a fifth cleaning method involves a dental sanitizing device, which uses sonic or ultraviolet light. In some models, the devices include a location to store the guard. Unfortunately, both of these methods are more expensive, but this may be worth it, especially if using an expensive custom device.

A sixth method involves everyday items that can be found in the home. Examples of these items include: hydrogen peroxide, bleach, vinegar, and lemon juice. Proper research should be conducted before attempting any of these methods, because the material may be damaged by these chemicals. Finally, patients can also opt for a professional dental cleaning. This should be done twice at a year, usually during a routine dental visit.

Despite rigorous cleaning, patients should never share night guards, because they are a breeding ground for bacteria, viruses, and fungus. Without proper cleaning, bacterial infections can cause gum recession, tooth decay, lesions, and gingivitis. If untreated, this can affect the heart and lungs, potentially resulting in death. Another problem with sharing custom night guards is the fact it will not fit properly, since the guard is molded to the one individual’s mouth and jaw. Wearing a loose night guard will counteract the benefits of using the night guard, while continued use of a tight night guard can disrupt alignment.

The Need for Higher Quality Disposable Night Guards

During discussion with Burgos, it became clear that many users are unable to afford custom fit units. Although Burgos acknowledges that a disposable unit may still produce acceptable results, he feels it's unlikely without dramatic innovation to the current production process. Nevertheless, even though he would lose the unproven advantage of a custom fit guard; disposable guards are much cleaner, more time efficient, and reduce the health risk of plaque buildup. Consequently, there is an identified market for affordable lower quality devices that still provide similar benefits.

A similar situation exists with Alicea, who noted that the cost of her device was approximately $300, and yet she has not experienced any benefit. Alicea's situation suggests that many patients are disappointed with the performance of their custom night guards, and wish avoid the expense. With this in mind, a disposable device provides another advantage, as it allows the patient to try a night guard without investing in a custom unit. Some patients may find that they are satisfied with this temporary solution, willing to pay more over the long-term in return for ease of cleaning.

These conclusions also appear relevant to the situation of Pedro, who noted that he only cleaned his guard approximately once a month. Indeed, while it is imperative that patients keep their guard clean, doing so can be difficult. Users will need to utilize a number of time-consuming methods on a daily basis including: brushing, soaking in mouthwash, or utilizing expensive cleaning tablets. The principal advantage of a temporary device is that one no longer needs to engage in these activities. Not only will temporary units improve sanitation, they are also likely to encourage users to wear the device more often, as many are deterred from wearing an unclean guard.

Without further research into the marketing and development aspects of this solution, it is difficult to discern exactly how a disposable device should be designed or sold. Of course, there are disposable guards available (including a model by Plackers), which sell for approximately one dollar per guard. This clarifies that they can be produced affordably, and it may be possible to develop a superior semi-disposable product that sells for a slightly higher retail.

It is my contention that patients desire a midrange disposable device, balancing cost and effectiveness. Currently, production is directed at two extremes, with patients forced to choose between expensive custom guards and inadequate cheap devices. Perhaps, for a few dollars more, it will be possible to develop a disposable unit that adequately serves patient needs, recognizing that there is little evidence to suggest that custom guards are effective.

Attempting to balance between permanent and disposable devices, research should be directed toward the production of an affordable semi-permanent unit that can be worn for a moderate amount of time. Ideally, such a device should be designed in a way that it is self-cleaning. With recent advancements in nanotechnology and layered resins, it may be possible to

apply a coating that deters biological growth and thereby reduces the need for cleaning. This will save patients considerable time, and encourage use of the device. Meanwhile, instead of being urged to purchase an expensive custom device, patients should be informed of non-invasive treatment options such as massaging and stress reduction therapy.

"The cost of a thing is the amount of what I will call life which is required to be exchanged for it, immediately or in the long run" (Thoreau, p. 20, 2007). When Henry David Thoreau wrote those words, he was referring to the idea that all things that are bought require a specific amount of time to work for prior. So, logic would dictate that a person should only make the effort to meet a need, and when that need is met, victory can be declared in its own way. Need can be defined as an affliction that must be coped with, and the affliction of temporomandibular joint disorder (TMJ) has several different theories about how to treat it. Following Thoreau's wisdom, the greatest balance between cost and effectiveness is what should be sought.

This research, on patients living in New York City during the summer of 2015, has proven that simple-cost effective treatments like store bought night guards can alleviate the symptoms caused by TMJ disorders as efficient as more expensive appliances such as laboratory made night guards.

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