Original Article

Use of the TMJ – MBV appliance in the treatment of the initial symptoms of wilkes stage 2 internal derrange ment of the temporomandibular joint – a follow up study

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Abstract

Introduction

The Temporomandibular joint (TMJ) is considered a highly complex joint, and TMJ disorders are commonly seen in the general population. Internal derangement, where the disc is not in the normal relationship with the condyle and the fossa, is also on of the commonly seen disorders. Many treatment options are available in the literature , from conservative therapy to physiotherapy and splint therapy to surgical treatment of these disorders.

Materials and methods:

50 patients , both males and females were examined in the dental opd of Kathmandu Medical College for internal derangement of the TMJ and patients with wilkes stage 2 disorders were selected . all the patients were give the TMJ – MBV appliance for a period of 2 months. All the patients were recalled for follow –up at regular time intervals; day 7, 15, 30, 45 and after 60 days. Consequently, the symptoms pertaining to wilkes stage 2 disorder like pain, clicking, difficulty in mouth opening and mastication were evaluated.

Results:

pain arising in the TMJ was seen to decrease from 82% to 4 % of the patients after a period of 45 days of appliance wear. Pain radiating to the adjoining areas was seen to decrease almost immediately , from 15% to 4 % after the use of the appliance. (74%) of the patients had the clicking sound which diminished after 60 days of follow – up to 20 %. All the patients had an increase in the inter – incisal distance, with the mean distance increase 27.30mm to 30.50mm after 2 months.

Conclusion:

The short term use of the TMJ-MBV appliance has a beneficial role in the treatment of the initial signs and symptoms of disc derangements like the elimination of pain and clicking sounds , represented by wilkes stage 2 internal derangement of the TMJ. This appliance has been found to prevent the progression of TMD disorders to degenerative joint disorders which are amenable to treatment by surgical methods only.

Keywords:

Condyle, temporomandibular joint, TMJ-MBV appliance

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Introduction

The Temporomandibular joint (TMJ) is a complex, sensitive, and a mobile joint. Temporomandibular joint disorders, commonly known as TMJ Disorder or TMD, are common in the general global population. A Cross-Sectional Study performed by Paulo Cesar R. conti et. al on the Prevalence and Etiology of Signs and Symptoms of Temporomandibular Disorders in High School and University Students in Brasil concluded that 41.3% had TMD symptoms, mainly pain and clicking sounds[1]. The TMD is frequently a causative agent or a significant aggravating factor in such common symptoms such as tension headache, migraine, facial pain, ear pain, and tinnitus. Otalgia and tinnitus are reported by as many as 65 percent of TMJ sufferers, due to the close proximity of the external auditory meatus to the TMJ and to tension on structures such as the discomallear and malleomandibular ligaments[2]. TMJ derangements are also one of the major causative factor of orofacial pain which leads to a reduced jaw function.

Studying the biomechanics of the TMJ enables us to understand the structure and function of a normal and a diseased TMJ, to predict changes due to alterations, and to propose more efficient methods of treatment[3]. The treatment of TMJ internal derangement disorders can vary from simple self-care methods like physiotherapy, muscle relaxants and oral appliance therapy to more complex procedures like arthrocentesis and temporomandibular joint surgery.

The Abnormal Joint – Disc Displacement With Reduction

Coordinated movement of condyle and disc is essential to maintain the integrity of the disc. Disc displacement is the most common TMJ arthropathy and is defined as an abnormal relationship between the articular disc and condyle. As the disc is forced out of the correct position there is often bone on bone contact which creates additional wear and tear on the joint, and often causes the TMD to worsen. Disc displacement generates a clicking (popping) sound when the disc is first forced out of alignment as the mouth opens up and then again as the disc is forced back into place as the mouth is closed. Clinically, this popping sound or clicking is regarded as an initial symptom of the temporomandibular joint internal derangement (TMJ-ID). The anterior disc displacement has different degrees of severity, classified by Wilkes[3].

Wilkes' staging classification of internal derangement of TMJ with respect to clinical, radiologic, and surgical findings.

	Early Stage	Early Intermediate Stage	Intermediate Stage	Late Intermediate Stage	Last Stage
Clinical	No significant mechanical symptoms other than opening reciprocal clicking, no pain or limitation of motion	One or more episodes of pain; beginning major mechanical problems consisting of mid-to-late opening loud clicking; transient	Multiple episodes of pain; major mechanical symptoms consisting of locking (intermittent or fully closed); restriction of motion; difficulty with function	Slight increase in severity over intermediate stage	Characterized by crepitus; variable and episodic pain chronic restriction of motion and difficulty with function
Radiological	Slight forward displacement; good anatomic contour of the disc; negative tomograms	Slight forward displacement; beginning disc deformity of slight thickening of posterior edge; negative tomograms	Anterior disc displacement with significant deformity or prolapsed of disc (increase thickening of posterior edge); negative tomograms	Increase in severity over intermediate stage; positive tomograms showing early-to-moderate degenerative changes; flattening of eminence; deformed condylar head, sclerosis	Disc or attachment perforation; filling defects; gross anatomic deformity of disc and hard tissues; positive tomograms withessentially degenerative arthritic changes
Anatomic Pathology	Excellent anatomic form; slight anterior displacement; passive in-coordination demonstrable	Anterior disc displacement; early anatomic disc deformity; good central articulating area	Marked anatomic disc deformity with anterior displacement; no hard tissue changes	Increase in severity over intermediate stage, hard tissue degenerative remodeling of both bearing surfaces (osteophytosis); multiple adhesions in anterior and posterior recesses; no perforation of disc or attachments	Gross degenerative changes of disc and hard tissues; perforation of posterior attachment; multiple adhesions; osteophytosis; flattening of condyle and eminence; subcortical cyst formation

This article presents a short term follow –up study on the efficacy of the TMJ appliance as an immediate and effective method to treat the early signs and symptoms of wilkes stage 2 TMJ internal derangement.

Materials And Methods:

A total of 50 patients, complaining of problem in one or both the TMJ , were examined at the OPD of the dental department at Kathmandu medical college and teaching hospital over a period of 1 year. Patients having complaints like pain , particularly in and around the joint radiating to the face, neck ,or shoulders, or near the ear, limited movement of the jaw, with clicking or popping sounds when opening the mouth causing difficulty in chewing, headaches and a change in the occlusion were included in the study. Our study was focused only for Wilkies stage 2 disorder, i.e disc displacement with reduction, as this included the initial signs and symptoms of a more advanced disorders. A general protocol was made to treat these patients , the protocol being divided into conservative therapy and appliance therapy. The exclusion criteria in our study were patients suffering from a more severe TMD disorder like disc displacement without reduction, degenerative joint diseases,, MPDS , patients with trauma patients who non-compliance to appliance therapy .

An orthopantomogram (OPG) and the TMJ view (open and closed mouth) was advised to each patient to visualize the condyle and its relationship with the glenoid fossa and the articular eminence. The condyle was evaluated for the presence of any disorder namely flattening of the head of the condyle (osteophyte) or any dislocation of the condyle.

Then , the patients were examined clinically , based on the following examination procedure:

- Inter – inscisal opening, which is normally in the range of 30 - 40 millimeters, sometimes approximated as “three finger widths.”
- Deviation on opening mouth
- Derangement of occlusion
- Firm bilateral palpation of temporalis muscles in the anterior, middle, and posterior segments.
- Firm bilateral palpation of the masseter muscles at their zygomatic origins, at their mid-bellies, and at their insertions on the mandible.
- Light palpation over both TMJs during maximal opening and closing to detect joint noises and irregularity in movement.
- Firm palpation with the small fingers in the patient’s ears as the patient opens and closes the mouth.

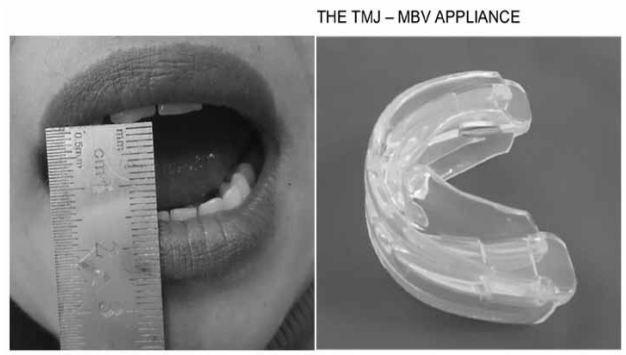
After a thorough clinical examination of the TMJ and the muscles of mastication, the patients were prescribed with oral muscle relaxants along with a combination of alternating heat and cold therapy for at least two weeks. A combination of paracetamol and chlorzoxazone was prescribed twice daily along with a topical application of diclofenac cream with a gentle massage extra-orally in the concerned TMJ region was advised to all the patients. All the patients were instructed to undergo physiotherapy and exercises of the jaws for a more effective result.

Pictorial Representation of the Appliance Therapy:

Pre-treatment
(before appliance insertion)

During appliance insertion

Intra-Oral Picture with the appliance



All the patients were instructed to wear the appliance for at least 8 hours a day at regular intervals, with each interval of at least 2 hours. Patients were instructed to remove the appliance while eating and at night.

All the patients were recalled at regular intervals , i.e on day 7, 15, 30, 45 and 60th day of the appliance therapy. They were examined mainly for any improvements on pain, clicking sounds, increase in interincisal distance, and deviation on opening mouth.

The TMJ appliance is a prefabricated , soft, flexible (silicone) type of appliance. This appliance is mostly used in patients having TMJ disorders showing pain and clicking sounds, characteristics of the wilkes stage 2 internal derangement. It works as a anterior repositioning appliance. The mechanism by which this appliance works is that it temporarily holds the mandible in an anterior and downward position, where the condyle is positioned onto the disc's intermediate zone, also referred to as the location where the condyle is reduced onto the disc5. There are two mechanisms by which the TMJ appliance helps to reduce the TMD symptoms: (a) it removes the disc-condyle mechanical disturbance, and (b) it transfers the condylar loading forces from the retrodiscal tissue to the intermediate zone.

Relationship of condyle to the disc and articular eminence during appliance use

Results:

A total of 50 patients , within the age group 17 to 40 years were studied for the efficacy of the TMJ – MBV appliance along with additional supportive therapy for the immediate management of symptoms related to TMD disorders. Out of the 50 patients, 24 were males (48%) and 26 were females (52%). All the patients were subjected to x ray , where an orthopantomogram (OPG) and a TMJ view (with open and closed mouth) were taken. Out of the 50 patients, 26 had a normal TMJ profile (52%) , where the condyle was round and placed in the glenoid fossa and there were no abnormalities seen (fig 1). The rest of the patients had some pathology; 16 had the presence of flattening of the condyle (32%) with the formation of osteophytes either in a single joint or bilaterally. 8 patients (16%) had their condyles displaced anteriorly from the glenoid fossa

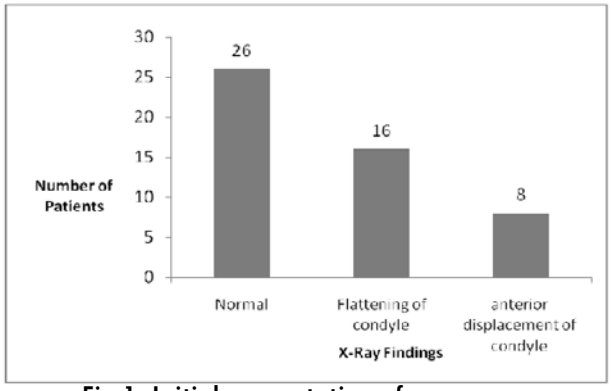


Fig 1: Initial presentation of x-ray

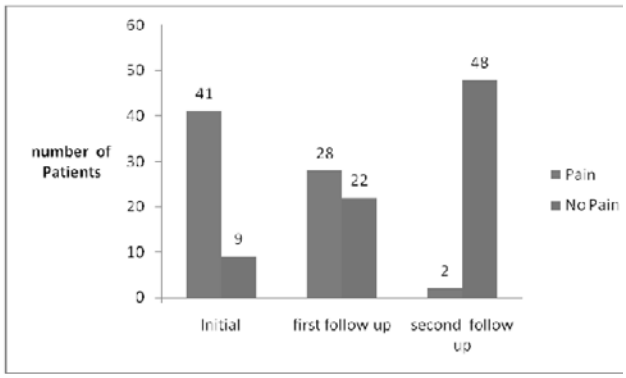


Fig 2: Presentation of pain in the joint proper: in the initial stage, the first follow-up at day 15 – 45 and the second follow-up at day 45 – 60

All the patients were evaluated for pain in the joint proper, either unilateral of bilateral (fig 2). At the time of presentation, 41 patients (82%)

complained of pain in the joint (either unilateral or bilateral) and were having difficulty chewing. Subsequent follow up, at days 15 to 45 revealed a decrease in the number of patients presenting with pain in the joint , with the percentage going down to 56%.further follow-up after 45 days of appliance therapy showed a drastic decrease (4%) in the patients presenting with pain in the joint .

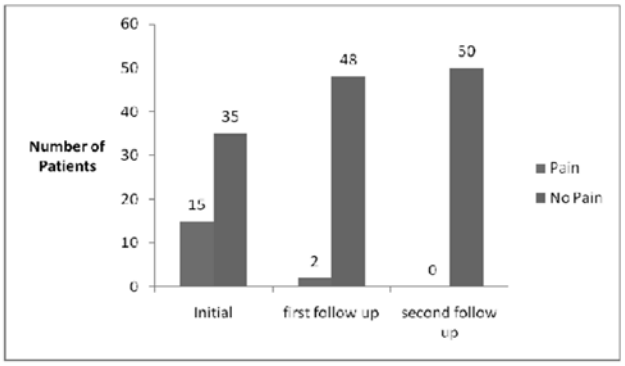


Fig 3: Presentation of pain radiating to the adjoining areas: in the initial stage, the first follow-up at day 15 – 45 and the second follow-up at day 45 – 60

Fig 3 shows the effectiveness of the TMJ-MBV appliance in the reduction of the TMD symptom: mainly radiating pain to surrounding areas, like the ear, the temporal region and the cervical region. 15 patients had presented with radiating pain to adjoining structures along with the tmj joint pain but follow up after 15 days showed that only 2 patients (4%) did not have relief from the appliance , but subsequent follow up after 45 days showed that all the patients were symptom free from pain.

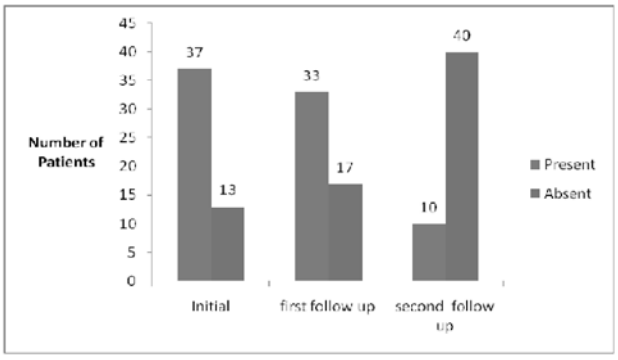


Fig 4: presentation of clicking (popping) sound : in the initial stage, the first follow-up at day 15 – 45 and the second follow-up at day 45 – 60

37 patients presented with clicking (popping) sound (74%) which decreased to 33 patients in the first follow-up period (66%); further decrease in the number of patients were seen during the second follow up period , to only 10 patients (20%).

	Min-Max	Mean	SD
Initial	17-35	27.30	3.929
first follow up	20-35	29.24	2.654
second follow up	23-36	30.50	2.043

Fig 5 : presentation of inter-incisal distance : in the initial stage, the first follow-up at day 15 – 45 and the second follow-up at day 45 – 60

Another important sign of the TMD is the decrease in the inter–incisal distance (IID). The initial presentation showed that among the 50 patients, the inter-incisal distance ranged from 17 to 35 mm, with the mean IID 27.3 mm . follow up after 15 to 45 days showed an increase in the mean IID (29.24mm) with a decrease in the standard deviation. Further follow – up showed that the mean IID was 30.50mm with a further decrease in the standard deviation. This showed the effectiveness of the TMJ-MBV appliance in increasing the IID in the first 2 months of the appliance therapy

Discussion

Temporomandibular joint (TMJ) connects the mandible or the lower jaw to the skull and regulates the movement of the jaw . It is a bi-condylar joint in which the condyles, located at the two ends of the mandible, function synchronously[5,6,9]. The important functions of the TMJ are mastication and speech. The most common TMJ disorders are pain dysfunction syndrome, internal derangement, arthritis, and traumas. With millions of people suffering from this disorder globally, TMD is a problem that should be looked at more carefully, since a small problem initially can lead to a more complex problem in the long run. Since the cause of a large fraction of TMD are currently unexplained, the better understanding of the etiology of TMDs will help prevent the reoccurrence of TMDs in once treated patients, having a history of a TMD. At Wright State University, Dayton, Ohio; research efforts were focused on developing 3-D models of asymptotic and diseased TMJs of men and women of different age groups to enable better understanding of joint motion and forces [5]. The finite element analysis of these models provided useful information about the contact stresses

that possibly contributed to the dysfunction of the joint.

There are several methods proposed in the literature, as part of the management of TMJ pain and dysfunction. These include initial conservative procedures like physical (physio) therapy, pharmacotherapy , counseling, occlusal treatment and splint therapy[6] to complex procedures like arthocentesis and in extreme cases, TMJ joint surgery. Our main focus in this study was the effectiveness of the TMJ-MBV appliance, when used along with other adjunct therapy in the treatment of the initial signs and symptoms of TMD like pain and clicking , deviation on opening and the easiness of mastication and speech. Based on its non-invasive and conservative features, the TMJ-MBV appliance is an important part of the occlusal therapy treatment[4]**.** Some types of occlusal splint therapies are the use of the nightguard, anterior bite plane, the posterior bite plane, the anterior repositioning appiiance and the stabilizing splints[7,8]**.** Although extensively studied**,** the usefulness of these modalities in recapturing the disc, decreasing pain and eliminating joint clicking, as well as an ideal design and wearing protocol have not been established so far[10]. The concept of "evidence-based dentistry, very well accepted in the modern dentistry, has, however, resulted in a new perspective in the field of pain and dysfunction, and one such treatment modality is the use of an occlusal appliance[11].

The TMJ-MBV appliance has a lot of advantages over the conventional intraoral splints. The appliance has a thick posterior section (air spring base) which helps in relieving pressure by gently decompressing the inflamed joints when placed in the oral cavity . Presence of breathing holes in the anterior part of the appliance allows for easy breathing with the mouth open. Again the presence of a tongue guard at the inferior part of the appliance helps in controlling of the tongue position for ease in appliance use. The TMJ – MBV appliance also helps in stretching the tight and painful muscles around the mandible, head and neck area resulting in an immediate decrease in pain[4]. Our patients also had an immediate relief from pain , especially in the adjoining areas , the effectiveness seen in the first 2 weeks of appliance therapy[6], where only 2 patients still had persistent pain. This was because the patient had difficulty in wearing the appliance and they were refusing to wear the appliance for the designated period of time. The patients, after minor adjustments in the appliance, showed compliance to the treatment and were also relieved from pain.

Out of the 41 patients presenting with joint pain, 37 patients also had clicking sounds that could be well appreciated in one or both the joints. Although 48 patients had a relief of pain after 45 days of treatment, 10 patients still had a persistent clicking sound. Rest of the patients had an elimination in the joint noise. In a study, Kurita, et al [12] have described successful disc recapturing in displacements with reduction. This resolution of clicking was probably due to morphological alterations in the disc itself, especially in its posterior region, eliminating the physical obstruction for translation, and consequently decreasing the sound[5] . Therefore, when this appliance is placed in the mouth and the patient occludes on this appliance, the condyle is maintained in the reduced position, thus removing any mechanical obstruction , which in turn reduces the TMJ sounds like clicking or popping . If the mechanical disturbance responsible for the joint noise irritates the TMJ, and the patient has parafunctional habits that continually stimulates this disturbance, wearing the appliance minimizes the consequent irritation. This affirmation, however, would require more sophisticated diagnostic tools, set as "gold standard", such as magnetic resonance image (MRI), not used in the present study.

For the 10 patients, there was persistence of clicking sound , mainly because 6 patients had a history of bruxism and 4 patients had a deviation on opening their mouth. All these patients had a derranged occlusion , with some having a class 3 malocclusion and others presenting with a deep bite. For the patients with bruxism, the appliance was beneficial in the long run, with relief of the usual symptoms of TMD. This was because of the patent aerofoil shaped

base and the dual moulded design[4] . Clenching during use of this appliance caused the force generated to get transmitted through the condyle and thus caused loading of the disc's intermediate zone rather than the retrodiscal tissue. Intuitively, this also helped benefit patients with retrodiscal tissue inflammation.

Sindelar, et al. [13] have found increased thickness of posterior band of miniature female pigs after wearing splints for two months. Remodeling of the disc is also suggested as a result of splint wearing [14] .The decompressing effect of such splints, however, has been questioned. Prolonged use, on the other hand, could stimulate the formation of a retrodiscal fibrosis and the establishment of a pseudodisc [15]. In the present study, after a period of initial use of the TMJ-MBV appliance for 2 months, all the patients were given stabilizing splints at once, as a gradual return to an intercuspal position has been proposed in the past [9].

Maintaining the mandible at the desired anterior location for an extended period may occasionally aggravate a patient's TMD symptoms. In our study, 3 of our patients complained of an increase in the TMD symptoms like pain and difficulty in opening the mouth. Therefore, we had to discontinue the use of the appliance and these patients were excluded from our study. Therefore, it appeared that only patients who met with all of the following criteria had a high probability of gaining improvement from this appliance[5]:

1. The patient's TMJ mechanical disturbance appeared to be related to his or her pain.
2. The TMJ noise , like clicking and popping, had been eliminated by placing the mandible in the recommended anterior position.
3. The masticatory system felt more relaxed on the whole, or comfortable with the mandible located in the recommended anterior location.

There was no improvement in the deviation of the mouth on opening in such patients even after 2 months follow –up, nor were the occlusal derangements improved. This again clearly showed that the TMJ appliance was only useful to treat the initial signs and symptoms of the TMD. For these patients, phase II therapy was started after the symptoms of the TMD like pain and clicking sound subsided. For our patients, the most important phase II therapy consisted of orthodontic therapy. Other treatment modalities of the phase II therapy include grinding or reshaping of the teeth, placement of crowns and bridges, and surgery. Two of our patients who were not included in the study had presented with a grating sound with severe pain. X –ray showed signs of a degenerative joint disease (Wilkes stage 5) and were adviced for joint surgery.

There was a significant increase in the proportion of patients who had a limited mouth opening due to pain and clicking , represented by the inter-incisal distance. The inter-incisal distance increased from a mean value of 27.30 mm with a standard deviation of 3.929 to a mean value of 30.50 mm with a SD of 2.043. This increase in the inter-incisal distance over 2 months of appliance therapy was because of the improvement in the symptoms of TMD. As the pain and the clicking sounds subsided, the patients found it easier to masticate and were able to move their mandible freely.

Conclusion

In our study, we found that short term use of the TMJ-MBV appliance has a beneficial role in the treatment of the initial signs and symptoms of disc derangements like the elimination of pain and clicking sounds , represented by Wilkes stage 2 internal derangement of the TMJ. Therefore, this appliance can be used to prevent the progression of TMD disorders to degenerative joint disorders which are amenable to treatment by surgical methods only. This appliance has been found to have better patient compliance, fewer side effects, and is more cost-effective than surgical treatment.

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