Efficacy of physiotherapy and intraoral splint in the management of temporomandibular disorders

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إن الهدف من هذه الدراسة هو المقارنة ما بين فعالية طريقتين لعلاج اضطرابات المفصل الفكي الصدغي, إحداهما باستخدام العلاج الطبيعي و الأخرى باستخدام الجبيرة الفموية أما بالنسبه للعلاج الطبيعي فقد تم استخدام نوعين من الأجهزة , الأول جهاز الأثاره الكهربائية للأعصاب,(TENS) أما الثاني فهو جهاز الموجات فوق الصوتيه .(US) و تم إجراء الدراسة على عينه مكونه من ٥٧ مريضا (٩ رجال و ٤٨ امرأة) تتراوح أعمارهم ما بين ١٦ – ٥٢ سنه جميعهم يعانون من اضطرابات في المفصل الفكي الصدغي , ولقد تم الاختيار بطريق عشوائية (مريضين كل أسبوع).و بالنسبة لطريقة العلاج فقد قسم المرضى إلى مجموعتين , تم علاج الأولى باستخدام الجبيره الفموية والثانية تم علاجها باستخدام العلاج الطبيعي و تم تقسيم المجموعة الثانية إلى مجموعتين متساويتين وضعت الأولى تحت المعالجة بواسطة جهاز الأثاره الكهربائية للأعصاب والأخرى بواسطة جهازالموجات فوق الصوتيه ثم طلب من كل مريض أن يقوم بتقييم درجة الألم وقت الزياره ثم تعبئتها ضمن جدول .(VAS) بعد الإطلاع على الجداول أوضحت الدراسه انخفاضا في درجات الألم لجميع المرضى المعالجين سواء باستخدام طريقة العلاج الطبيعي أو طريقة الجبيره الفموية وذلك ما بين الزيارة الأولى والزيارة الأخيرة (الرابعه) أثناء فتره العلاج. و كنتيجة لهذه الدراسه تبين أنه لا يوجد فرق في استخدام العلاج بطريقة الجبيره الفموية أو العلاج الطبيعي كوسيلتين لعلاج اضطرابات المفصل الفكي الصدغي. كماوقد تبين من الدراسه أن العلاج باستخدام جهازالموجات الفوق صوتيه أكثر فعاليه من استخدام جهاز الأثاره الكهربائيه للأعصاب في معالجة اضطرابات المفصل الفكي الصدغي.

The aim of this study was to compare the efficacy of two physiotherapy modalities of treatment (TENS and US) with intraoral stabilization splints in the management of TMD patients. A sample of 57 patients (9 male and 48 female) in the age range of 16-52 years, with confirmed TMD diagnosis were chosen in a systematic random basis (2 cases/week). Patients were allocated randomly into two main groups, a physiotherapy group and intraoral stabilization splint group. The physiotherapy group was further divided randomly into two subgroups. The first received TENS treatment and the second one received "US" treatment. The patient on Visual Analogue Scale (VAS) did a rating of pain. A significant decline in pain scores ($P<0.05$) was observed in both physiotherapy and intraoral stabilization splint TMD groups from the first to the last fourth visit. However, no significant difference ($P<0.05$) was observed between the use of physiotherapy and intraoral stabilization splint in the treatment of TMD. Ultrasound therapy in this study was found to be more effective in the treatment of TMD compared to TENS therapy.

Introduction

The aetiology of TMD is not straightforward. Both central and peripheral factors appear to be important in respect of both morphofunctional (occlusion, bruxism) and physiological factors, Implicated as multifactorial causes.[1] Treatment plan for TMD should not be determined solely by the disorder but also and more important by the individuals needs.[2] However, treatment options for TMD include counseling, physiotherapy, pharmacotherapy, splint therapy, intra-artiular steroids and surgery.[2] Although it is generally believed that physiotherapy (PT) plays an effective role in reducing the pain and restricted function associated with temporomandibular disorders (TMD), a few studies in the efficacy of physical therapy for TMD have been conducted.[3]

During the past decade there have been an increasing interest in the use of transcutaneous electrical nerve stimulator (TENS), in the treatment of muscles and joint pains. The results obtained by TENS were debatable whether they are due to placebo effect or a true neurophysiologic effect.[4,5] Two theories have been suggested in respect to the neurophysiologic mechanism. The gate control theory,[6] which suggests that the stimulation of thick, myelinated sensory fibers (A-fibers) blocks the impulses of thin pain-modulating fibers (C-fibers) and closes the gate to pain signals at this level of entry into the spinal cord. This theory forms the basis for use of high frequency (HF) TENS. The other theory which was reported by SjöLund and Eriksson[7] was called "acupuncture-like TENS theory." It suggests that electrical stimulation releases endogenous morphine-like substances with analgesic properties. On this theory, use of low frequency (LF) TENS was based. The documented use of ultrasound therapy in TMD is yet another modality of treatment. Ultrasound therapy (US) has two main effects.[2]

Firstly, thermal effect due to an increased tissue temperature caused by absorption of the ultrasound waves which leads to increased blood flow. Secondly, a mechanical effect caused by ultrasound waves producing pressure changes in the tissue resulting in micromassage. This also increases the flexibility of collagen fibers, hence increases the breakdown of fibrous and scar

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tissue. Intraoral stabilization splints (ISS) have long proven to be of a great therapeutic value in the management of TMD, although their precise mode of action is far from clear.[8] Numerous seemingly sensible reasons have been proposed to account for how I.S.S. may contribute to pain relief. Popular convictions include: reduction in muscle hyperactivity, a change in occlusal vertical dimension, reduction in intra-joint pressure, placebo effect, behavioral modification via cognitive awareness lingual response to oral space restriction,[9] changing for existing occlusal relations including potential malocclusions and also altered changes in the relationships between the articulating surfaces within the temporo-mandibular joint.

The aim of this study was to compare the efficacy of two physiotherapy modalities of treatment (TENS and US) with intraoral stabilization splints in the management of TMD patients.

Materials and Methods

This study was conducted in Al-Ahsa Dental Center and King Fahad Hospital-Hofuf (KFHH), Department of Physiotherapy. Al-Ahsa Dental Center and KFHH are both located in Al-Ahsa province in the Eastern area of Kingdom of Saudi Arabia (KSA). A sample of 57 patients (9 males and 48 females) aged 16-52 years, with confirmed TMD diagnosis were chosen on a systematic random basis (2 cases/week). Written informed consent was obtained from all patients and the protocol of the study was approved by the ethics committee of Al-Ahsa Directorate of Health Affairs, (KSA).

In this study, a TMD diagnosis was established if the patient had one or more of the following conditions: pain in the masticatory muscles, in the temporomandibular joint and in associated hard and soft tissues, limitation in jaw function and sounds in temporomandibular joint.[10]

Patients were screened using the Abridged Psychiatric Self-rating Questionnaire (APSQ)[11] to exclude any psychiatric overlay on these TMD patients. Patients were initially allocated randomly into two main groups, a physiotheraphy group and intraoral stabilization splint group.

The physiotherapy group was further divided randomly into two subgroups. The first subgroup received TENS treatment while the second received US treatment. Department of Physiotherapy of KFHH has used the two modalities successfully for treatment of many other musculoskeletal disorders.

The TENS appliance used was of high frequency (HF) type (model ENS 911-ENRAF NONIUS-Holland) with pulse width 0.15 m sec. The frequency was set to 100 Hz, while the stimulus intensity was adjusted to patient tolerance and continuous sensation. Patients received alternate day treatment sessions (30 mins), each week continuously for four weeks. The used US appliance was of the type (Sonopulse 463-ENRAF NONIUS-Holland) with output 0.25 watt/cm2 and pulse at 2-1.

The US is a site specific, and was applied with small probe directly over the skin through a medium, for 3-5 mins. All patients, treated with US received weekly three treatment sessions each week for four weeks. The I.S.S. was constructed on the upper models of the patients with heat activated polymethylacrylate. The upper and lower models of patients were mounted on a semi-adjustable articulator using face bow record and in a registered centric relation. Chairside adjustment of the splint later resulted in a balanced static occlusion, in centric relation. A smooth and shallow anterior guidance approximately 45 degrees at the front of the splint provided a lasting posterior disocclusion.[12] The patients were instructed to wear their intraoral stabilization splint throughout the night and as much as possible during the day, for three months. The patients were weaned off gradually from the appliance in the fourth month. A rating of pain level was marked by the patient before and after treatment using a Visual Analogue Scale (VAS). The VAS is a 100 mm horizontal line representing a pain continuum.[13] At one end of the line are the words "least possible pain", and at the other end, "worst possible pain". Respondents were instructed to mark at the point that corresponds to their amount of pain perceived. The mark was then translated to a numerical value from 0 to 100. After a base line scoring, the patients were either supplied with intraoral stabilization splint or sent to the physiotherapy department to randomly receive either US or TENS.

The patient was considered improved if he has shown a regular and marked reduction in pain scores from the first visit to the last visit. Data were collected and statistically analyzed using an Epi Info 6.[14]

Results

The mean age of the physiotherapy group was 30.00 ± 11.49 years (n= 30) while that of the splint group was 25.04 ± 8.7 years (n = 27). As shown in

Figure 1, no significant difference was observed in the level of education between the two study groups ($P > 0.05$), were cross-matched.

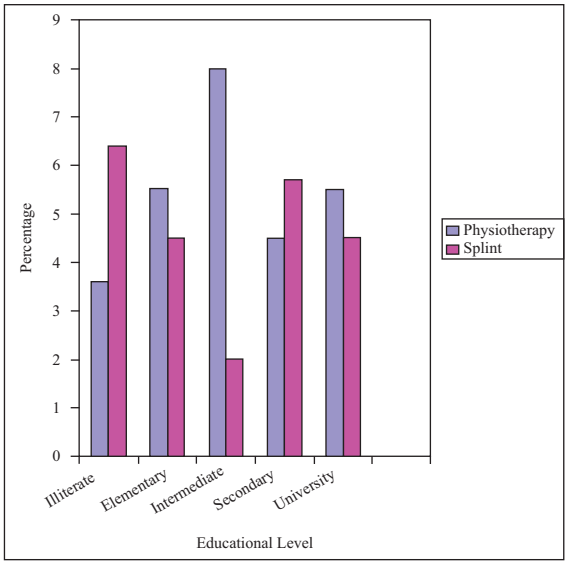

Fig. 4. Level of Education among both studied group.

Significant differences in pain scores ($P < 0.05$) were observed in both physiotherapy and intraoral stabilization splint TMD groups from the first to the last visit of pain evaluation (Tables 1 and 2). Following treatment, 22 cases (73.3%) of the physiotherapy group showed improvement in their TMD condition while on the splint group only 19 cases (70.4%) showed improvement. No significant difference was observed between the two treatment groups ($P > 0.05$). However, significant statistical differences were observed between the two physiotherapy modalities of treatment ($P < 0.05$). The ultrasound group showed a higher success rate of 93.3% improvement while the TENS showed only a success of 53.3%.

Table 1. Mean values of subjective pain score among physiotherapy patients (30)

Weekly Visits	X	Standard Deviation	Paired *t* Test	*P* value
Visit 1	7.43	± 1.25		
			4.64	< 0.05
Visit 2	5.73	± 2.16		
			2.26	< 0.05
Visit 3	4.93	± 2.57		
			4.77	< 0.05
Visit 4	3.17	± 3.01		

$\bar{X}$ = The arithmetic mean

Table 2. Mean values of subjective pain score among stabilization splint patient ($n = 27$)

Monthly visits	X	Standard Deviation	Paired *t* Test	*P* Value
Visit 1	7.07	± 1.41		
			3.129	< 0.001
Visit 2	6.15	± 1.96		
			7.56	< 0.01
Visit 3	4.41	± 2.14		
			2.04	< 0.05
Visit 4	3.52	± 3.30		

Discussion

Current research has reinforced the view that TMD patients suffer from musculoskeletal condition, and present with problems which are heterogeneous in nature and multifactorial in aetiology.[8] Zarb *et al.*[8] described the management of TMD as a condition and not as a disease entity and hence it can only be managed rather than cured. Clark *et al*[15] in their review recommended that physical therapies used in the treatment of TMD because these therapies should be effective for other pain conditions. Dahlström[16] concluded that no particular conservative treatment method for TMD appeared to be more efficacious than any other. In the present study no significant difference ($P < 0.05$) could be observed between the use of physiotherapy and intraoral stabilization splint in the treatment of TMD. However, Linde *et al.*[17] compared TENS with occlusal splint and found that the number of patients with at least 50% reduction in pain was significantly less in the splint group than in the TENS group.

Pain provoked by function is the signature of TMD.[18] Resting pain unrelated to jaw function is less common and should direct clinician to suspect other disorders.[19] This is the rationale why pain was used in this study as a parameter to detect the degree of progress in TMD treatment. Significant reduction in pain scores following treatment was observed in the present study in both physiotherapy and intraoral stabilization splint groups. However, the treatment period was significantly shorter in physiotherapy group (3weeks) compared to intraoral stabilization splint group (4 months). This short period of treatment gave the physical therapy advantage over intraoral stabilization splint. Therefore, a longer period of follow-up is recommended in order to give a clear picture as to which of the modality is more

effective in the treatment of TMD.

Mejersjo and Carlsson[20] evaluated the long-term results of TMD treatment using different modalities of treatment including physical therapy and intraoral stabilization splint. They concluded that in general, most patients with TMD had minimal recurrence of symptoms of 7 years after conservative treatment procedures. There is consistent neither or conclusive evidence from the literature on the long-term effects of intraoral splint therapy. However, Daves and Gray[21] in a long-term follow-up study on patients concluded that intraoral stabilization splint was a successful long term treatment for TMD cases. They added that almost 90% of patients who had initially improved, maintained this improvement without showing any relapse for 3 years.

In this study the number of patients who responded successfully to ultrasound therapy was significantly higher than those who responded to TENS treatment. Only a few studies have been reported on US in the treatment of TMD.

On the other hand there are many studies in the literature about the use of TENS in the treatment of TMD.[22-24] One study by Graff-Rudford[22] suggested that there maybe some beneficial effect of TENS. Mòystad *et al.*[23] reported that conventional TENS, acupuncture like TENS, and placebo TENS all led to significant improvement in pain and function during a 3 week trial. However, Block and Laskin[24] reported no significant differences between TENS and placebo after 3-6 weeks of treatment.

A review about the use of physical therapy strategies in treatment of chronic musculoskeletal pain conditions including TMD was done by Feine *et al.*[25] They concluded that there was no satisfactory evidence that any of the treatment reviewed was capable of curing or even significantly reducing symptoms of chronic musculoskeletal conditions including temporomandibular disorders.

Conclusions

1. Both physiotherapy and intraoral stabilization splint therapies produced significant reduction in pain associated with TMD patients.

2. It appears that patients were helped while they are undergoing treatment regardless of the specific form of therapy used. In other words these forms of reversible, non-invasive therapy are better than no therapy.
3. More consistent and conclusive evidence directed towards the long-term effects of physiotherapy and intraoral stabilization splint in the treatment of TMD is required.

4. Ultrasound therapy was found to be more effective in the treatment of TMD when compared to TENS therapy ($P<0.05$).

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