The Impact of the Rehabilitation of Occlusal Interferences to the Activity of Masticatory Muscles

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The Impact of the Rehabilitation of Occlusal Interferences to the Activity of Masticatory Muscles

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Abstract

Aim: A comparison was made between the electromyographic values to patient with limited unilateral defect on dental arches before and after prosthetic rehabilitation with fixed dental prosthesis.

Study design: Electromyographic tests were carried out during function at maximum effort clenching of the masseter muscles and anterior temporalis muscles in a group consisting of 10 patients and have the need of prosthetic rehabilitation. The electromyographic exploration results three weak after prosthetic rehabilitation were compared to those made before prosthetic rehabilitation.

Results: There were significant differences among electromyographic values before and after prosthetic rehabilitation.

Conclusion: We thus conclude that among limited unilateral defects on dental arches there is place for prosthetic treatment of the occlusion as prophylactic treatment for muscular activity.

Introduction

There are a lot of studies proving the association between occlusal factors to signs and symptoms of TMD and a lot of studies has failed on proving that occlusion has nothing to do with TMD. Jarabak (1) affirms that occlusal instability with loss of posterior support might cause some sub-classifications of TMD including muscle spasm. Kirveskari (2) in a cross-sectional analysis after a 3-year study, showed a clear association between the number of interferences and the signs of TMD. Kirveskari (3) related that the most common subjective symptoms include facial pain, headaches, TMJ sounds, and problems associated with jaw movements. The consequences of these problems include damages on teeth, periodontal tissue, TMJs and neuromuscular system as well as functional disturbances during chewing, swallowing, and speaking.

According to Long (4) before occlusal treatment, the dentist should evaluate the integrity of the articular elements and their relationship to each other during function and at rest, and the degree of occlusal modification necessary to achieve a simultaneous contact of the maxillary and mandibular teeth while the articular element are in apposition.

The aim of this study was to assess the impact of the rehabilitation of occlusal interferences at the activity of masticatory muscles. To assess the occlusal interferences we have examined the dental occlusion in both static and dynamic state. Electromyographic activity was recorded by surface electrodes over anterior temporalis and masseter muscles of both sides in clenching, swallowing and chewing test using gum.

Subjects

In this study was involved 10 volunteers, aged 18-50 years (M=43 years); 3 males and 7 females who gave their written consent for participating in this study.

Inclusion criteria:
- Healthy volunteers with limited defects on one side of dental arches
- Healthy volunteers with natural untreated dentition (without prosthetic rehabilitation which naturally may alter the occlusion).

Exclusion criteria:
- To test subjects had not to have history of temporal-mandibular disorders
- To test subjects had not undergone orthodontic treatment
All patients were rehabilitated with fixed dental prosthesis.

Methods

For all the subjects were performed the occlusal examination and electromyographic test to assess the difference of the values between two sides of the mouth. After prosthetic rehabilitation with fixed dental prosthesis the occlusal examination and electromyographic test were repeats for the entire
patients.

The examination for each patient was made using following protocol:

**A-Occlusal examination:**
1. The anatomical examination:
   - Relations between upper and lower incisors
   - Relations between upper and lower canines
   - The progress of Spee’s and Wilson’s curves
   - Situation and direction of abraded surfaces;

2. The occlusal defects observed, lead the functional examination, which permit to find out:
   - The exaggerated contacts at maximal intercuspal position
   - The exaggerated contacts at centric relations
   - Workers and balancing side interferences

**B. Electromyographic tests of masseter and temporalis muscles before the prosthetic rehabilitation.**

**C. The prosthetic rehabilitation of occlusal defects with fixed dental prosthesis.**

**D. Occlusal examination after prosthetic rehabilitation.**

**E. Electromyographic tests of masseter and temporalis muscles after the prosthetic rehabilitation.**

The International Society of Electrophysiology and Kinesiology (ISEK) has established standardized guidelines for electromyography evaluations, as determined in Standards for Reporting EMG Data(5). Electromyographic activity was recorded by surface electrodes over anterior temporalis and masseter muscles of both sides in clenching at teeth and clenching at cotton rolls.

**Electromyographic equipment:**
Recordings are made on 4 channels of simultaneous EMG signal (Neurowerk system). The analogous EMG signal is amplified, band-pass filtered with cut-off frequencies of 10Hz (high-pass) to 1500Hz (low-pass). The analog signals recorded are digitized. After digitalization, the signal is filtered again by a digital filter pass-band of 10Hz 500Hz. Neurowerk software is used to visualize and process the EMG signal.

**Electrodes:**
We use skin surface active electrodes (Neurowerk disposable electrodes 32KE13) with a contact diameter of 10 x 2 mm, parallel bars of pure silver (Ag), and spaced 10 mm apart and fixed to acrylic resin of 20x 20mm.

**EMG Examination:**
During the whole EMG examination, the volunteers sit relaxed and upright in a straight-back chair without head support, with the Frankfurt occlusal plane parallel to the floor. They keep their eyes opened and arms on their legs.

Electrode Placement Procedures: Before electrode placement, the volunteer’s skin is previously cleaned with 70% alcohol. The electrodes are positioned in relation to muscle fiber length, with the silver bars positioned perpendicular to maximize signal capture and to minimize noise interference. The conductivity of the electrode-skin interface was increased using conductive gel after thorough cleaning of the skin with alcohol. Muscle function tests must be performed before electrode placement according to the positioning criteria described by Cram and Kasman (6), which are as follow:

- Masseter muscle: electrodes positioned on muscle belly that could be better located during dental clenching (2 cm above of the external angle of the jaw).
- Anterior portion of the temporalis muscle: located on the muscle belly through application of muscle function test.

**EMG data acquisition**
The EMG activity is recorded during following four situations:
1) Maximum voluntary clench on teeth for masseter on the side with missing teeth
2) Maximum voluntary clench on teeth for masseter on the side without missing teeth
3) Maximum voluntary clench on teeth for temporalis anterior on the side with missing teeth
4) Maximum voluntary clench on teeth for temporalis anterior on the side without missing teeth

Differences in muscles performance become more evident at clenching when maximum effort is used (7, 8).

For maximal dental clenching the volunteer is requested to maintain maximal isometric contraction of jaw elevator muscles during the recording time. The time considered for EMG signal recording during the rest period and maximal isometric contraction is 5 seconds. EMG signal recordings are stored in a computer for later analysis and processing. EMG recording of maximum voluntary clenching on teeth was performed as well.
The patient is instructed to make a maximum contraction effort in maximum intercuspidation and he must start from a rest state and then maintain the contraction for 5 seconds. In this case, we calibrated the screen reticule to 100 ?V /div in amplitude and to 1 sec/div in speed. In this way, it is possible to measure the average range in ?V achieved by each of the monitored muscles.

**FIGURE 1: Electromyographic activity during masseter clenching**

**FIGURE 2: Electromyographic recording at masseter and temporalis anterior.**

### Results

**TABLE 1**

† Index of muscular symmetry, in %.

* P- values by non-parametric test of Wilcoxon singed-rank test for coupled samples.

**TABLE 2**

† Index of muscular activity in %;

* P- values by non-parametric test of Wilcoxon singed-rank test for coupled samples.

**TABLE 3**

† Index of turns/s in %;

* P- values by non-parametric test of Wilcoxon singed-rank test for coupled sample.

### Conclusions

1. The difference of muscular symmetry before and after rehabilitation is significant because is erased the occlusal interferences and mandible is not attempt to shift to avoid the interference anymore.
2. The difference of muscular activity before and after rehabilitation is significant because there is no more the exaggerated use only of preferred side that is clearly shown and in turns/s activity.
3. As easily noted the muscular activity of masseter and temporalis anterior is improved significantly after prosthetic rehabilitation of dental occlusion.

### References

Illustrations

Illustration 1

Figure 1- Electromyographic activity during masseter clenching

Illustration 2

Figure 2- Electromyographic recording at masseter and temporalis anterior
Illustration 3

Table 1 - Index of muscular symmetry

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<th>Difference (IMS1-IMS2)</th>
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Illustration 4

Table 2 - Index of muscular activity

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Illustration 5

Table 3 - Index of turns

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