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Anterior repositioning splint in the treatment  
of temporomandibular joints with  
reciprocal clicking: Comparison with a  
flat occlusal splint and an untreated  
control group

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The anterior repositioning splint is widely used to treat temporomandibular joints with reciprocal clicking. This treatment was compared to a flat occlusal splint and to an untreated control group. The anterior repositioning splint decreased joint pain at rest, during chewing, and during protrusion. Reciprocal clicking was eliminated and palpatory tenderness of the joint and muscles was reduced. This favorable effect was of short duration. The majority of the patients reported pain and clicking and demonstrated tenderness following removal of the splint after 6 weeks' treatment. The flat occlusal splint decreased joint tenderness but did not affect clicking or muscle tenderness. In the control group the clicking remained and the frequency of muscle tenderness increased. The results indicate that temporomandibular joints with reciprocal clicking can be successfully treated by positioning the mandible anteriorly. Since the symptoms returned when the splint was removed a more permanent change of mandibular position seems necessary. (ORAL SURG. ORAL MED. ORAL PATHOL. 60:131-136, 1985)

Splint therapy is widely used to treat patients with temporomandibular joint disorders.<sup>1-10</sup> The application of arthrography<sup>11-17</sup> has led to an improved

understanding of anterior disk displacement as a frequent cause of temporomandibular joint pain and dysfunction, although little is known about the prevalence of disk displacement in asymptomatic persons.

Anterior disk displacement has been classified

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**Table 1.** Age and gender distribution of seventy patients

Age group (yr)	Male	Female	Total
10-19	3	12	15
20-29	8	11	19
30-39	5	15	20
40-49	4	5	9
50-59	1	3	4
60-69	1	2	3
Median age	30.5	29.5	30.0

functionally as displacement with or without reduction.<sup>14</sup> Displacement with reduction is clinically characterized by reciprocal clickings.<sup>11-13, 15, 18-21</sup> To treat this disorder, Farrar<sup>2, 22</sup> suggested the use of a splint that positioned the mandible anteriorly in order to maintain the disk in a normal relationship to the condyle. This method of treatment has been widely adopted<sup>23-26</sup> but, as pointed out by Dolwick and Riggs<sup>25</sup> and Clark,<sup>27, 28</sup> the literature offers only theoretic assumptions regarding its effectiveness and no systematic evaluations are available.

The aim of this prospective study was therefore to evaluate the effect of an anterior repositioning splint in the treatment of patients with reciprocal temporomandibular joint clicking. The results were compared to those obtained with a flat occlusal splint and with no treatment.

## PATIENTS

From January, 1982, to March, 1984, 1,704 patients were referred to the Department of Stomatognathic Physiology, University of Lund, because of pain and dysfunction of the masticatory system. Every third patient (568 patients) was selected and given an appointment for a clinical examination. Forty-three patients did not appear at the clinic, and 525 were examined. Unilateral or bilateral reciprocal clicking, defined as clicking during opening and closing,<sup>29</sup> was noted in 88 of the 525 patients (17%). In 78 patients the reciprocal clicking could be eliminated by beginning mandibular movements from a position anterior to the intercuspal position (centric occlusion) but not as far anterior as an edge-to-edge incisal position. In the remaining 10 patients, reciprocal clicking could not be eliminated unless mandibular movements started from a position anterior to the edge-to-edge incisal position. These 10 patients, as well as another 8 patients who were unwilling to participate in the study, were excluded. The study is therefore based on 70

patients. An informed verbal consent to participate in the study was obtained from all patients. Age and sex distributions are shown in Table I.

## METHODS

The patients were randomly assigned to one of the groups, to be treated with an anterior repositioning splint or with a flat occlusal splint or to serve as a control group without treatment.

The patients in all three groups were informed about the basic anatomy and function of the temporomandibular joint, mechanisms of clicking, and possible causes of pain. All patients were advised to rest the joint and to avoid hard and tough food.

### Anterior repositioning splint

The disk was recaptured by having the patient open the mouth until clicking occurred and then to close into such an anterior position that the closing click did not occur. Attempts were made to select a position as far posterior as possible but still prevent a closing click. An anterior repositioning splint, designed to keep the mandible in the anterior position and thereby eliminate the reciprocal clicking, was then placed on the maxillary teeth.<sup>2, 3</sup> This anterior position was maintained through inclines on the splint which allowed the mandibular teeth to occlude with the splint only in the anterior position (Fig. 1). Any attempt to move the mandible posteriorly resulted in an increase of the vertical dimension through these inclines. Thus, the disk was kept in the reduced position. The anterior repositioning splint was used 24 hours a day for 6 weeks; then its use was gradually reduced during the following 2 weeks, being first removed for 2 hours between meals and then successively for longer periods.

### Flat occlusal splint

A flat occlusal maxillary splint (Fig. 2), as designed by Posselt,<sup>1</sup> was used. The flat occlusal splint was adjusted to maximal occlusal contact in centric relation and centric occlusion, to group contact in laterotrusion, and to anterior guidance on protrusion. The design of the flat occlusal splint allowed all mandibular movements from centric relation to be performed smoothly without deflecting tooth contacts. The flat occlusal splint was used at nighttime only<sup>30</sup> for 6 weeks, and then its use was gradually decreased during the following 2 weeks.

### Control group

The patients in this group did not receive any treatment.

**Table II.** Distribution (number of patients) of clinical findings before treatment and at follow-up after 6, 17, and 52 weeks in three treatment groups (n = 70 patients)

Clinical findings	Treatment groups		
	Anterior repositioning splint (n = 24)	Flat occlusal splint (n = 23)	Control group (n = 23)
Reciprocal clicking			
Before treatment	24	23	23
After 6 weeks	2	23	21
After 17 weeks	19*	21	23*
After 52 weeks	19†	22*	21*
Palpatory tenderness laterally over the joint			
Before treatment	9	9	9
After 6 weeks	2	2	11
After 17 weeks	7	5	8
After 52 weeks	7	6	13
Palpatory tenderness of lateral pterygoid muscle			
Before treatment	17	14	20
After 6 weeks	8	13	19
After 17 weeks	13	14	18
After 52 weeks	15	12	19
Palpatory tenderness of insertion of temporal muscle			
Before treatment	19	15	19
After 6 weeks	7	12	21
After 17 weeks	12	12	17
After 52 weeks	11	9	19
Palpatory tenderness of superficial masseter muscle			
Before treatment	9	8	8
After 6 weeks	4	5	16
After 17 weeks	8	8	12
After 52 weeks	9	6	18

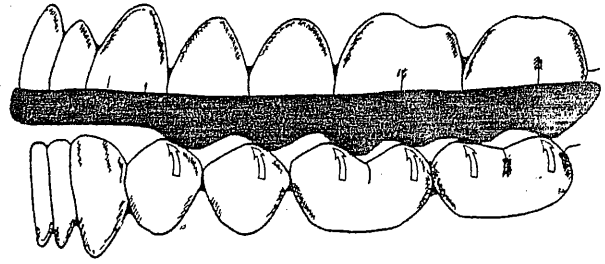
\*One of these patients demonstrated limitation of opening and deviation to the affected side.

†Four of these patients demonstrated limitation of opening and deviation to the affected side.

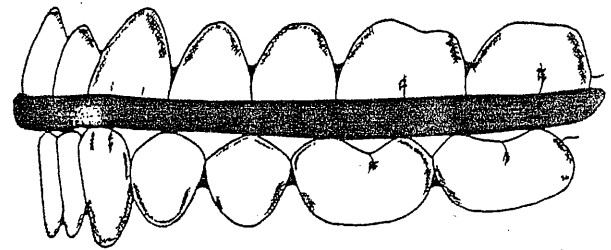
**Clinical recordings**

Reciprocal clicking was recorded by stethoscope. Palpatory tenderness of the joint and masticatory muscles were recorded as described by Krogh-Poulsen.<sup>31</sup> Pain at rest, during chewing, and during protrusion was recorded by the patient by marking on 10-cm visual analog scales. The distance from the end of the scale to the patient's mark was then measured to the nearest centimeter.

Recordings were made before treatment and after 6, 17, and 52 weeks. The before-treatment recordings were compared to those made at the follow-up examinations. In 12 patients with bilateral symp-



**Fig. 1.** Anterior repositioning splint. (Redrawn from Farrar: J Prosthet Dent 28: 629-636, 1972.)



**Fig. 2.** Flat occlusal splint.

toms, the recordings from the initially most painful side were used for analysis.

**Statistical methods**

The statistical methods used were Fisher's exact test for assessing if observed frequencies significantly differed from those expected and Wilcoxon's matched-pairs signed-ranks test for comparison of paired variables. The levels of statistical significance were based on two-tailed tests.

**RESULTS**

**Anterior repositioning splint (24 patients)**

When the anterior repositioning splint was initially inserted, reciprocal clicking was eliminated in all patients. During the first 6 weeks of treatment clicking reappeared in two patients, in spite of continuous use of the splint. When we compared the recordings on visual analog scales before treatment and at the 6-week follow-up, we found that pain at rest ( $p < 0.001$ ), pain during chewing ( $p < 0.001$ ), and pain during protrusion ( $p < 0.005$ ) were significantly reduced.

The clinical examination showed that palpatory tenderness was less frequent at the 6-week follow-up than before treatment laterally over the temporomandibular joint ( $p < 0.04$ ), in the lateral pterygoid muscle ( $p < 0.02$ ), and in the insertion of the temporal muscle ( $p < 0.002$ ) (Table II).

After 17 weeks (11 weeks without the anterior

14. Katzberg RW, Dolwick MF, Helms CA, Hopens T, Bales DJ, Coggs GL: Arthrotomography of the temporomandibular joint. *AJR* 134: 995-1003, 1980.
15. Eriksson L, Westesson P-L: Clinical and radiological study of patients with anterior disc displacement of the temporomandibular joint. *Swed Dent J* 7: 55-64, 1983.
16. Westesson P-L: Double-contrast arthrotomography of the temporomandibular joint: Introduction of an arthrographic technique for visualization of the disc and articular surfaces. *J Oral Maxillofac Surg* 41: 163-172, 1983.
17. Westesson P-L: Arthrography of the temporomandibular joint. *J Prosthet Dent* 51: 535-543, 1984.
18. McCarty WL Jr: Diagnosis and treatment of internal derangements of articular disc and mandibular condyle. In: Solberg WK, Clark GT (Editors): *Temporomandibular joint problems. Biologic diagnosis and treatment*, Chicago, 1980, Quintessence Publishing Company, Inc., pp. 145-168.
19. Isberg-Holm AM, Westesson P-L: Movement of disc and condyle in temporomandibular joints with and without clicking: a high-speed cinematographic and dissection study on autopsy specimens. *Acta Odontol Scand* 40: 167-179, 1982.
20. Isberg-Holm AM, Westesson P-L: Movement of disc and condyle in temporomandibular joints with clicking: An arthrographic and cineradiographic study on autopsy specimens. *Acta Odontol Scand* 40: 153-166, 1982.
21. Eriksson L, Westesson P-L, Rohlin M: Temporomandibular joint sounds in patients with disc displacement. *Int J Oral Surg* 14:229-237, 1985.
22. Farrar WB, McCarty WL Jr: A clinical outline of temporomandibular joint diagnosis and treatment, ed. 9, Montgomery, Ala., 1982, Normandie Publications, p. 165.
23. Bellavia WD: A functional jaw device to aid in treating anterior displaced discs. *J Craniomandibular Pract* 1: 53-60, 1983.
24. Dugal GL: Closing a minor unilateral open bite on TMJ patients. *J Craniomandibular Pract* 1: 39-41, 1982-83.
25. Dolwick MF, Riggs RR: Diagnosis and treatment of internal derangements of the temporomandibular joint. *Dent Clin North Am* 27: 561-572, 1983.
26. Manzione JV, Tallents R, Katzberg RW, Oster C, Miller TL: Arthrographically guided splint therapy for recapturing the temporomandibular joint meniscus. *ORAL SURG ORAL MED ORAL PATHOL* 57: 235-240, 1984.
27. Clark GT: A critical evaluation of orthopedic interocclusal therapy: effectiveness for specific symptoms. *J Am Dent Assoc* 108: 364-368, 1984.
28. Clark GT: A critical evaluation of orthopedic interocclusal appliance therapy: design, theory and overall effectiveness. *J Am Dent Assoc* 108: 359-364, 1984.
29. Farrar WB: Characteristics of the condylar path in internal derangements of the TMJ. *J Prosthet Dent* 39: 319-323, 1978.
30. Dahlström L, Carlsson GE, Carlsson SG: Comparison of effects of electromyographic biofeedback and occlusal splint therapy on mandibular dysfunction. *Scand J Dent Res* 90: 151-156, 1982.
31. Krogh-Poulsen W: *Klinisk undersøgelse. In Krogh-Poulsen, W (editor): Patofunktion, Bidfunktion, Bettfysiologi*, ed. 2, Copenhagen, 1979, Munksgaard Publications, Ltd., pp. 107-140.
32. Clark GT: Treatment of jaw clicking with temporomandibular repositioning: Analysis of 25 cases. *J Craniomandibular Pract* 2: 263-270, 1984.
33. Bellavia WD, Missert W: Repositioning the mandible anteriorly with fixed composite overlays. *J Craniomandibular Pract* 3: 172-178, 1985.
34. Eriksson L, Rohlin M, Westesson P-L: The Correlation of temporomandibular joint sounds with joint morphology in fifty-five autopsy specimens. *J Oral Maxillofac Surg* 43:194-200, 1985.
35. Clark GT, Beemsterboer PL, Solberg WK, Rugh JD: Nocturnal electromyographic evaluation of myofascial pain dysfunction in patients undergoing occlusal splint therapy. *J Am Dent Assoc* 99: 607-611, 1979.
36. Kopp S: Short term evaluation of counselling and occlusal adjustment in patients with mandibular dysfunction involving the temporomandibular joint. *J Oral Rehabil* 6: 101-109, 1979.
37. Kopp S, Wenneberg B: Effects of occlusal treatment and intraarticular injections on temporomandibular joint pain and dysfunction. *Acta Odontol Scand* 39: 87-96, 1981.
38. Wedel A, Carlsson GE, Dahlström L, Kallenberg A, Kopp S, Lundqvist S, Mejersjö C, Wenneberg B: Stabiliseringsskena eller avslappningsplåt—en jämförelse mellan två typer av bettskenor. *Tandläkartidningen* 4: 137-144, 1981.
39. Kopp S: Pain and functional disturbances of the masticatory system—a review of etiology and principles of treatment. *Swed Dent J* 6: 49-60, 1982.

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