Impact of Over-Erupted Maxillary Third Molar on Attrition of Incisors: A Report of Two Cases

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Abstract

Cases of interocclusal space loss without an obvious reduction in the vertical dimension are difficult to manage. Herein, we present two cases of severe anterior tooth wear without an obvious reduction in the vertical dimension and with over-erupted left maxillary third molar(s).

Occlusal contact features were analysed and chewing patterns were assessed using a series of electronic instruments.

The over-erupted maxillary third molar caused a rotational chewing movement to the opposite side of the over-eruption, leading to abnormal loading on the anterior teeth, causing their heavy wear. Limitation of such a compensatory movement was observed in Case #2, with orofacial pain, but not in Case #1, without orofacial pain.

The study proposes the role of posterior occlusion in severe anterior tooth wear and offers new insights into the role of modulating posterior occlusion for the prevention and functional treatment of anterior tooth wear.

Key Words: Tooth wear, Occlusion, Over-eruption, Third molar, Mandibular movement

Introduction

Severe tooth wear localized to the anterior maxillary or mandibular teeth without obvious reduction of the vertical dimension but with loss of interocclusal space is difficult to manage [1-3]. Increasing the vertical dimension of the occlusion in such patients will create a posterior disclusion [2]. Moreover, the median survival time of composite resin restorations was shown to be around 5 years [4-6]. The management of anterior tooth wear is thus often problematic.

The causes of tooth wear are physiochemical factors, such as abrasion, erosion, and attrition, [7-9] the latter being observed in almost all people, and especially elderly individuals [10]. Tooth wear is also linked with the grinding chewing pattern [11]. Posterior occlusion is critical to the chewing function and is generally considered to be necessary to optimize the survival of anterior restorations [12]. Herein, two cases of severe anterior tooth wear without obvious reduction of the vertical dimension are presented, only one of them presenting with orofacial pain. Both cases had an over-erupted left side maxillary third molar. The occlusion contact features were described, and the chewing patterns were analysed. The purpose of the study was to describe the functional behaviours of two patients with severe anterior tooth wear and over-erupted maxillary third molar(s), so as to propose a functional treatment strategy for severe anterior tooth wear.

Materials and Methods

This study was performed in compliance with the Declaration of Helsinki and was approved by the Institutional Review Board of the Oral Hospital, Fourth Military Medical University (FMMU, IRB-REV-2016042). One of the investigators (LW) verbally explained in detail the purpose of the study to each patient. The patients were asked to freely decide whether to continue the detection and observation process. The diagnosis of tooth wear were taken via clinical observation and that of orofacial pain by reviewing the disease history following the Diagnostic Criteria for Temporomandibular Disorders (DC/TMD). Plastic casts were taken in Jeltrate Dental Alginate Impression Material (Dentsply, Tianjin, China). Occlusal papers (Dingshanhu, Shanghai Qing Pu Dental Materials Co. Ltd, Shanghai, China) were used to observe the occlusion contacts. Moreover, occlusal imprints were produced by spreading Vinyl Polysiloxane Bite Registration materials (3M Deutschil GmbH, Neuss, Germany) onto the mandibular dentition and asking the patients to close freely into the Intercuspal Position (ICP), as previously described [13]. Additionally, the T-Scan III occlusal analysis system (Tekscan, Inc., Boston, MA, USA) was used in combination with the BioEMG III electromyographic recording system (BioPAK system, version 6.0; software, version 8.1; Bioresearch Associates, Inc., Milwaukee, WI, USA) with the aid of the T-Scan/BioPAK linking software (Tekscan, Inc., Boston, MA, USA /Bioresearch Associates, Inc., Milwaukee, WI, USA) to record the occlusion contacts during Maximal Voluntary Clenching (MVC) in ICP and in the position such that only the over-erupted third molar was occluded with the opposing tooth. The surface electromyographic (SEMG) activities of the bilateral masseters (MM) and anterior temporalis (TA) were recorded during MVC in ICP [14-16] The stable SEMG signal was sampled for 3.24 seconds to calculate the average SEMG value.

The unilateral gum-chewing movement was recorded using the JT-3D Electrognathograph (EGN) and BioPAK system software (Bioresearch Associates, Inc., Milwaukee, WI, USA). As previously reported, [17] an Average Chewing Pattern (ACP) was created to represent individual mean chewing patterns using the BioPAK Electrognathography software (BioPAK; Bioresearch Associates, Inc., Milwaukee, WI, USA).

Case #1 involved a 37-year-old man, who visited our department with the chief complaint of bruxism lasting for over 10 years. The mouth opening length was 45 mm. There was no orofacial pain detectable by palpation or Temporomandibular Joint (TMJ) sounds. Case #2 involved a 53-year-old female, who visited our department with the chief complaint of limitation of mouth opening lasting three years and pain in the right TMJ lasting over two months. Her

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mouth opening length was only 25 mm. No obvious discomfort was noticed in the left TMJ area. In both cases, no obvious osseous changes of the TMJs were revealed on a panoramic radiograph. Both cases had over-erupted left maxillary third molars, while Case #1 also had a lesser over-eruption of the right maxillary third molar (*Figure 1*).

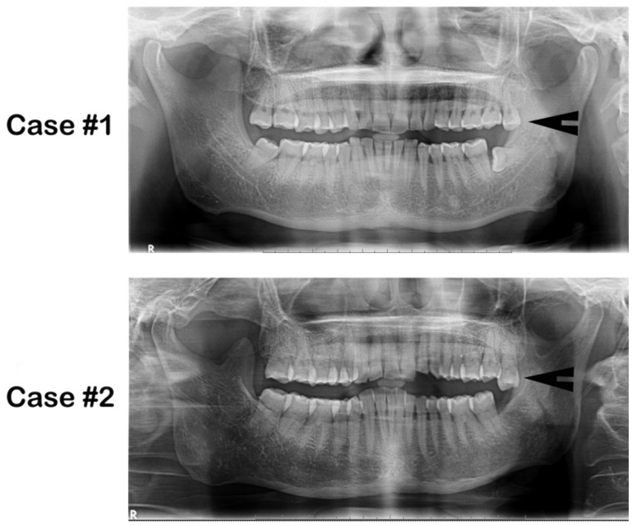

Figure 1. *Panoramic radiograph of the two cases. Both cases had over-eruption of tooth 28. Case #1 had a low mesioangular impact tooth 38 while case #2 lacked tooth 38. No obvious osseous changes were observed in TMJs in both cases.*

Results

Severe anterior tooth wear was present in teeth 11, 12, 21, 22, 31, 32, 33, and 41 in Case #1 and in teeth 11, 12, and 22 in Case #2 (*Figure 2*). Case #1 had Angle's Class I relation, while Case #2 had Angle's Class III relation. The arrangement of the dentition was generally good in Case #1, while in Case #2, the mandibular dentition showed minor crowding (*Figures 3 and 4*). Her left lateral incisors showed crossbite.

The impact contacts were more numerous on the left side than on the right side of the arch in Case #1. In Case #2, they were distributed on both sides of the arch, with a preponderance of the lingual side of the teeth (*Figure 5*). The impact contact number and size in Case #1 were 3 and 167 pixels, respectively, and 15 and 2051 pixels in Case #2, respectively.

The distribution of the contact sites and strength during MVC in ICP did not show significant differences between the two cases. Contact on the left over-erupted maxillary third molar without any other teeth in contact was achieved when the patients were trained to rotate the mandible to the over-eruption side and then clench their teeth (*Figure 6*). No obvious regularity was noticed in the SEMG activity (*Table 1*).

In both cases, the mandible moved less ipsilaterally when performing left-side chewing compared to right-side chewing. From the frontal view, when performing right-side chewing, the main body of the chewing cycle, in both cases, was located on the chewing side (*Figure 7 (A, B, A', B')*) although in Case #2, the motion did not start from or end in ICP. When performing left-side chewing, however, the main body of the ACP was located opposite to the chewing side in Case #1.

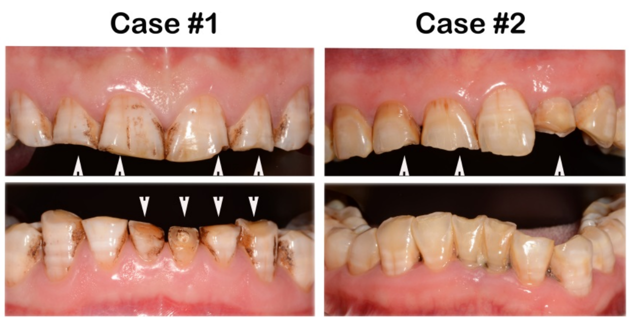

Figure 2. *Severe tooth wear appeared, with shortening greater than one third, in tooth 11, 12, 21, 22, 31, 32, 33 and 41 in Case #1, and in tooth 11, 12, and 22 in Case #2. The worn teeth are sharp and rough at the incisal edge.*

Figure 3. *Intraoral photograph of Case #1. Dentitions are well arranged, and the occlusion is in Angle's Class I relation. Tooth 48 has erupted although it does not reach the height of the occlusal plane. Tooth 38 is not observable. Teeth 18 and 28 are over-erupted, the latter in a more obvious manner. The stain marks obtained from biting on occlusal papers in the intercuspal position are dark and diffuse.*

Although the main body of the chewing cycle in Case #2 was located on the chewing side when performing left-side chewing, the chewing cycle showed less departure from the midline compared with the right-side chewing cycle. From the horizontal and sagittal view, the mandible moved posteriorly in Case #1, but protruded anteriorly in Case #2, before moving posteriorly during the opening and before entering into ICP during closing.

In both cases, as indicated by the tangent lines, the chewing cycle was located more anteriorly close to ICP when performing left-side chewing compared to right-side chewing (*Figure 7(C-F, C'-F')*).

Figure 4. Intraoral photograph of Case #2. Dentitions show minor asymmetry. Occlusion is in Angle's Class III relation. Tooth 38 is lacking and tooth 28 is over-erupted. Tooth 22 has a cross-bite relation with tooth 32 and tooth 33. Tooth 11, 12, and 22 presented with severe tooth wear. The stain marks obtained from biting on occlusal paper in the intercuspal position are light and ridge-shaped.

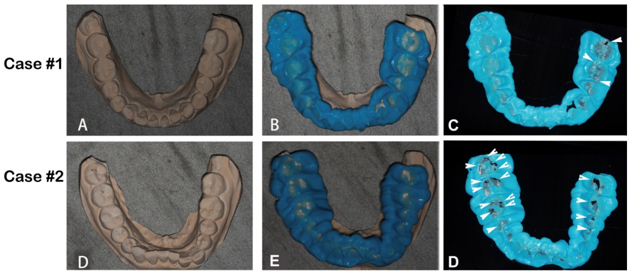

Figure 5. Occlusion imprint. The impact contacts, defined as the penetration sites on the imprint, are distributed more in the left than the right side of the arch in Case #1 but are more symmetrical in Case #2. The impact contacts (arrows) are fewer in Case #1 than in Case #2.

Generally, chewing velocity was low to zero near ICP. The angle between the horizontal axis and the tangent line of the entrance trajectory to ICP was larger when performing left-side compared to right-side chewing in both cases, meaning that the closing velocity was reduced earlier when performing left-side chewing than when performing right-side chewing (*Figure 7 (G, H, G', H')*).

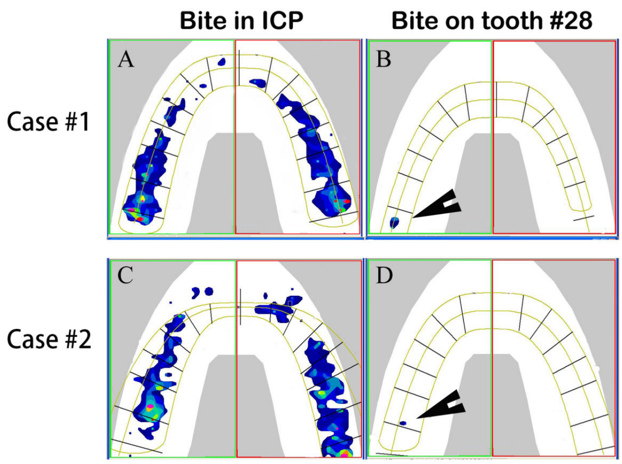

Figure 6. T-scan occlusion recordings. Contacts obtained from Maximal Voluntary Clenching (MVC) in the Intercuspal Position (ICP) are similar between the two cases, and distributed more in the posterior than in the anterior arch (A, C). When the patient was required to bite on the left side maxillary third molar with the left side mandibular second molar, this single contact (arrow heads) prevented the other teeth from achieving occlusal contact.

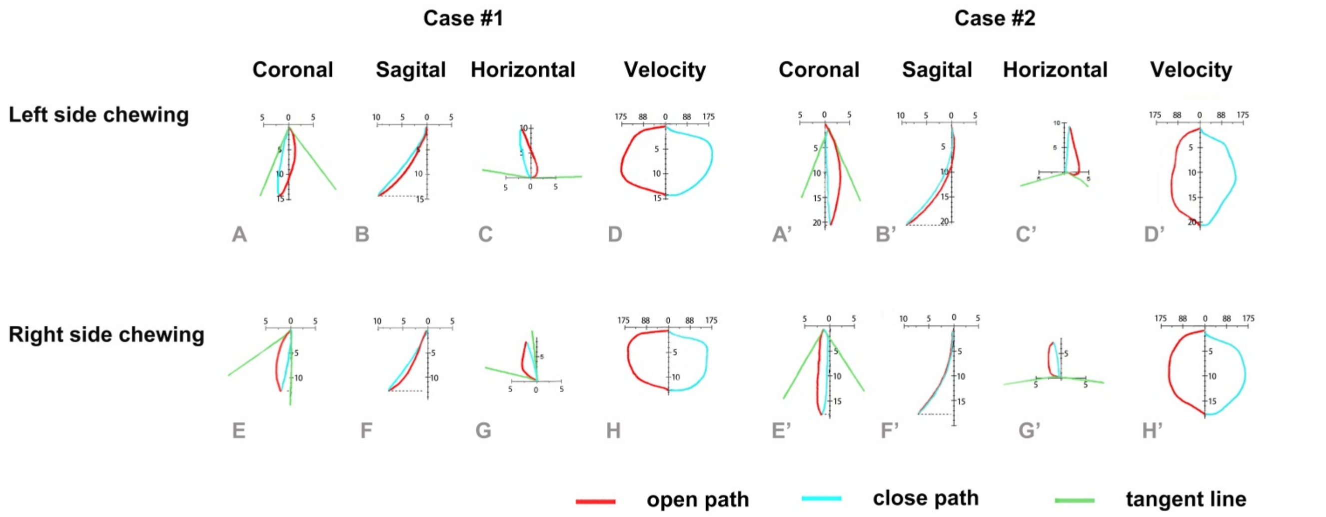

Figure 7*. Average chewing pattern in Case #1 (A-H) and Case #2 (A'-H') from right-side chewing (A, C, E, G, A', C', E', G') and left-side chewing (B, D, F, H, B', D', F', H'). (A, A', B, B'): front view; (C, C', D, D'): horizontal view; (E, E', F, F'): sagittal view. (G, G', H, H'): velocity graph. The horizontal axis shows the velocity of the movement, and the vertical one the opening length. L: trajectory line of the chewing cycle starting from ICP.*

Discussion

During the chewing process, the mandible moves laterally with more or less anterior/posterior extension. An over-erupted maxillary third molar makes the ipsilateral chewing less extended posteriorly and more anteriorly to prevent the single contact on the over-erupted third molar. As presented in *Figure 6 (B, D)* occluding on the single pair of the over-erupted third molar caused disclusion of the other teeth, reducing chewing efficiency and increasing the possibility of trauma to the chewing apparatus. To prevent such an inefficient and injury-prone effect, the patients did not simply protrude their mandible during chewing; they rotated the mandible more to the contralateral side (Case #1) or less to the ipsilateral side (Case #2) and, at the same time, reduced the velocity of closing to ICP when performing a chewing movement using the over-eruption side (*Figure 7*). Such a moving compensation caused the contra-lateral maxillary incisors to suffer heavier loading and to be severely worn (*Figure 2*).

Case #1 had also over-eruption of the maxillary right third molar, less pronounced than that on the left side, as indicated in *Figure 1*. It seemed that his severely over-erupted left maxillary third molar impacted chewing function more compared with the right-side one. He adopted a pattern of chewing extending to the right side. When chewing with the over-eruption side, he even rotated his mandible to the contralateral side as indicated in *Figure 7 (A,B)* which explained his extensive tooth wear, as shown in *Figure 3*. Although the extensive chewing caused some of the mandibular anterior teeth to be severely worn and led the posterior teeth to be worn flat as indicated by the staining of the occlusal paper obtained by centric clenching (*Figure 3*), the chewing cycle could be maintained as starting from and ending in ICP, as it is usually required, regardless of which side was used to chew (*Figure 7 (A-H)*). He had night bruxism but no signs of Temporomandibular Disorders (TMD).

The patient in Case #2, however, was restricted in performing extensive chewing. When chewing using the over-eruption side, she rotated the mandible to the ipsilateral side less than when using the contralateral side (*Figure 7 (A, B, A', B')*). Such a restriction of deviation in chewing movement may be caused, at least partially, by the crossbite relation of the left lateral incisors. The chewing cycle was even deviated anteriorly at the starting and ending phase, especially when chewing using the crossbite side, which coincided with the over-eruption side. Such a chewing pattern increased the loading on the crossbite incisors and explained the heavy wear of the left maxillary lateral incisor (*Figure 4*). However, her less extensive chewing pattern prevented the mandibular incisors from being severely worn and also the posterior teeth from being extensively worn by contact to form the diffuse contact stains typical of teeth worn flat; instead, her pattern led to ridge-shaped contact stains (*Figure 4*).

Table 1*. SEMG values (µV) of the bilateral masseters (MM) and anterior temporalis (TA).*

		RTA	LTA	RMM	LMM
MVC in ICP	Case #1	161	136.4	160.8	130
	Case #2	85.2	115.7	89.6	101.3
MVC on the over-erupted third molar	Case #1	14.4	8	6	6
	Case #2	8.1	9.4	4	3.9

It has been previously reported that among patients with loss of posterior teeth, those whose missing teeth are fewer but scattered in more quadrants have a higher prevalence of symptoms of TMD, [18] meaning that more abnormal occlusal factors are more difficult to adapt to, which leads to susceptibility to TMD. Case #2 had an over-erupted maxillary third molar and also a pair of crossbite lateral incisors, and the patient failed to effectively adapt to her occlusion. When performing the chewing movement on the side without over-eruption, the mandible started from and ended in a position away from ICP (*Figure 7C'*). Such an unsuccessful adaptation explained her dysfunctional symptoms, as shown in *Table 1*. The present data also agree well with our recent report showing that in TMD patients, the impact contacts at the molar regions, revealed by the imprint, were larger in number and area size, and were distributed more on guiding cusps, than those observed in asymptomatic controls [13].

It has been previously indicated that the association of SEMG with TMD is weak [14-16] In agreement with those reports, in the current study, the association between TMD symptoms and the SEMG values of MM and TA in centric MVC and in the MVC on the over-erupted third molar was unclear. The impact of the over-erupted maxillary third molar on the jaw-closing muscle activity was also unclear. Larger sample sizes are needed to provide further insight into these aspects.

Clinical management of tooth wear requires comprehensive analysis and risk assessment to reach an optimal outcome. In this study, two cases with severe anterior tooth wear were analysed, and the promoting role of an over-erupted maxillary third molar in severe anterior tooth wear was proposed. In this view, the treatment of severe anterior tooth wear was undertaken not only by restoring the worn anterior teeth but also by correcting the posterior occlusion to improve functional behaviours, such as the chewing pattern that could have initiated the severe anterior tooth wear. In terms of prevention, early correction of the posterior occlusion could help avoid severe anterior tooth wear.

This study is a report of only two cases: Therefore, studies with larger samples are needed to determine to what extent our results can be generalized.

In conclusion, posterior occlusion may play a role in severe anterior tooth wear and could be considered as a target in the treatment and prevention of anterior tooth wear. Clinical trials are required to establish these concepts on a firmer basis.

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Disclosure of Interest

The authors report no conflict of interest.

Author Contributions

The collection of patient clinical data was performed by Lei Wang. Occlusion detection, SEMG, ENG, etc., were conducted by Shaoxiong Guo. The data were analysed and presented by Meiqing Wang, Shaoxiong Guo, and Wei Xiong.

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