

# Long-term stability of conservative orthodontic treatment in a patient with temporomandibular joint disorder

Silvia Naomi Mitsui, Akihiro Yasue<sup>1</sup>, Shingo Kuroda<sup>1</sup> and Eiji Tanaka<sup>1</sup>

## ABSTRACT

This article reports the orthodontic treatment of a 20-year-old patient with dental crowding and temporomandibular joint disorders (TMDs). The patient presented moderate anterior crowding with a Class I molar relationship and masticatory disturbance in the mandibular position induced by previous splint therapy. Orthodontic treatment with multi-bracket appliance was initiated to correct the anterior crowding in both dental arches, after the extraction of first premolars and third molars, and also to maintain the splint-induced position of the condyles. After 26 months of treatment, an acceptable occlusion was achieved without any TMD symptoms. After 18-month retention, flattening on the right condyle was observed, possibly as an adaptative remodeling. After 16-year retention period, the occlusion was maintained without recurrence of any TMD symptoms, indicating a long-term stability of occlusion and temporomandibular joint (TMJ) components. Our results suggest the possibility of compromised treatment in patients with TMD to achieve a long-term stability in occlusion and TMJ function.

**Key words:** Degenerative joint disorder, long-term stability, splint therapy, temporomandibular joint

## INTRODUCTION

Temporomandibular joint disorders (TMDs) are the most prevalent clinical entity afflicting the masticatory apparatus,<sup>[1,2]</sup> characterized by intra-articular morphologic abnormalities.<sup>[3]</sup> The etiology of TMD is poorly understood, but is generally accepted that is multifactorial, involving factors such as mechanical stress, host adaptative capacity, psychological factors, and comorbidities.<sup>[4-6]</sup>

Management of TMDs may be divided into conservative and surgical modalities. The decision to surgically manage any

arthritic condition of the temporomandibular joint (TMJ) must be based on the evaluation of the patient's response to noninvasive management, the patient's mandibular form and function, and the effect the condition has on the patient's quality of life.<sup>[3]</sup> Irrespective of the type of TMDs management, the goals should be to decrease joint pain, swelling and muscle spasm/pain, increase joint function, prevent further joint damage, and prevent disability, and disease-related morbidity.<sup>[3,7]</sup>

The conservative treatment, especially splint therapy, is the most popular management of the TMDs among clinical practitioners.<sup>[8]</sup> Splint therapy would include the correction of condylar dislocation, if any, and the subsequent occlusal reconstruction might be required to achieve an optimal environment within the TMJ.<sup>[9]</sup> With these considerations, orthodontic treatment will be of great significance for cases requiring occlusal reconstruction at the induced condylar position after splint therapy. Previously, many cases of orthodontic treatment for the patients with TMD have been published;<sup>[9-11]</sup> however, few reports have described the

Department of Orthodontics and Dentofacial Orthopedics, Tokushima University Graduate School of Oral Sciences,  
<sup>1</sup>Department of Orthodontics and Dentofacial Orthopedics, Institute of Biomedical Sciences, Tokushima University Graduate School, Tokushima, Japan

**Address for correspondence:** Prof. Eiji Tanaka, 3-18-15, Kuramoto, Tokushima 770-8504, Japan.  
 E-mail: etanaka@tokushima-u.ac.jp

### Access this article online

Quick Response Code:	Website: www.jorthodsci.org
	DOI: 10.4103/2278-0203.186168

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

**For reprints contact:** reprints@medknow.com

**How to cite this article:** Mitsui SN, Yasue A, Kuroda S, Tanaka E. Long-term stability of conservative orthodontic treatment in a patient with temporomandibular joint disorder. J Orthodont Sci 2016;5:104-8.

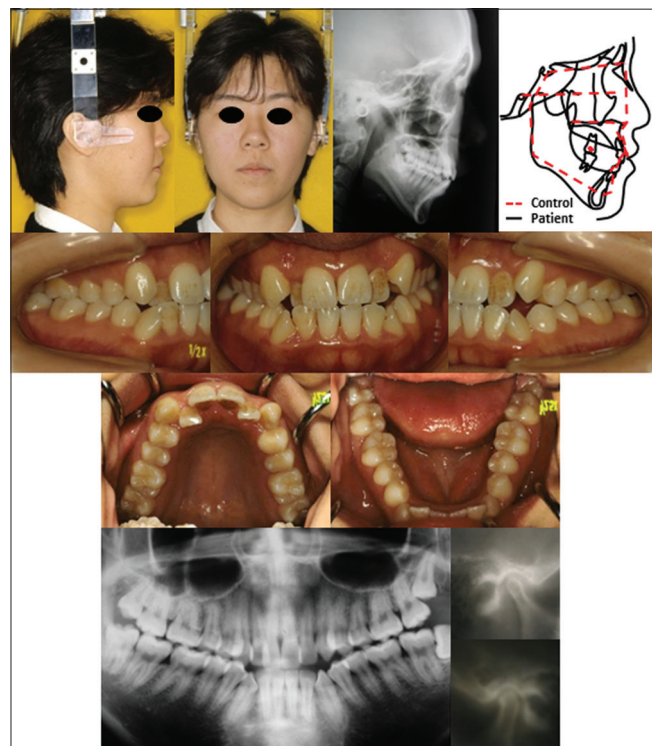
long-term outcomes of occlusal reconstruction with splint therapy and multi-bracket appliance treatment in patients with TMD. This article reports the 16-year stability of conservative orthodontic treatment in a patient with TMD.

## CASE REPORT

### Diagnosis and Etiology

A female patient, aged 20-year-old, had dental crowding as a chief complaint [Figure 1]. She had a history of untreated tinnitus and trismus at the age of 12 years. Four years later, she consulted with a prosthodontist for having TMJ crepitus, pain in the preauricular area on the right side, and tenderness in the sternocleidomastoid muscle. Her symptoms were alleviated by approximately 3 years and a half of occlusal splint therapy. She was then introduced to the Department of Orthodontics in our university dental hospital.

Her facial profile was straight and no facial asymmetry was observed. As for the occlusal status, she had moderate anterior crowding in the upper and lower dentitions. The upper and lower dental midlines coincided with the facial midline. Overjet and overbite were 2.2 and 1.2 mm, respectively. The molar relationship was Angle Class I on both sides. Arch length discrepancies were -7.0 and -5.5 mm in maxillary and mandibular dentitions, respectively. During mandibular excursive movement, group function was observed during right mandibular movement; meanwhile, the left mandibular movement was guided by the second molar of the balancing side.



**Figure 1:** Pretreatment records (age 20 years)

The panoramic radiograph showed the existence of all third molars [Figure 1]. For the TMJ, lateral tomograms showed slight osteophyte on the left mandibular condyle. Both condyles were located at a concentric position relative to the glenoid fossa.

Cephalometric analysis, when compared with the Japanese norm, showed a Skeletal Class I relationship (ANB, 4.4°), a steep mandibular plane angle (FMA, 36.4°), and lingually inclined lower incisors (IMPA, 86.4°) [Table]. The inclinations of maxillary and mandibular incisors were within the normal range.

In the pretreatment clinical examination, TMJ crepitus was detected only on the right side. No trismus was detected; however, maximum mouth opening without pain was approximately 28 mm. As for the muscle symptoms, the patient often had dull pain and fatigue in the masseter muscles when she discontinued using the splint during sleep. Tenderness in the lateral pterygoids was observed up on palpation.

### Treatment Objectives

The patient was diagnosed as having an Angle Class I malocclusion, with a Skeletal Class I jaw base relationship, a steep mandibular plane, and severe crowding in both dental arches. The treatment objectives were (1) to correct the anterior crowding observed in both dental arches and (2) to achieve an acceptable occlusion with a mutually protected functional Class I occlusion.

### Treatment Alternatives

Nowadays, a nonextraction treatment plan can be considered using titanium miniscrews for skeletal anchorage to align anterior teeth, distalizing posterior ones, and to achieve counterclockwise rotation of the mandible by molar intrusion. However, at that time, this treatment plan was not possible. Proximal reduction of tooth width or expansion of both dental arches would have been the nonextraction alternatives, but for the amount of the arch length discrepancy, and hyperdivergent mandibular angle, and because of the poor prognosis of the expansion, especially in the lower arch, an extraction treatment was planned to achieve an ideal occlusion and maintain her facial profile.

### Treatment Progress

Before the initiation of orthodontic treatment, the upper and lower first premolars and third molars were extracted. Then, a transpalatal arch was placed between the maxillary first molars and orthodontic treatment with multi-bracket appliances was started. The stabilization type splint was kept in use only during the first several months of the treatment, and it was adjusted according to the orthodontic alignment of the dentitions in each visit. An acceptable occlusion without any recurrences of TMJ symptoms was achieved after 26 months of orthodontic treatment, and the multi-bracket appliances were removed. Immediately after the removal, lingual bonded retainer was fixed on the upper dentitions, and circumferential retainers were added on both the arches.

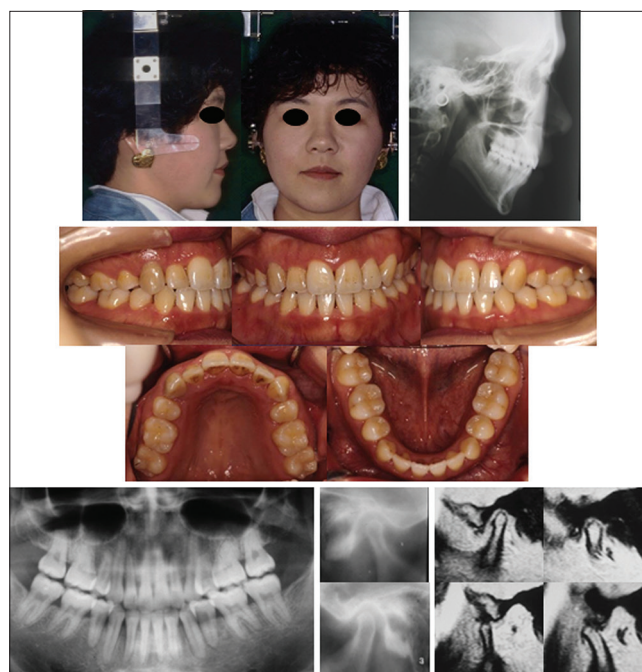
## RESULTS

An acceptable profile and Class I occlusion of the patient were maintained [Figure 2]. Overjet and overbite had slight changes to 2.4 and 2.1 mm, respectively. Canines-guided lateral mandibular movements were achieved with no balancing-side contact. Panoramic radiograph showed almost root parallelism, but all second premolars revealed a slight root resorption [Figure 2]. Cephalometric analysis revealed no change of mandibular position during treatment, and the gonial and mandibular plane angles remained as large as the initial stage [Table 1]. The upper and lower incisors became more lingually inclined.

Lateral tomograms revealed slight changes of condylar structure and the forward and downward repositioning of both condyles [Figure 2]. Throughout the treatment time, the patient did not experience TMJ pain. Maximum mouth opening without pain was 40.0 mm, although TMJ crepitus was still detected on both sides. Magnetic resonance imaging showed anterior

**Table 1: Cephalometric summary**

Variables	Japanese Norm	SD	Pretreatment	Posttreatment
ANB	2.8	3.61	4.4	3.5
SNA	80.8	4.45	81.1	80.2
SNB	77.9	2.44	76.6	76.7
GoA	122.1	5.29	129.6	129.5
FMA	30.5	3.60	36.4	36.3
IMPA	93.4	6.77	86.4	84.5
FMIA	56.0	8.09	57.5	59.2
U1-FH	112.3	7.99	107.9	102.9
I.I.A.	123.6	10.64	129.5	136.3



**Figure 2:** Posttreatment records (age 22 years and 2 months)

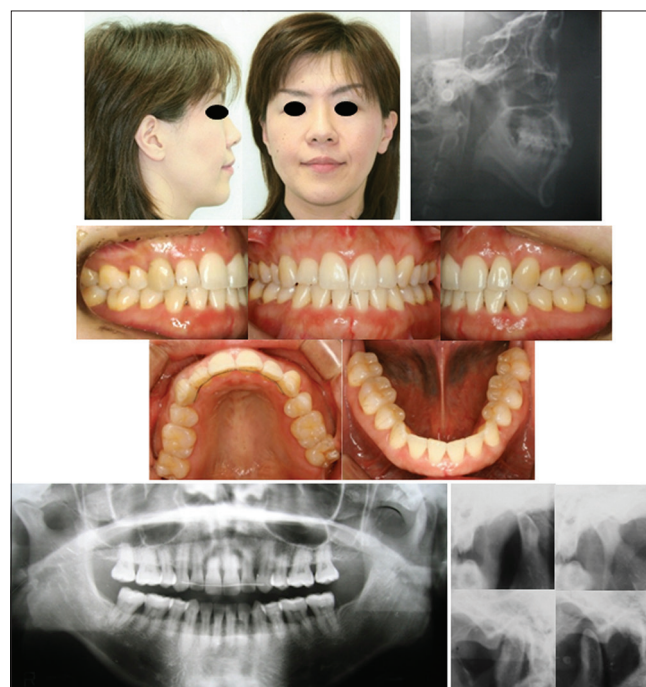
disc displacement without reduction bilaterally [Figure 2]. At 18-month retention, the occlusion showed good stability and the canine guidance was maintained. However, panoramic radiograph showed flattening progression on the right condyle, while recurrence of the TMD symptoms was not observed.

After 16-year retention, the facial profile was preserved [Figure 3]. An acceptable occlusion with Class I canine and molar relationships and adequate overjet and overbite were maintained without recurrence of TMD symptoms [Figure 3]. From the panoramic radiograph, flattening of the right condyle remained and did not deteriorate [Figure 3]. Lateral cephalogram revealed no changes throughout the 16-year retention period [Figure 3]. As for the TMD symptoms, no difficulty of mouth opening, TMJ pain, muscle tenderness, and tinnitus did occur during the 16-year retention period.

When we evaluated the changes in the maxillary and mandibular intercanine widths during orthodontic treatment, an increase of 3 and 1.5 mm was observed, respectively. However, a decrease of 26.7% in the maxilla and 60% in the mandible were observed after 18-month postretention, followed by slight decrements after 16 years of postretention.

## DISCUSSION

Occlusal splints are effective to protect the TMJ from involuntary overloading and to reduce the muscle hyperactivity and articular strain due to bruxism. The most commonly used is the stabilization type splint, with smooth surface to allow free multidirectional contact movements, preferably from and to a centric jaw position. The long-term



**Figure 3:** Sixteen years postretention records (age 38 years and 3 months)

use of this splint is a matter of patient preference, based upon the patient's perception of its efficacy, which in part it is likely to be a placebo effect that is often associated with the treatment of miofacial pain.<sup>[12]</sup> In a controlled study on the effects of occlusal splint therapy in patients with severe TMJ osteoarthritis, a reduction of clinical signs was observed.<sup>[8]</sup> However, critical evaluation of splint therapy was not yet conducted due to the lack of evidence, and their clinical effectiveness to relieve pain seems modest when compared with pain treatment methods in general.<sup>[13]</sup> In the pretreatment clinical examination, the patient experienced dull pain and fatigue in the masseter muscle and tenderness in the lateral pterygoid when she discontinued using the occlusal splint during sleep. Group function and balancing-side contact were observed on the right and left mandibular excursive movement, respectively. After 26 months of orthodontic treatment combined with the splint, canine-protected occlusion without balancing-side contact was achieved. Although there is a lack of consensus about the influence of the occlusion in TMD, we hypothesize that, in our patient, the achievement of functional and stable occlusion, without any deleterious interference, might have influenced positively in the reduction of symptoms.

Regarding the flattening progression of the right mandibular condyle observed in the patient after 18-month postretention, it presumably represents functional remodeling that could have been stimulated by the occlusal equilibration. Functional remodeling of TMJ is characterized by morphologic changes involving the articular structures of the joint that are not associated with any significant alterations in the mechanical function of the joint or occlusion.<sup>[6]</sup> Tanaka *et al.*<sup>[9]</sup> reported that adaptative remodeling of the condyle was found 2 years after splint therapy and the subsequent orthodontic treatment in an adult case of TMJ osteoarthritis. Condylar remodeling after retention was also reported by Sasaguri *et al.*<sup>[14]</sup> in a case with rheumatoid arthritis, suggesting the remodeling of the eroded condyles might be an adaptative response to a stable and functional occlusion.

Relapse, considered as a multifactorial problem, is still an unsolved problem for orthodontists.<sup>[15]</sup> Al Yami *et al.*<sup>[16]</sup> concluded that about half of the total relapse takes place during the first 2 years after retention, which was also observed in the intercanine widths of our patient. The reduction of the intercanine widths observed in our patient is also consistent with Little *et al.*,<sup>[17]</sup> who have measured a postretention intercanine widths reduction in 60 of 65 patients. This process of arch constriction appears to continue well after the cessation of growth during the 20–30-year age span. From age 30 to 40 years and beyond, the process continues, but usually at a lessened degree or rate. Moreover, according to Burke *et al.*,<sup>[18]</sup> mandibular intercanine width is extremely sensitive to expansion beyond 1 mm.

## CONCLUSION

A female patient with TMD symptoms underwent orthodontic treatment combined with splint therapy. After 16-year postorthodontic retention period, an acceptable occlusion was maintained without recurrence of any TMD symptoms, indicating a long-term stability of occlusion and the TMJ components. Our results suggest the possibility of compromised treatment in patients with TMD to achieve long-term stability in occlusion and TMJ function.

## Declaration of Patient Consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

## Financial Support and Sponsorship

Nil.

## Conflicts of Interest

There are no conflicts of interest.

## REFERENCES

1. de Bont LG, Dijkgraaf LC, Stegenga B. Epidemiology and natural progression of articular temporomandibular disorders. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 1997;83:72-6.
2. Michelotti A, Iodice G. The role of orthodontics in temporomandibular disorders. *J Oral Rehabil* 2010;37:411-29.
3. Tanaka E, Detamore MS, Mercuri LG. Degenerative disorders of the temporomandibular joint: Etiology, diagnosis, and treatment. *J Dent Res* 2008;87:296-307.
4. Arnett GW, Milam SB, Gottesman L. Progressive mandibular retrusion – idiopathic condylar resorption. Part I. *Am J Orthod Dentofacial Orthop* 1996;110:8-15.
5. Arnett GW, Milam SB, Gottesman L. Progressive mandibular retrusion-idiopathic condylar resorption. Part II. *Am J Orthod Dentofacial Orthop* 1996;110:117-27.
6. Macfarlane TV, Kenealy P, Kingdon HA, Mohlin BO, Pilley JR, Richmond S, *et al.* Twenty-year cohort study of health gain from orthodontic treatment: Temporomandibular disorders. *Am J Orthod Dentofacial Orthop* 2009;135:692.e1-8.
7. Mercuri LG. Surgical management of TMJ arthritis. In: Laskin DM, Greene CS, Hylander WL, editors. *TMDs, an Evidence-based Approach to Diagnosis and Treatment*. Chicago: Quintessence; 2006. p. 455-68.
8. Kuttilla M, Le Bell Y, Savolainen-Niemi E, Kuttilla S, Alanen P. Efficiency of occlusal appliance therapy in secondary otalgia and temporomandibular disorders. *Acta Odontol Scand* 2002;60:248-54.
9. Tanaka E, Kikuchi K, Sasaki A, Tanne K. An adult case of TMJ osteoarthritis treated with splint therapy and the subsequent orthodontic occlusal reconstruction: Adaptive change of the condyle during the treatment. *Am J Orthod Dentofacial Orthop* 2000;118:566-71.
10. Kuroda S, Sugawara Y, Tamamura N, Takano-Yamamoto T. Anterior open bite with temporomandibular disorder treated with titanium screw anchorage: Evaluation of morphological and functional improvement. *Am J Orthod Dentofacial Orthop* 2007;131:550-60.
11. Kaku M, Koseki H, Kawazoe A, Abedini S, Kojima S, Motokawa M,

- et al.* Treatment of a case of skeletal class II malocclusion with temporomandibular joint disorder using miniscrew anchorage. *Cranio* 2011;29:155-63.
12. Dao TT, Lavigne GJ. Oral splints: The crutches for temporomandibular disorders and bruxism? *Crit Rev Oral Biol Med* 1998;9:345-61.
  13. Forssell H, Kalso E. Application of principles of evidence-based medicine to occlusal treatment for temporomandibular disorders: Are there lessons to be learned? *J Orofac Pain* 2004;18:9-22.
  14. Sasaguri K, Ishizaki-Takeuchi R, Kuramae S, Tanaka EM, Sakurai T, Sato S. The temporomandibular joint in a rheumatoid arthritis patient after orthodontic treatment. *Angle Orthod* 2009;79:804-11.
  15. Blake M, Bibby K. Retention and stability: A review of the literature. *Am J Orthod Dentofacial Orthop* 1998;114:299-306.
  16. AlYami EA, Kuijpers-Jagtman AM, van't Hof MA. Stability of orthodontic treatment outcome: Follow-up until 10 years postretention. *Am J Orthod Dentofacial Orthop* 1999;115:300-4.
  17. Little RM, Riedel RA, Artun J. An evaluation of changes in mandibular anterior alignment from 10 to 20 years postretention. *Am J Orthod Dentofacial Orthop* 1988;93:423-8.
  18. Burke SP, Silveira AM, Goldsmith LJ, Yancey JM, Van Stewart A, Scarfe WC. A meta-analysis of mandibular intercanine width in treatment and postretention. *Angle Orthod* 1998;68:53-60.

## New features on the journal's website

### Optimized content for mobile and hand-held devices

HTML pages have been optimized of mobile and other hand-held devices (such as iPad, Kindle, iPod) for faster browsing speed.

Click on **[Mobile Full text]** from Table of Contents page.

This is simple HTML version for faster download on mobiles (if viewed on desktop, it will be automatically redirected to full HTML version)

### E-Pub for hand-held devices

EPUB is an open e-book standard recommended by The International Digital Publishing Forum which is designed for reflowable content i.e. the text display can be optimized for a particular display device.

Click on **[EPub]** from Table of Contents page.

There are various e-Pub readers such as for Windows: Digital Editions, OS X: Calibre/Bookworm, iPhone/iPod Touch/iPad: Stanza, and Linux: Calibre/Bookworm.

### E-Book for desktop

One can also see the entire issue as printed here in a 'flip book' version on desktops.

Links are available from Current Issue as well as Archives pages.

Click on  View as eBook