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Condylar resorption during active orthodontic treatment and subsequent therapy: report of a special case dealing with iatrogenic TMD possibly related to orthodontic treatment

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SUMMARY **A 28-year-old female underwent orthodontic treatment for approximately 22 months. During the later stages of this treatment, the patient reported right shoulder and neck-muscle pain. In addition, temporomandibular joint disorder (TMD) with a 'clicking' sound during mastication commenced 5 months prior to treatment completion. Specific medication to deal with these symptoms was suggested by medical specialists, as were some stress-relief methods, although the pain still progressed, and subsequent clinical and radiographical examinations were undertaken by another orthodontist. Right mandibular condylar resorption was observed from both the panorex and temporomandibular joint (TMJ) radiographs. No clinical signs of rheumatic disease were observed, although bruxism was noted. Following the termination of the orthodontic treatment by the second practitioner, the patient was treated with splint therapy 1 month subsequent to which, the previous symptoms of pain in the shoulder and neck, and the clicking sound during mastication had subsided. During the 14-month period of splint therapy and follow-up, new bone growth in the right condyle was observed from radiographs.**

KEYWORDS: **condylar resorption, orthodontic treatment, splint therapy, TMD**

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Introduction

The exact relationship between temporomandibular joint disorder (TMD) and orthodontic treatment remains to be elucidated. Strong scientific evidence suggesting that TMD may be induced by some orthodontic treatment still appears to be lacking. Some studies, however (1–6) have reported that orthodontic treatment was not responsible for any iatrogenic TMD. Furthermore, several authors have indicated that orthodontic treatment can be beneficial as regards the health of an adjacent temporomandibular joint (TMJ; 7).

Contrasting this, however, although such an occurrence is rare, a case of condylar resorption arising 2 years subsequent to earlier active orthodontic treatment has been reported previously (8), in which circumstance, bone remodelling was suggested to have possibly been the aetiological factor.

In this paper, we report on a case of an adult female who received orthodontic treatment, and for whom TMD with right condylar resorption was noted during the patient's active treatment phase. The timing of onset and the dimension of the symptoms of such a condition, the history of the condition, the treatment procedures undertaken and any associated follow-up radiographs are also presented.

Case report

This 28-year-old female first presented with a Class II, division 1 malocclusion, a severe overjet and a deep overbite (Fig. 1). Data collection, including panorex imaging prior to orthodontic treatment, revealed a normal morphology of the right mandibular condyle (Fig. 2), with bruxism having been noted to have existed for about 12 months. Whilst the patient was in the USA, orthodontic treatment with upper and lower

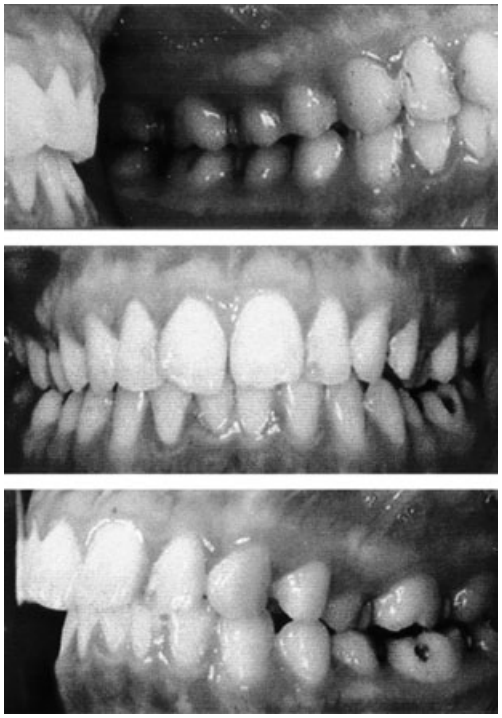

Fig. 1. Occlusal relationship of the patient's dentition prior to orthodontic treatment (top: left side, middle: front view, bottom: right side).

Fig. 2. Panorex image conducted prior to orthodontic treatment had commenced, revealed normal morphology of right condyle.

fixed edgewise appliances was performed subsequent to bilateral extraction of the upper first bicuspids in October 1996. The appliances were banding on bilateral upper first molars and lower molars with tubes. The other teeth were bonding by 0·018 slot of edgewise brackets with hooks on lateral portion of the teeth. After several steps of rounding and levelling, upper canine retraction, anterior retraction and ideal arches for final interdigitation were obtained. The active orthodontic treatment would be scheduled for completion within 2 years. The purpose was to correct severe overjet, crowding and anteroposterior discrepancy in order to achieve a well-balanced and interdigitation of a harmonized occlusion. Upon her return to Taiwan in August 1997, the patient was continued to be treated by a Taiwanese orthodontist using Class II elastic materials, 1 month subsequent to which, soreness of the right side of the face and a persistent dull pain with a clicking sound emanating from the right TMJ during mastication had been reported. Maximal mouth opening (MMO) was 48·5 mm as measured at the distance between the upper and lower incisal edges of the central incisors. Pain over the right TMJ at the time of opening the mouth was first detected in October 1997, the pain scale, modified from LeResche *et al.* (9), for a mouth opening (MO) of 40, 30 and 13 mm being four, three, and one, respectively. At the end of October, the pain scale corresponding to a mouth opening of 32 and 25 mm was, respectively, seven and four. A bilateral panorex investigation at this time revealed normal findings for mandibular condyles. Maximal mouth opening without pain was noted to be 34 mm during the monthly follow-up (November), although right TMJ clicking was still noted during mastication at that time. Furthermore, tenderness of the right masseter and sternocleidomastoid muscles was reported. In December 1997, the intensity of pain over the right TMJ on mouth opening and mastication appeared to have reduced but TMJ clicking at a mouth opening of 20 mm was still noted, and lower splint therapy (full-coverage occlusal stabilization type) was commenced. One week subsequent to splint delivery, both pain and clicking appeared to have been reduced. Finally, the right-side TMJ noise appeared to have subsided 2 weeks later. The patient was unfortunately lost for follow-up for the subsequent 4 months.

In May 1998, the patient returned to our clinic because of pain over the right TMJ on mouth opening and a clicking sound emanating from the right TMJ during mastication with the MMO declining to only 10 mm and a pain scale of six at that position, this figure increasing to a level of 29, 1 week subsequent to splint therapy. Neither TMJ pain nor clicking was noted at a mouth opening at 20 mm.

Sharp right-side TMJ pain was noted again in December 1998, at which time, right condylar resorption was observed on panorex imaging (Fig. 3) and TMJ radiograph (Fig. 4). Upon laboratory investigations with blood samples obtained from the patient, no

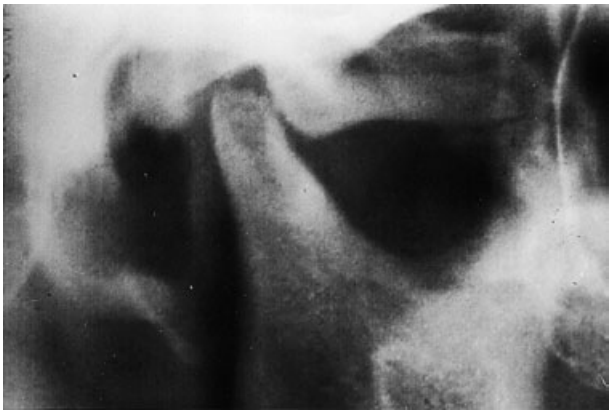

Fig. 3. Panorex image of the patient showing right-condyle resorption.

Fig. 4. Close-up view of TMJ image showing right-condyle resorption.

evidence of any bone-involving systemic diseases such as rheumatoid factors and hyperparathyroidism were found. It was recommended to the patient at this time that the orthodontic treatment being conducted at that time should cease immediately. In fact, no orthodontic adjustment had been performed subsequent to October 1998. After undergoing splint therapy for 2 months, both the TMJ pain and the clicking sound during mastication and mouth opening had almost subsided, although right condylar resorption was still noted on panorex image at this time. No further progressive destruction of the right mandibular condyle was noted

Fig. 5. Close-up view of TMJ image revealing condylar flattening and an enhanced density of the cortical image over the right condyle 14 months subsequent to splint therapy.

in June 1999. Between July and September 1999, a flattening of the right condylar head and an enhanced (bone) density of the cortex of the right condyle had been noted on routine panorex image and TMJ radiograph. At the patient's last appointment (August 2000), no TMJ symptoms and signs were reported, and some right condylar remodelling was noted through TMJ imaging (Fig. 5).

Discussion

Prolonged bruxism may cause intracapsular TMJ derangement, resulting in degenerative disease of that joint (10). A review of our patient's clinical data revealed that she had suffered from bruxism for about 12 months although no change to normal mandibular bone structure had been noted prior to orthodontic treatment which commenced in October 1996. Whether orthodontic force is one of the predominant factors responsible for the induction of TMD in this particular case is the subject of some conjecture and clearly worthy of consideration.

Changes in mechanical force may cause mandibular bone remodelling. Systemic hormones influence bone remodelling by regulating the movement of minerals such as Ca, P and K from bone to extracellular fluid and back, constituting a normal part of their overall effect

upon bone growth and remodelling. Alteration of mechanical forces mediate any bone-modelling response which may occur, and which may also modulate the effects of systemic hormones (11). No evidence of any bone-involving systemic diseases such as rheumatoid factors and hyperparathyroidism were found for this patient. Class II elastics were used to close the space of the upper jaw and alleviate the midline deviation of this patient's dentition, thus suggesting that the mechanical force germane to orthodontic work might explain why condylar resorption occurred for this patient.

Bone-remodelling cycle is closely coupled with bone resorption and new-bone formation. Post-menopausal and age-related bone loss commences when resorption increases and new bone formation no longer keeps pace (12). In addition, the activation of new remodelling sites may also increase with age (13). For these reasons, age may possibly be one of the factors contributing to the bone resorption in the present case. This idea is further substantiated by the study of Yamada *et al.* (14) who, using computed tomography and magnetic resonance imaging, investigated how condylar bony changes relate to the craniofacial morphology of orthodontic patients, these authors finding that for the bilateral condylar-change group, osteophyte formation and erosion were the most common bony changes noted, such changes being present amongst adult as well as juvenile subjects. In the unilateral condylar-change group, flattening of the condyle head was the most common feature and erosion only appeared to be present for subjects aged below 19 years (14). Furthermore, these authors also noted that such condylar bony changes might be progressive and unstable amongst the adults of the bilateral group as well as for juveniles of both groups. It appears thus, that condylar resorption may be related to a lateral mandibular shift and a retrognathic mandible for orthodontic patients who demonstrate TMD symptoms.

Splint therapy may be one of the treatment regimens of choice to control TMD (15). Upon use of full-coverage occlusal stabilized splint for our present case at the onset of the TMD problem, effective results with new bone growth was evidenced radiographically. A previous study (16) indicated that an occlusal splint might allow resolution of the effects of muscle microtrauma and associated symptoms of pain or discomfort of TMJ, and that such splinting may also improve jaw support, and facilitate the spatial re-orientation of the jaw into an optimal position. The lower repositioning appliance used in our specific case was designed to provide vertical and anteroposterior adjustments of condylar elements.

The relationship between orthodontic treatment and TMD has long been of interest to the practicing orthodontist. It has been concluded by a number of workers that orthodontic treatment performed during adolescence elicits no significant effect upon the induction of TMD later in the patient's life (7, 17), although in another study (18), those female Class II malocclusion patients demonstrating a severe initial overjet, overbite and moderate to severe crowding of the lower arch were most predisposed to developing TMD subsequent to orthodontic treatment. Therefore, as noted in the present case, this kind of patient should be observed closely, especially when TMD is reported during active orthodontic treatment. It is unfortunate that the patient in the present case was lost for follow-up for a period of about 4 months during the TMD treatment, thus making it impossible to detect any early mandibular bony changes through radiography. The importance of routine X-ray follow-up subsequent to the commencement of orthodontic work, at least, once every 3 months cannot be overemphasized.

Although a case of condylar resorption subsequent to active orthodontic treatment has been reported previously (8), to the best of our knowledge, the present report may be the first to demonstrate condylar resorption during active orthodontic treatment without any evidence of any systemic disorders having been detected. Although no direct evidence has yet been established to prove that orthodontic treatment may result in condylar resorption, the following points are worthy of attention if TMD (or its potential for development during treatment) is suspected:

1. The close observation of a patient's condition when TMD is noted during active orthodontic treatment.
2. The evaluation of any pre-existing systemic disorders including rheumatoid diseases and hyperparathyroidism.
3. A routine radiographic examination should be performed at least once every 3 months.
4. The immediate cessation of any further orthodontic adjustments until the aetiology of any developing bone lesion is determined.
5. The commencement of splint therapy which may be one of the best modalities to treat TMD and any associated bone remodelling.

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