Canine Coupling and Disclusion Time Reduction in Postorthodontic Patient: Muscular and Temporomandibular Joint Activity Assessment

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Introduction

Occlusal pattern in post orthodontic patients was examined in various studies [1-3]. Emphasis was put on the distribution of the occlusal contacts in multi-bite recordings with the use of T-scan III occlusal analysis system [2], on the length of the disclusion time (DT) in orthodontically treated and non-orthodontically treated patients [1], the presence of non-working side contacts in laterotrusion and protrusion movements [3].

There is still a controversy regarding the role of canine guidance in protecting occlusion. The prevalence of canine guidance was stated to be less than group function in the examined group [4,5]. An effort was made to classify the stages of canine disclusion in another study [6]. The above mentioned study argues that already existing lateral movement pattern schemes are not enough to describe the full variety of occlusal patterns in lateral excursive movements. Previous studies [4-6] consider both canine guidance and group function to be physiologically relevant for the lateral excursive movements.

One of the earlier studies attempted to classify the lateral excursive movements with the use of T-scan II occlusal analysis system [7,8]. Classifications consisting of 6 groups was described in this study. The groups were divided concerning the amount of disclusion from maximum intercuspation into maximum canine excursion.

Another group of authors claim that gingival recessions and clefts are influenced by occlusal trauma [7], which has been studied in maximum intercuspation and eccentric movements. The results of that study indicate that interferences in both maximum intercuspation and eccentric movements contribute to gingival recessions and clefts.

Our case report is aimed to describe the T-scan III occlusal adjustment procedure under the control of temporo-mandibular joint function assessment and surface electromyography of the occlusal muscles.

Abstract

The article introduces the author’s protocol of assessment of patients with distorted canine guidance. Temporo-mandibular function examination, as well as surface electromyography is done to assess both TMJ and occlusal muscles. T-scan III computer-guided occlusal adjustment is made for balancing both static occlusion and excursive movements.

Keywords: Occlusion, T-scan III, Occlusal adjustment, Electromyography, Joint Vibrant Analysis, Disclusion Time Reduction

Case Description

The female patient, 35 years old, underwent orthodontic treatment with non-removable lingual appliance on both jaws. Orthodontic wire bonded retainers were placed on the lingual surface of the upper and lower front teeth. Permanent restorations were made on teeth #6,7,8,9,10,11 after the completion of orthodontic treatment (Figure 1).

The patient’s chief complaint was reoccurring incisal edge abrasion on the tooth #11. Both clinical and instrumental examinations were made. Clinical examination consisted of muscle and TMJ palpation, instrumental examination was done with the use of surface electromyography of masseteric and temporal muscles. Joint vibration analysis (JVA) was made to assess the function of the TMJ and T-scan III occlusal
analysis was also conducted to analyze occlusal contacts both in static occlusion and excursive movements.

Our standard protocol of assessment of patients exhibiting canine abrasion is: muscle palpation, Joint Vibrant Analysis (JVA, Bioresearch, Milwaukee, USA), surface electromyography of chewing musdes (m.masseter, m.temporalis), T-scan III occlusal analysis. The aim of this examination is to assess 1) presence of temporo-mandibular joint (TMJ) disfunction (preliminary assessment is made with the JVA appliance); 2) muscle balance between right and left sides and between masstetic and temporal muscles; 3) to assess the pattern of occlusal contacts both in static occlusion and excursive movements.

JVA findings, both zoomed and detailed views, are shown in figures 2 and 3. The waveform produced by the condylar head
movement is a low amplitude low frequency wave (Figure 2). The respective numbers obtained through the analysis of three successive opening-closing cycles are shown in figure 3.

T-scan III occlusal analysis (Telscan, USA) was conducted in the following sequence: centric occlusion recording, multi-bite recording, and left and right excursive movements. The centric relation movement is shown in figure 4. For the functional assessment multi-bite recording is of more value (Figure 5). The latter shows the prevalence of the right side contacts in multiple biting recording. Special attention should be paid to the non-balanced canine coupling. There is an absence of the contact between canines on the left side, which is shown in Figure 4.

Surface myography (obtained by BTSTM Joint appliance, Bioengineering, Italy) resume is shown in figure 6. The prevalence of the clenching activity of the left temporal muscle is obvious. It is depicted in percentage (262.66% on left temporal muscle) (Figure 7).

The aim of the treatment was to eliminate the cause of the canine abrasion (tooth #11), to establish balanced occlusion under the control of TMJ stability. T-scan III computer-guided occlusal adjustment procedure was conducted with Disclusion Time Reduction (DTR) in excursive movements as well as canine composite onlays were made on the teeth # 6 and 11 (Figure 8).
Figure 4: T-scan III computer occlusal analysis in centric occlusion before treatment.

Figure 5: T-scan III occlusal analysis before treatment - multi-bite recording.

Figure 6: Surface electromyography with BTS TMJoint before treatment.
T-scan III computer-guided occlusal adjustment was made through sequential adjustment of premolar and molar cusps striving for the achievement of the DTR time around 0.5 sec per side. This provides clear canine guidance with no group function. Absence of any group contacts on both working and non-working sides secures canines from being abraded in future (Figures 9-11).

Figure 12 shows the distribution of contacts along the dental arch. Both contacts on the teeth #6 and 11 are present. The percentage distribution is nearly equal (51 and 49%) on both sides.

In addition, figures 13 and 14 show the full canine guidance on both sides accomplished in nearly 0.5 seconds each.

**Discussion**

Studies on evaluation of different types of lateral excursive movements differ in their methodology and final conclusions. The role of canine guidance and the benefit of canine guidance to overall distribution of contacts were not clearly discussed. We suggest that canine guidance obtained during the 0.5 seconds of Disclusion Time preserves ipsilateral side canine from being abraded. The evaluation of Disclusion Time can be accomplished through the use of T-scan III occlusal analysis system. The successive T-scan III computer-guided occlusal adjustment aims to reduct Disclusion Time.

The present study shows the example of utilizing the T-scan III occlusal analysis and computer guided occlusal adjustment for obtaining the non-compromised occlusion after orthodontic treatment.

T-scan III occlusal adjustment procedure, according to our protocol, can be conducted in the case of no existing pathological changes in TM Joints. The latter are examined with the JVA, which is a preliminary test for revealing any TM Dysfunction. As the before and after treatment recordings are made, it gives opportunity to assess any changes that occlusal adjustment may have caused.
Excessive occlusal adjustment in this case was overcome through the procedure of composite onlay fabrication on the palatal surfaces of teeth #6 and 11. The onlays were aimed to, firstly, reduce the amount of occlusal adjustment on premolars and molars of the ipsilateral side and, secondly, to achieve a full canine coupling and reduce left temporal muscle firing.

As shown in surface electromyography, before treatment record (Figure 6) exhibited prevalence of the left temporal muscle over the others. The prevalence of the left temporal muscle was presented simultaneously with the absence of canine coupling on the tooth 11. On the opposite side, the presence of the canine coupling, as shown in Figure 4, was combined with average temporal muscle activity.

After the T-scan III occlusal adjustment and canine coupling accomplished on the left side, left side temporal muscle activity ceased.

![Canine coupling was accomplished on the inner surface of teeth #6 and 11.](image)

![Joint Vibrant Analysis at the end of treatment -zoomed view.](image)
Figure 10: Joint Vibrant Analysis at the end of treatment - detailed view.

Figure 11: Surface electromyography at the end of treatment (BTS TMJoint)
Figure 12: Centric occlusion at the end of treatment.

Figure 13: Left excursion recording at the completion of treatment.

Figure 14: Right excursive recording at the completion of treatment.
Conclusion

Post orthodontic treatment cases exhibit non-balanced occlusion. Balancing of occlusion can be accomplished through the T-scan III computer guided occlusal adjustment procedure. Temporomandibular joint function should be assessed before any occlusal adjustment procedures. Canine coupling can reduce the amount of occlusal adjustment and balance muscle activity.

References


