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Comparison of Effectiveness of Stabilization Splint, Anterior Repositioning Splint and Behavioral Therapy in Treatment of Disc Displacement with Reduction

Redüksiyonlu Disk Deplasmanı Tedavisinde Stabilizasyon Splinti, Ön Konumlandırıcı Splint ve Davranışsal Tedavinin Etkinliklerinin Karşılaştırılması

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Summary

Objective: Splint therapy is a proven modality for many types of temporomandibular joint (TMJ) disorders. Stabilization and anterior repositioning splints are often the choice of treatment for disc displacement with reduction. The aim of this study was to compare the efficacy of behavioral therapy, stabilization and anterior repositioning splints in patients with disc displacement with reduction.

Materials and Methods: The subjects (n=105) were selected from the patients who were referred to the TMJ Diseases Clinic over a period of two years. The Research Diagnostic Criteria for Temporomandibular Disorders were used for evaluation. The patients were instructed to use their splints only during the night. All patients were scheduled for a total of seven follow-up visits within six months. Seventy-two patients who completed their scheduled visits were examined for subjective and objective symptoms.

Results: The subjective symptoms (graded chronic pain scale) and objective symptoms (assisted and unassisted maximum opening, TMJ sounds, muscle and joint palpation tenderness) improved in all treatment groups. However, no significant differences have been observed between the groups.

Conclusion: According to the results of this study, it can be concluded that behavioral therapy and splint therapies are both good choices for the treatment of disc displacement with reduction. *Turk J Phys Med Rehab 2011;57:25-30.*

Key Words: Temporomandibular joint disorders, occlusal splints, disc displacement, behavior therapy

Özet

Amaç: Splint tedavisi birçok temporomandibular eklem rahatsızlığı için etkinliği kanıtlanmış bir tedavi seçeneğidir. Stabilizasyon ve ön konumlandırıcı splintler redüksiyonlu disk deplasmanında genellikle tercih edilen splint tipleridir. Bu çalışmanın amacı redüksiyonlu disk deplasmanı tedavisinde uygulanan davranışsal tedavi, stabilizasyon ve ön konumlandırıcı splintlerin tedavi etkinliklerinin değerlendirilmesidir.

Gereç ve Yöntem: Temporomandibular Rahatsızlıklar Teşhis ve Tedavi Kliniği'ne iki yıl içerisinde başvuranlar arasından seçilmiş hastalar çalışmaya dahil edildi (n=105). Hastaların değerlendirilmesinde "Temporomandibular Rahatsızlıklar Araştırma Teşhis Kriterleri" kullanıldı. Hastalara splintlerini yalnızca gece kullanmaları önerildi. Bütün hastalar altı ay boyunca toplam yedi kez kontrol edildi. Kontrollere düzenli devam eden yetmiş iki hasta objektif ve subjektif semptomlardaki değişiklikler açısından değerlendirildi.

Bulgular: Bütün tedavi gruplarında hastaların subjektif semptomlarında (kronik disfonksiyonel ağrı derecesi) ve objektif semptomlarında (yardımlı ve yardımsız maksimum ağız açma miktarları, temporomandibular eklem sesleri, kas ve eklemlerde palpasyonda ağrı) iyileşme olduğu görüldü, ancak tedavi grupları arasında istatistiksel olarak anlamlı bir fark görülmedi.

Sonuç: Bu çalışmanın bulguları ışığında davranışsal tedavi, stabilizasyon splinti ve ön konumlandırıcı splintlerin redüksiyonlu disk deplasmanı tedavisinde kullanılabilecek başarılı tedavi alternatifleri olduğu söylenebilir. *Türk Fiz Tıp Rehab Derg 2011;57:25-30.*

Anahtar Kelimeler: Temporomandibular eklem rahatsızlıkları, oklüzal splintler, disk deplasmanı, davranışsal tedavi

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Introduction

The prevalence of temporomandibular disorders (TMD) was reported to be 40-60 percent in given and general populations in epidemiologic studies (1). Disc displacement is a commonly seen subgroup among TMD patients (2).

Internal derangement of the temporomandibular joint (TMJ) can be defined as an abnormal relation between the mandibular condyle and the intra-articular disc when the teeth are in occlusion (3). Disc displacement with reduction (DDwR) is a subgroup of internal derangement, in which the intra-articular disc has slipped forward and mouth opening is accompanied by a clicking sound at any stage of opening. In some cases, a second clicking sound is perceived usually during the last stage of mouth closure. DDwR patients may be asymptomatic, except for the clicking sound, or may develop symptoms as joint tenderness on lateral or posterior palpation, joint pain increasing during function, deflection of mandibular midline to the affected side on mouth opening before clicking. Muscle pain usually exists along with internal derangement symptoms.

For the treatment of DDwR, the literature suggests use of splints, physical, behavioral, pharmacologic and surgical therapies (4-19). Each of these treatment modalities can be used individually or may be combined. Various types of splints were investigated for the treatment of DDwR, however, stabilization splints (SS) and anterior repositioning splints (ARS) are the most commonly used types (20). In 1963, Ramfjord (21) described the Michigan splint, which basically is an SS without canine guidance for the treatment of TMD. After Farrar (22) described the ARS in 1971, studies have been carried out to compare the effectiveness of the two splint types (23-28). Some studies concluded that ARS is the best choice for DDwR, whereas others indicated that there is no significant difference between the two splint types. However, to our knowledge there is no study suggesting that the SS is superior to ARS for treatment of DDwR.

Recently, behavioral therapy (BT) has been used for TMD patients suffering from pain and dysfunction either alone or in combination with other treatment modalities. The majority of studies reveal the efficacy of psychologically based treatments for chronic pain; however, the management of TMDs has also benefited from such behavioral interventions as well (29). There is a lack of randomized clinical trials for the comparison of BT to the other conservative treatments at subtypes of TMD. Also, data comparing splint and nonsplint therapies are not widely available (30).

Therefore, the aim of this study is to compare the effectiveness of BT, SS and ARS in patients with DDwR.

Materials and Methods

Subjects

The subjects were selected from the patients who referred for treatment of TMD over a period of two years (February 2002-January 2004) to the TMD Clinic at the Department of Prosthodontics, Faculty of Dentistry, Istanbul University. A trained prosthodontist (HK) in the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) protocol examined all of the subjects (31).

Inclusion Criteria

The patients included in this study were with a RDC/TMD Axis I diagnosis of DDwR (Group IIa) in at least one TMJ and had full dentition with or without third molars.

Exclusion Criteria

Patients with the following were excluded:

1. Having any other RDC/TMD Axis I diagnosis as disc displacement without reduction, myofascial pain, arthritis;
2. History of trauma to the face or jaw;
3. History of TMD treatment or surgery;
4. Using removable prosthesis.

Simple randomization was used to compose the treatment groups. A total of 105 patients (35 patients for each group) participated in this study. All patients were informed about the study and their informed consents were obtained.

Behavioral Therapy Group

The patients in all three groups were informed about the basic anatomy and function of the TMJ, the mechanisms of clicking and locking, possible causes of pain and treatment modalities for DDwR. A booklet including all the information was given to the patients.

The patients in BT group were advised to rest the TMJ as much as possible, to avoid hard and tough food, to use thermal packs and to avoid forehead position and wrong working/sleeping positions.

Stabilization Splints Group

For each patient in this group, a SS was constructed for the maxillary arch using 2 mm polyvinyl acetate sheet (Biocryl C, Scheu-Dental GmbH, Germany) and self-curing acrylic resin (Dentalon Plus, Heraeus Kulzer Gmbh & Co., Germany) as described by Okeson (1). Finally, the SSs should have all mandibular buccal cusps and incisal edges contact the flat surfaces of the appliance in centric relation and during protrusive and lateral movements, only the mandibular canines should exhibit contact on the appliance beyond freedom in centric. The patients were asked to wear their splints only at night for 6 months. A booklet was given about the splint usage to all patients. The splints were adjusted during the course of the therapy.

Anterior Repositioning Splints Group

For each patient in this group, an ARS was constructed for the maxillary arch using 2 mm polyvinyl acetate sheet (Biocryl C) and self-curing acrylic resin (Dentalon Plus) as described by Okeson (1). An anterior stop is used to locate the correct anterior position, which is the sufficient protrusion that eliminates the reciprocal click. The correct anterior position is marked with an articulating paper, and then grooved with a small round bur. The groove helps to locate the correct mandibular position. Finally, in the established forward position, all mandibular teeth should contact on the surface of the ARS. The forward position established by the appliance should eliminate the joint symptoms. The patients were asked to wear the splints at night for 6 months. A booklet was given about the splint usage to all patients. The splints were adjusted during the course of the therapy. Two of the patients, had reciprocal clicks for a second time during controls and their splints were repositioned to eliminate the symptoms.

Data Collection

All patients were scheduled for recalls in one-, seven-, fifteen-, thirty-, ninety-, and one hundred eighty-day intervals. The given

information about the problem and solutions was repeated for patients in the BT group and adjustments were made in the splint groups at each appointment. The examinations of all patients were completed according to the RDC/TMD at the beginning and at the end of the therapies.

The RDC/TMD evaluates the pain with palpation by using the scale (0=no pain, pressure only; 1=mild pain; 2=moderate pain; 3=severe pain), but cannot compare the pain scores before and after treatment. The scale below was designed for this study.

No Change: The pain scores with palpation did not differ before and after treatment.

Improved: The pain score with palpation before treatment was 3 and decreased to 2 or 1 after treatment; the pain score before treatment was 2 and decreased to 1 after treatment.

Cured: The pain score with palpation before treatment was 3, 2 or 1 and decreased to 0.

Exacerbated: The pain score with palpation before treatment increased after treatment.

Statistical Analyses

All statistical analyses were performed with the NSCC 2000 (Kaysville, Utah, USA) software program, and the level of significance was set at $p<0.05$. During the statistical evaluation, along with the descriptive statistical methods (mean, standard deviation), parameters with normal distribution for the comparison of quantitative data were evaluated with one-way ANOVA. The qualitative data were assessed using the chi-square test.

Results

Since 35 patients were randomly assigned to one of the three treatment groups, a total of 105 patients were included in the study. Three patients in the ARS group wanted to leave the treatment and 2 patients in the BT group wanted to have splints. One patient in the BT group moved to another city. One patient in the SS group had a trauma to his face. Twelve patients in each ARS and BT group and 1 patient in the SS group did not return for recalls.

Finally, 20 patients (3 bilateral, 17 unilateral DDwR, 17 women and 5 men; mean age: 26.9±11.01 years) in the BT group, 32 patients (3 bilateral, 29 unilateral DDwR, 29 women and 3 men; mean age: 27.16±8.08 years) in the SS group and 20 patients (5 bilateral, 15 unilateral DDwR, 11 women and 9 men; mean age: 26.55±10.19 years) in the ARS group continued with follow-ups.

The subjective symptoms of the patients could be evaluated using the RDC/TMD Axis II. The chronic pain grade classifications for each subject were achieved by calculating the scores of questions 7-13 in the Axis II. Before treatment, the majority of patients had chronic pain grade I and II. After treatment, even though the chronic pain grades in all treatment groups improved, there was no statistically significant difference between the groups (Table 1-2).

The measurements of vertical jaw opening, joint sounds and pain with palpation were evaluated using the RDC/TMD Axis I.

According to vertical jaw opening, an increase in unassisted opening without pain, maximum unassisted opening and maximum assisted opening were observed after treatment, but there was no statistically significant difference between the treatment groups (Table 3).

Reciprocal clicking is the chief clinical symptom of DDwR. Elimination of clicks by opening and closing in a protruded jaw position is the most important finding for differentiating DDwR from hypermobility and local soft tissue thickening on the articular eminence, which also have the opening and closing click symptom. If the click could be eliminated in a protruded or more anterior jaw position "Yes" was marked. If the click was not eliminated, "No" was

Table 1. Chronic pain grades before the treatment.

Chronic Pain Grade	Treatment			
	Stabilization Splint n (%)	Anterior Repositioning Splint n (%)	Behavioral Therapy n (%)	Total n (%)
Grade 0	0 (0)	0 (0)	3 (15.0)	3 (4.2)
Grade I	13 (40.6)	11 (55.0)	10 (50.0)	34 (47.2)
Grade II	18 (56.3)	9 (45.0)	6 (30.0)	33 (45.8)
Grade III	1 (3.1)	0 (0)	1 (5.0)	2 (2.8)
Total	32 (100.0)	20 (100,0)	20 (100.0)	72 (100.0)
Chi-Square Test χ^2:11.16 p=0.08				

Table 2. Chronic pain grades after the treatment.

Chronic Pain Grade	Treatment			
	Stabilization Splint n (%)	Anterior Repositioning Splint n (%)	Behavioral Therapy n (%)	Total n (%)
Grade 0	11 (34.4)	13 (65.0)	11 (55.0)	35 (48.6)
Grade I	11 (34.4)	4 (20.0)	5 (25.0)	20 (27.8)
Grade II	10 (31.3)	3 (15.0)	4 (20.0)	17 (23.6)
Total	32 (100.0)	20 (100.0)	20 (100.0)	72 (100.0)
Chi-Square Test χ^2:5.12 p=0.27				

marked. If the subject lacked either a reproducible opening click or a reproducible closing click, "NA" was marked. After the treatment, in all treatment groups the number of joints with reproducible reciprocal click was decreased. However, no statistically significant difference was found between the treatment groups (Table 4 and 5).

Muscle pain is not a primary complaint of the patients with DDwR, but it can be seen together with TMJ pain. However, a reduction in the number of subjects with muscle pain in all groups was observed, but there was no statistically significant difference among the groups.

When TMJ pain on palpation was evaluated, no statistically significant differences were found, except for the lateral pole of the right TMJ (Table 6).

Discussion

In some of the previous studies designed for evaluation of effectiveness of splint therapies, untreated control groups were used (23,25,28) but not in some others (27). In these studies, the patients included in the so-called "control group" or "natural course", cannot be evaluated as untreated. When patients are observed periodically, the inert untreated group turns into an active treatment group because of the changes in the patient's cognitive expectancy (Hawthorne effect). Thus, this study included a BT group instead of control group or natural course group.

The results of this study showed that maximum mouth opening in all treatment groups improved, but there was no statistically significant difference between groups. Limited mouth

Table 3. Vertical jaw opening in treatment groups before and after treatment.

	Stabilization Splint (Mean±SD)	Anterior Repositioning Splint (Mean±SD)	Behavioral Therapy (Mean±SD)	F.	Sig.
Unassisted opening without pain (before treatment)	36.56±10.14	38.80±9.97	39.70±9.15	0.71	>0.05
Unassisted opening without pain (after treatment)	43.44±7.82	43.95±10.42	42.50±9.81	0.13	>0.05
Maximum unassisted opening (before treatment)	46.91±6.96	47.00±5.88	47.35±7.88	0.03	>0.05
Maximum unassisted opening (after treatment)	48.63±7.2	50.70±7.85	49.10±7.3	0.50	>0.05
Maximum assisted opening (before treatment)	50.28±6.38	50.10±5.56	50.55±7.21	0.03	>0.05
Maximum assisted opening (after treatment)	51.66±6.88	53.35±7.98	52.00±7	0.35	>0.05
One-Way ANOVA test					

Table 4. The elimination of reciprocal click by opening and closing in a protruded jaw position before treatment.

Before Treatment		Stabilization Splint (n=32)	%	Anterior Repositioning Splint (n=20)	%	Behavioral Therapy (n=20)	%	
Right	Yes	18	56.3	13	65.0	14	70.0	p>0.05
	NA	14	43.8	7	35.0	6	30.0	
Left	Yes	17	53.1	12	60.0	9	45.0	p>0.05
	NA	15	46.9	8	40.0	11	55.0	
Chi-Square Test								

Table 5. The elimination of reciprocal click by opening and closing in a protruded jaw position after treatment.

AfterTreatment		Stabilization Splint (n=32)	%	Anterior Repositioning Splint (n=20)	%	Behavioral Therapy (n=20)	%	
Right	No	2	6.3	0	0.0	1	5.0	
	Yes	7	21.9	3	15.0	6	30.0	p>0.05
	NA	23	71.9	17	85.0	13	65.0	
Left	No	2	6.3	0	0.0	0	0.0	
	Yes	2	6.3	6	30.0	5	25.0	p>0.05
	NA	28	87.5	14	70.0	15	75.0	
Chi-Square Test								

opening is not the chief complaint in DDwR patients, especially in those who do not experience myofascial pain. Therefore, it is not surprising that there was no difference between the splint groups and BT group.

The chief complaint of DDwR patients was the reciprocal clicking. The treatment groups did not differ regarding the disappearance of reciprocal clicking and the results corroborated the results reported by Nicolakis et al. (32) that BT can be as successful as splint treatment and this treatment choice should be kept in mind. However, these results do not mean that splints are unnecessary. There was no difference in the disappearance of reciprocal clicks between the groups in our study, while regarding the improvement in pain with palpation of TMJ, a significant difference was observed, which was due to the occurrence of exacerbated pain in four subjects in the BT group.

In case of DDwR, it should be investigated whether the healing criteria are appropriate for this disorder. The main question is whether the reposition of the disc/the vanishing of the clicking sound should be considered as a success or the vanishing of pain and functional deficit despite the continuation of the click. After 2.5 years of follow-up, Okeson et al. (33) reported that there was no clicking sound in 34% of the patients with DDwR, but that the success rate went up to 75% when asymptomatic clicking and even to 80% when patient's satisfaction of the therapy result were considered as success. According to Davies et al., the clicking improved in 55–88 percent of patients after 3 months of splint therapy, but the success rate rose to 90% when patients were asked about their satisfaction after three years. These results show that patients value their quality of life more than the clicking (34-36).

There was no statistically significant difference between the treatment groups when analyzing the improvement in muscle pain on palpation. When the pain intensity was examined before and after the treatment, there was a significant difference between the pre- and post-treatment values in all therapy groups. Our results are not in concordance with the results of the meta-analysis where the ARS was superior to the SS in patients with DDwR in terms of pain management (20). However, nearly all of the patients in our study suffered functionally impairing chronic pain before treatment. Dworkin et al. (37) reported that BT showed similar successful results as pharmacological, physical and splint therapies in patients with chronic pain level 0, 1 or 2.

In the present study, subjective and objective symptoms in patients with DDwR improved in all treatment groups. When one investigates the literature about TMD treatment, all studies compare the objective findings of clinical and radiological examinations, but the subjective findings as chronic pain degree, depression and somatization are not taken into consideration. However, Dworkin et al. (37,38) in 2002 investigated the efficacy of brief cognitive BT interventions that emphasize education and skills training for the self-management of TMD. They concluded that self-management of TMD may offer real benefit to a significant number of TMD patients. The use of RDC/TMD psychosocial assessment criteria can contribute to a successful clinical decision-making in the management of TMD. Also, Truelove et al. (30) in 2006 compared three treatment modalities: self-care treatment without any intraoral splint appliance (UT), UT plus a conventional flat-plane hard acrylic splint (HS), and UT plus a soft vinyl (a low-cost athletic mouth guard) splint (SS). All patients improved over time and the authors suggest that clinicians who treat patients with TMD should consider prescribing low-cost non-splint self-care therapy for most patients.

This clinical research showed no significant difference between the treatment groups. However, if the allocation of 33 drop-out patients out of 105 voluntary participants is analyzed, it is to be pointed out that demands for treatment change and discontinuance at follow-ups in the ARS and BT groups particularly are clearly more frequent than in the SS groups.

Conclusion

Within their limits, the results of this study indicate that splint therapies and BT are both successful choices for the treatment of DDwR.

Table 6. Number of subjects with improvement in TMJ pain with palpation.

		Stabilization Splint		Anterior Repositioning Splint		Behavioral Therapy		
		(n=32)	%	(n=20)	%	(n=20)	%	
TMJ Lateral pole "outside" Right	No change	12	37.50	3	15.00	4	20.00	χ^2:18.57 p=0.005*
	Improved	7	21.90	10	50.00	3	15.00	
	Cured	13	40.60	7	35.00	9	45.00	
	Exacerbated	0	0.00	0	0.00	4	20.00	
TMJ Lateral pole "outside" Left	No change	6	18.80	1	5.00	3	15.00	χ^2:7.03 p=0.31
	Improved	11	34.40	7	35.00	3	15.00	
	Cured	15	46.90	12	60.00	13	65.00	
	Exacerbated	0	0.00	0	0.00	1	5.00	
TMJ Posterior attachment "inside ear" Right	No change	14	43.80	5	25.00	5	25.0	χ^2:5.37 p=0.49
	Improved	5	15.60	5	25.00	4	20.0	
	Cured	13	40.60	10	50.00	10	50.0	
	Exacerbated	0	0.00	0	0.00	1	5.0	
TMJ Posterior attachment "inside ear" Left	No change	6	18.80	5	25.00	4	20.00	χ^2:4.89 p=0.55
	Improved	11	34.40	5	25.00	3	15.00	
	Cured	14	43.80	10	50.00	11	55.00	
	Exacerbated	1	3.10	0	0.00	2	10.00	

Chi-Square Test. *p<0,01

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