*Case Report*

# Changes in Position of the Temporomandibular Joint Disc and Condyle After Disc Repositioning Appliance Therapy: A Functional Examination and Magnetic Resonance Imaging Study

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**Abstract:** Disc-repositioning splints are routinely used in the treatment of anteriorly displaced discs. The rationale of these appliances is to direct the mandibular condyle anteriorly in the glenoid fossa and to recapture the disc onto the condyle. The stability of disc recapture depends on reestablishment of the occlusion and the adaptive capabilities of the temporomandibular joint. It could therefore be suggested that treatment success is potentially higher in the active growth period. In this case report, partial disc recapture was observed on magnetic resonance images after application of a maxillary disc-repositioning appliance. Orthodontic treatment was applied for the retention of disc recapture. (*Angle Orthod* 2000;70:400–408.)

**Key Words:** Anterior mandibular repositioning; Disc displacement with reduction; Disc-repositioning appliances; Internal derangement

## INTRODUCTION

The diagnosis and treatment of temporomandibular joint (TMJ) disorders are controversial. One disorder type, which is related to disc-condyle disharmony, is called temporomandibular joint internal derangement (TMJ-ID). Clinical signs and symptoms such as limitation of mouth opening, sounds (clicking, crepitation, grading, and grinding), deviation, deflection during mouth opening, and closing and lateral excursion all characterize TMJ-ID.

Disc displacement with reduction occurs when the disc is placed anteriorly relative to the condyle and the condyle passes over the thick posterior band of the disc at the beginning of mouth opening. Painful clicking may occur at this time. Once maximum opening has occurred, the condyle can capture the disc, and a normal relationship occurs between the condyle and the disc at this stage. However, in maximum intercuspation, the disc once more becomes situated anterior to the condyle.

Functional clinical examination methods are commonly used for the diagnosis of TMJ-ID. However, it has been reported[1] that a clinical examination for the diagnosis of anterior disc displacement with reduction has an accuracy of 43–75%. This suggests that a clinical examination should be utilized together with other imaging methods in order to determine the relationship between the disc and condyle before and after treatment. Arthrography and computed tomography are 2 imaging methods generally employed for diagnosis of a TMJ-ID.[2–7] In recent years, magnetic resonance imaging (MRI) has been used because it is a noninvasive method that does not appear to cause any biological hazard.[1, 8–12]

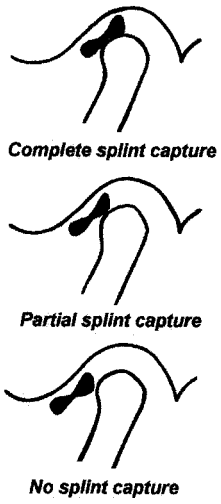


**FIGURE 1.** Criteria used for MRI assessment of disc recapture.

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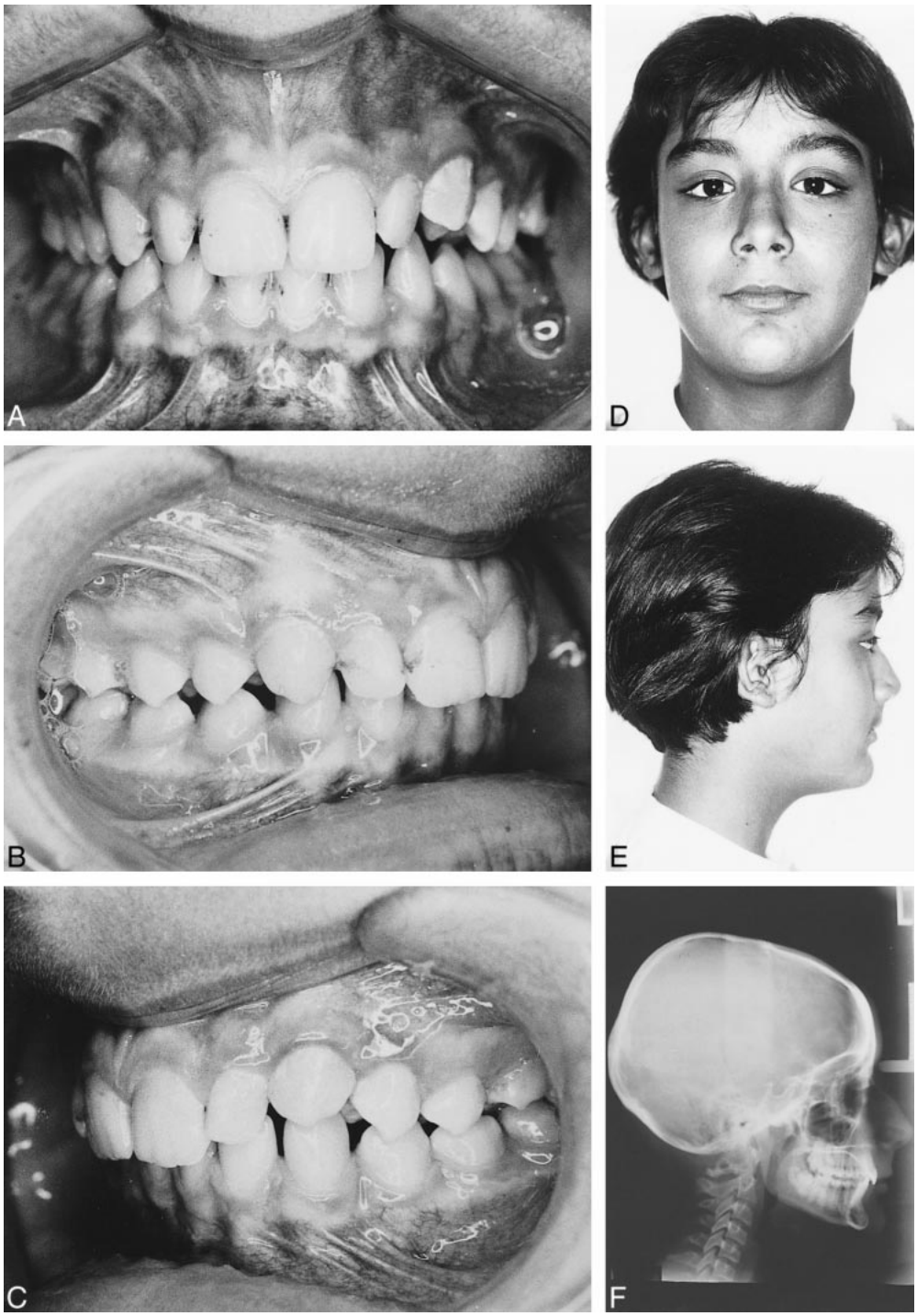


**FIGURE 2.** (A–C) Intraoral and (D,E) extraoral photographs and (F) a lateral cephalogram before disc-repositioning appliance insertion.

In the treatment of disc displacement with reduction, a disc-repositioning appliance has been widely used and accepted as a conservative treatment.[2,4–7,11–16] According to disc-repositioning theory,[11,12,16] the condyle is positioned forward and downward in the glenoid fossa so that the condyle recaptures the disc. However, it has been suggested that no direct correlation exists between the use of such splints and the elimination of the clinical symptoms or the construction of an ideal relationship between the disc and the condyle.[11]

Kurita et al[11] indicated that the recapture of the disc by disc-repositioning splint therapy could be established clinically at a rate of 70%. However, they also suggested that, because of the high rate of false-negative clinical results

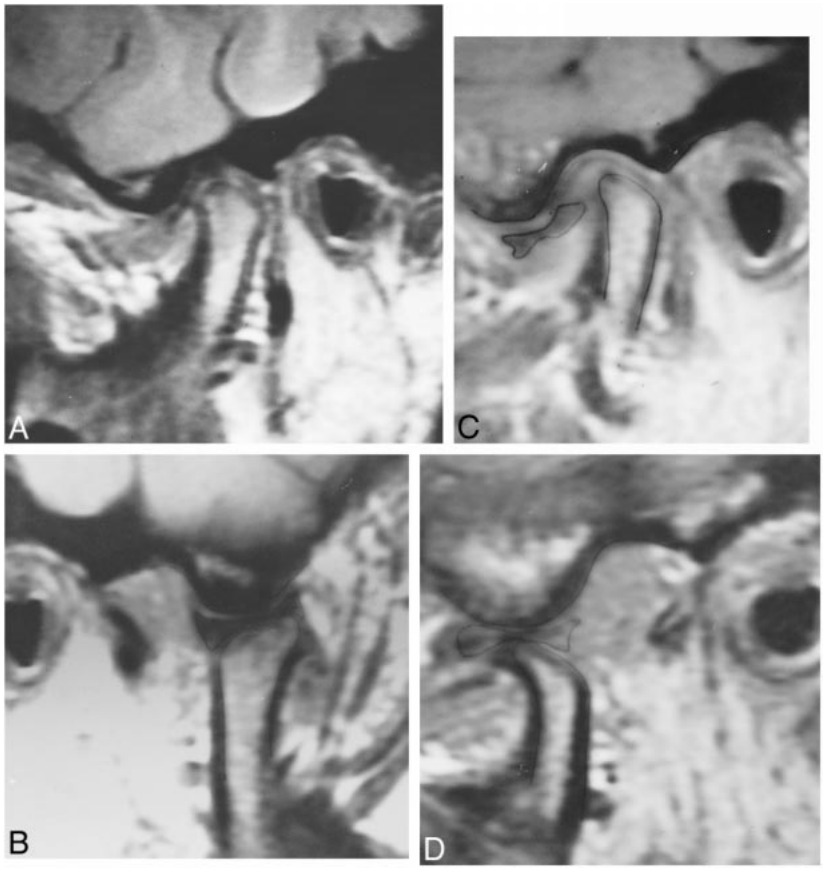


**FIGURE 3.** (A,B) Left and (C,D) right temporomandibular joint magnetic resonance images on closed and open mouth before disc-repositioning appliance therapy.

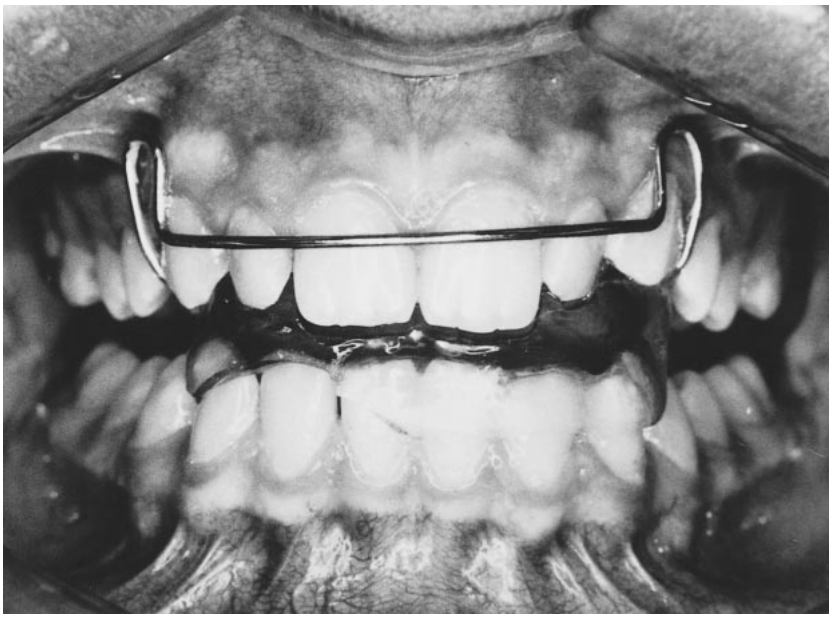

**FIGURE 4.** View of disc-repositioning appliance.

**TABLE 1.** Functional Examination Results Before and After Disc-Repositioning Appliance Therapy

| | Before Splint | After Splint |
|---|---|---|
| Maximum opening | 30 mm | 40 mm |
| End feel test | Hard | Normal |
| Right lateral excursion | 7 mm | 7 mm |
| Left lateral excursion | 5 mm | 7 mm |
| Protrusive excursion | 5 mm | 7 mm |
| Condyle translation | Right restricted, left normal | Normal |
| Pain on TMJ[a] palpation | Right (yes), left (no) | Normal |
| Joint sounds | Right median click, left (no) | No |
| Elimination test | Right (yes), left (no) | No |
| Deviation | "C" to the right | No |
| Deflection | No | No |
| Overjet | 5 mm | 2 mm |
| Overbite | 5 mm | 2 mm |

[a] TMJ indicates temporomandibular joint.

after application of a disc-repositioning splint, clinical results should be supported with a MRI. Kurita et al[12] also noted that signs and symptoms should have been eliminated by recapture of the disc. Nevertheless, even when signs and symptoms have not been eliminated by use of a disc-repositioning splint, disc recapture may still be observed in an MRI. However, it has been considered that the posterior attachment of the anteriorly positioned disc has become extended and thinner. Because of this, even if the disc returns to an appropriate position with the condyle, the posterior attachment may be deformed.[10] However, the elimination of sound and pain may be related to the adaptive capabilities of TMJ structures. The criteria for the success of the treatment are related not only to the elimination of sounds, but also to the elimination of pain. It has been reported that sounds are a common finding and have been observed in 28–50% of the adult population in epidemiological studies.[10]

Retrodiscal tissues are highly innervated and undergo a metaplastic transformation during adaptation. Consequently, they become less innervated, and pain is relieved.[16] The success of repair depends on the amount of disc displacement, the extent of the damage to the tissue, the amount of load on the joint, and the tissue repair capabilities.[16]

After insertion of the disc-repositioning splint, the disc recapture has been evaluated on MRI scans as[12] complete splint capture, partial splint capture, or no splint capture (Figure 1). Following disc-repositioning appliance therapy,

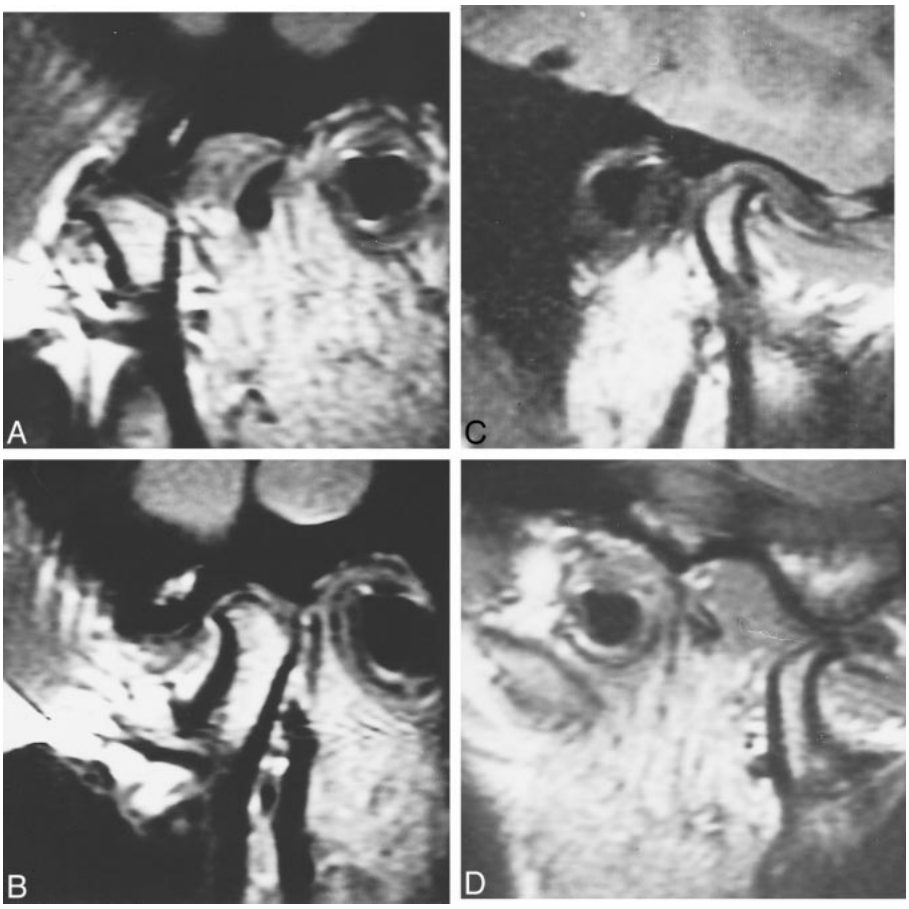


**FIGURE 5.** (A,B) Left open- and closed-mouth temporomandibular joint magnetic resonance images and (C,D) right open and closed temporomandibular joint magnetic resonance images after disc-repositioning appliance therapy.

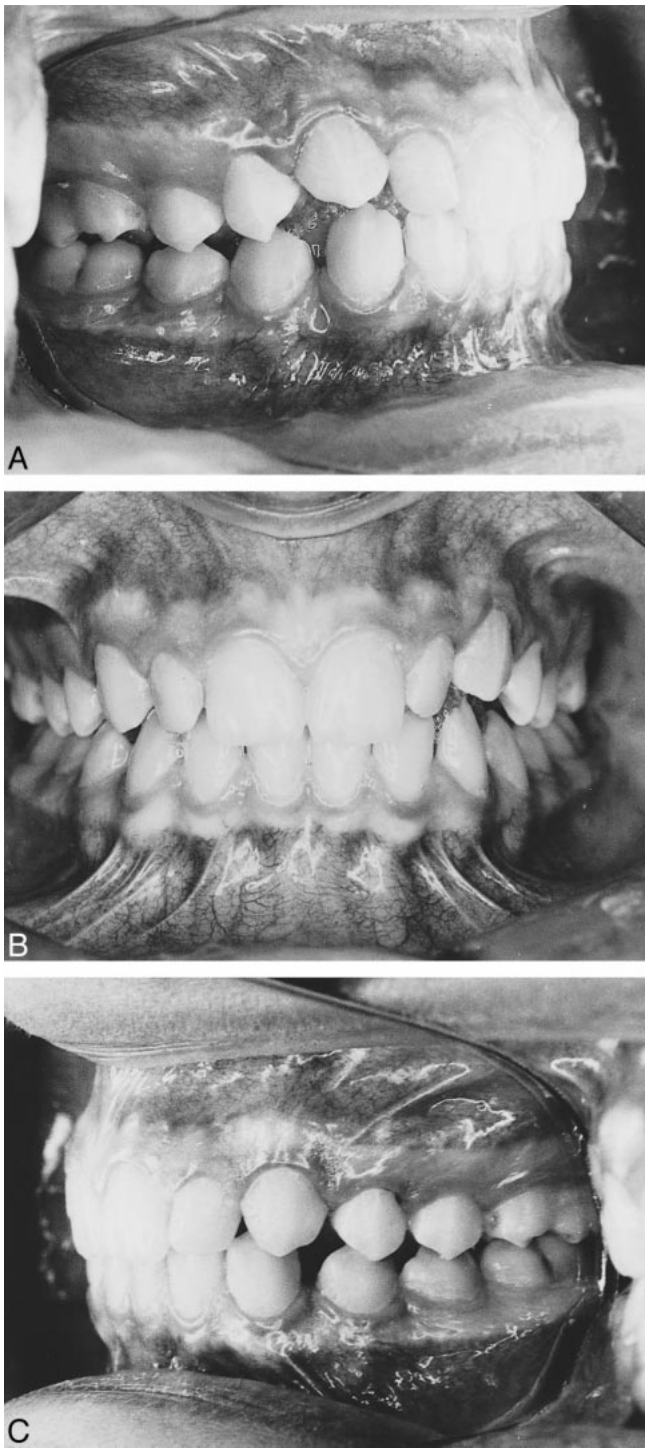


**FIGURE 6.** (A–C) Intraoral photographs after disc-repositioning appliance therapy.

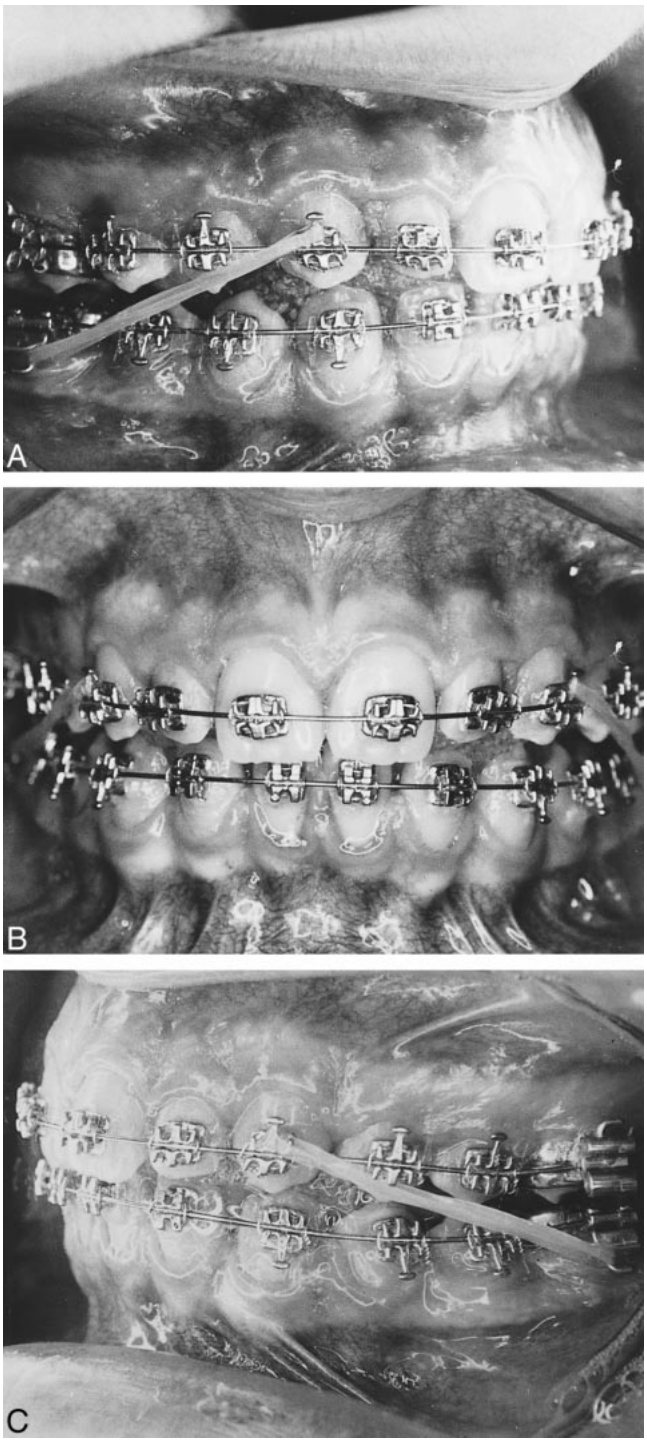


**FIGURE 7.** (A–C) Intraoral photographs during fixed orthodontic treatment.

the buccal occlusion is altered because of the mandible's more forward position. Successful results may occur even after a short period of disc-repositioning splint therapy. However, pain and clicking reoccur later because of the mandible's returning to its original position. Therefore, for the stability of disc recapture, a stable occlusion must be provided after splint therapy by orthodontic, prosthetic, or surgical means.[5,6,17]

## CASE REPORT

In this report, the results of disc-repositioning splint and orthodontic treatment in a patient with unilateral disc displace-

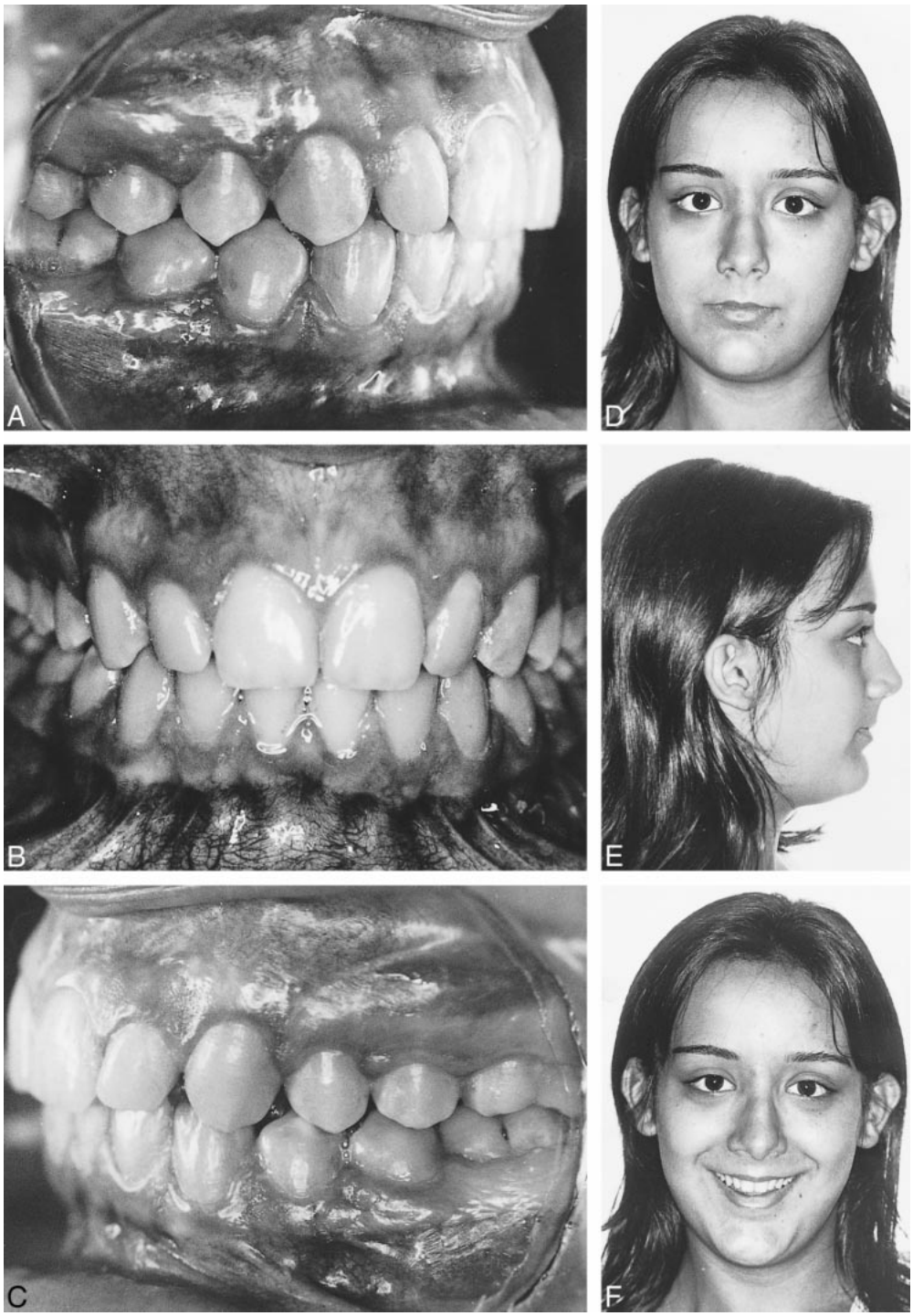


**FIGURE 8.** (A–C) Intraoral and (D–F) extraoral photographs at the end of fixed orthodontic treatment.

ment with reduction are presented. The patient was a 12.8-year-old girl with a chief complaint of pain and sounds when opening and closing her mouth. The patient demonstrated an angle Class II division 1 malocclusion associated with a retrognathic mandible. The right and left buccal occlusion was in an angle Class II molar relationship. The upper midline deviated to the left with an overjet and overbite of 5 mm. There were no transverse discrepancies between the maxillary and mandibular teeth. Minimal crowding existed in both the upper and lower dental arches (Figure 2). A detailed clinical and functional examination was performed. The functional examination used in this study was as follows.

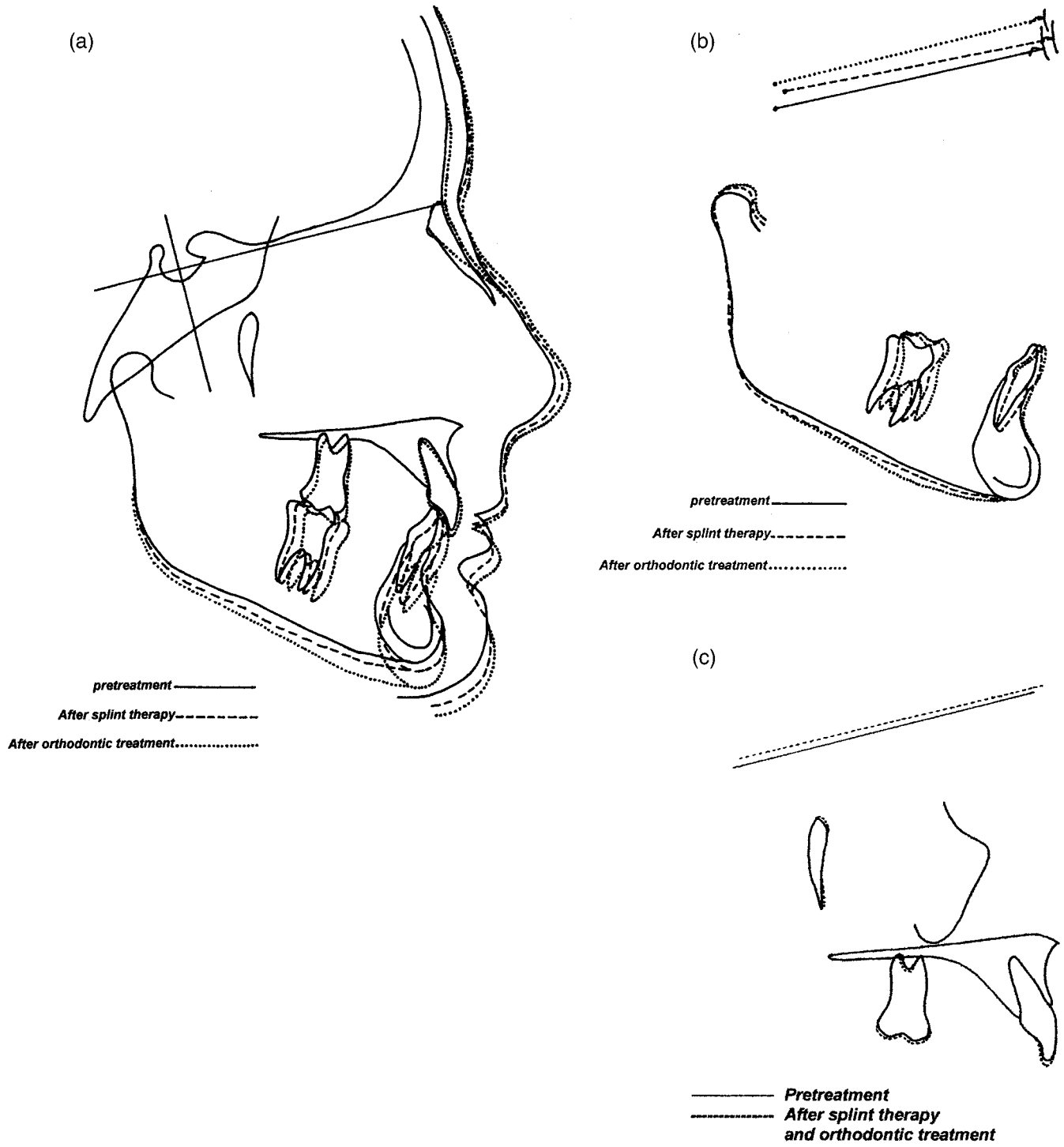


**FIGURE 9.** (A–C) Superimpositions made on lateral cephalograms.

### Maximum interincisal distance

The patient was asked to open slowly until pain was first felt. At that point, the distance between the incisal edges of the maxillary and mandibular anterior teeth was measured. This was the maximum comfortable opening. The patient was next asked to open maximally. This was recorded as the maximum opening amount. In the absence of pain, the maximum comfortable opening and maximum opening were almost the same.

### Application of the "end feel test"

If mandibular opening is restricted, it is helpful to test the ''end feel.'' The end feel describes the characteristics of the joint when an attempt is made to increase mouth

opening passively by gently placing downward force on the lower incisors with the fingers to increase the interincisal distance. If the end feel is ''soft,'' increased opening can be achieved. A soft end feel suggests muscle-induced restriction. If no increase in opening can be achieved, the end feel is said to be ''hard.'' Hard end feels are likely associated with intracapsular sources.[18]

### Alterations in the opening pathway

With deviation, the opening pathway is altered but returns to a normal midline relationship at maximum opening. With deflection, the opening pathway is shifted to one side and becomes greater with opening. At maximum opening, the midline is deflected to its greatest distance.

### Examining for lateral movement of the mandible

The patient was observed in centric occlusion, and the area of the mandibular incisor directly below the midline between the maxillary central incisors was noted. This can be marked with a pencil. The patient first made a maximum left and a maximum right laterotrusive movement. The distance the mark moved from the midline was measured, revealing the distance the mandible moved in each direction.

### Palpation of the TMJ

During the opening and closing, a finger was moved behind the condyle to palpate the posterior aspect of the joint. External auditory canal ''little finger'' examination will elicit posterior joint tenderness. If tenderness is present, a stethoscope is needed to evaluate joint sounds on opening, closing, and excursive movements.

### Elimination of clicking

Clicking appears during opening and closing. If the position of the mandible is forward during opening and closing, clicking may disappear because the condyle recaptures the disc.

Although the left TMJ was healthy on functional examination, a disc displacement with reduction was diagnosed in the right TMJ. In order to eliminate observer error, bilateral sagittal TMJ MRI scans of mouth opening and maximum intercuspation were obtained by means of a 1.5 Tesla (T) super conductive Magnetic Resonance system (GE Medical, Milwaukee, Wis) equipped with TMJ coils. The MRI protocol included proton density–weighted spin echo sequences (Repetition time (TR) 500, Echo time 21, Matrix: 256×128, FOV: 10 cm, NEX: 4). Another specialist who was not informed about the functional examination results evaluated the MRI scans.

The MRI images confirmed the normal left TMJ (Figure 3A,B), but a disc displacement with reduction was observed in the right TMJ (Figure 3C,D). The MRI scans and the functional examination results confirmed that the objectives of the treatment were to recapture the disc, eliminate the pain and sound, and provide retention of the disc recapture by orthodontic treatment.

Because the results of the elimination test were positive according to item 7 of the Functional Examination,[2,5] application of a disc-repositioning appliance was selected. The mandible was directed forward until the click disappeared, and the closure was transferred to a semiadjustable articulator with a wax bite. The disc-repositioning appliance was made on the upper dental arch, where it covered the whole lingual surface and capped the labial surface of the mandibular teeth to keep the mandible in a forward position (Figure 4). The appliance was used 24 hours a day except for meals. After 9 weeks, clinical signs and symptoms disappeared, and the appliance was worn only at night. Clinical records and MRI scans were again obtained. The clinical findings of the functional examination before and after splint therapy are presented in Table 1.

The results of clinical examination suggested that the condyle recaptured the disc after the splint therapy. However, it was observed that, although the left TMJ did not show any change (Figure 5A,B), partial splint capture was achieved in the right TMJ on bilateral MRI scans (Figure 5C,D).

Following splint therapy, overjet and overbite were reduced to 2 mm, and an end-to-end molar relationship was established (Figure 6). After 2 years of edgewise mechanics, Class I molar and canine relationships and an overjet and overbite of 1 mm were achieved (Figures 7 and 8). Superimpositions were made on craniofacial structures (Figure 9).

## CONCLUSIONS

After the application of a disc-repositioning appliance, reduction in the position of an anteriorly located disc was observed. Reestablishment of the occlusion by orthodontic treatment was anticipated to provide the best stability of the disc condyle relationship following the splint therapy. However, in order to determine whether the corrected disc-condyle relationship is stable, treated patients must be followed longitudinally.

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