

Modifications of Dental Proprioceptivity After Apicectomy

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Introduction: The proprioceptive control resulted from the periodontal mechanoreceptors is a major factor upon the control of masticatory muscle activity.

The **aim** of this study is to present the modification of dental proprioceptivity consequentially to apicectomy, which is followed by changes in the masticatory muscles activity.

Material and methods: In the present study we included a number of 11 patients from private practice, all of them presenting chronic periapical infection on which we performed apicectomy. To measure and compare the muscular contraction, we used electromyographic recordings before and after the surgery. We used the BioEMG II device, with surface electrodes placed bilaterally on the masseter muscles, the achieved data were recorded and analyzed using the device software.

Results: The data obtained preoperatively allowed us to visualize the shrinkage of the amplitude of the electromyographic signal, because the muscular activity was inhibited by the periodontal mechanoreceptors as protective reflex. Postoperative results showed us a significant raise of the amplitude of electromyographic signals ($p = 0.001$), following the elimination of mechanoreceptors from the apical area.

Conclusions: The achieved results suggested that the mechanoreceptors localized in the apical third of the root, in the periodontal space are important in providing the control of masticatory muscles activity.

Keywords: proprioception, electromyography, apicectomy

Introduction

Proprioception is the sensory function that transduces stimuli received by proprioceptive receptors in joints, tendons, muscles, and the inner ear into neural impulses to be transmitted to the central nervous system. Proprioception provides sense of stationary positions and movements of one's body parts, and is important in maintaining kinaesthesia and postural balance [1].

The periodontal mechanoreceptors are located near the apex of the tooth between the fulcrum and the apex [2].

Unfortunately these proprioceptors will be eliminated if we perform apicectomy on specific teeth. If periodontal afferent information is not available, the control of the occlusal forces is impaired [3]. Theoretically speaking, after this surgical intervention the capacity of regulating the masticatory force on that certain tooth or teeth will be eliminated or reduced, depending on the scale of apicectomy.

The aim of our study is to demonstrate the importance of the proprioceptors located around the apical third of the root, in regulating the force of masticatory muscles contraction and to point out their practical implications in both conventionally and implant – retained prosthodontics.

Material and method

Patients

The study was conducted on a number of 11 patients, selected randomly. Even if the number of patients is not high, and they were selected randomly, we gain a group of patients to match different categories: gender, age, the loca-

tion of the apicectomy by tooth. The patients were selected from private practice. All of them met the criteria of non-painful chronic periapical infection on at least one tooth. The chronic periapical infection diagnostic was established after intraoral periapical x-rays and specific clinical signs. Three days before the surgical procedure we invited the patients to take part at the first electromyography session.

Electromyography

For this study we used a BioEMG II device. BioEMG II is a surface electromyograph produced and developed by BioRESEARCH Assoc Inc. from Milwaukee, WI, USA. It is specifically designed to record craniofacial muscle activity in both rest and function.

We made two types of electromyographic registrations. At first we measured the muscle activity in maximal intercuspal position, then we positioned a cotton roll on the indiscriminated tooth (which will endure apicectomy later), and the patient bit on it. This way we could measure the muscle activity regulated only by the proprioceptors located around that single tooth, because the single contact between the maxilla and mandible will be located at that point.

Surgical procedures

After the measurements were taken, we proceeded for the apicectomy. To eliminate the chronic infection localized around the root-tip, we had to make efficient periapical curettage. With this we removed the granular tissue, the end of the tooth root, parts from periodontal ligaments, parts from periosteum, and the infected and pasty bone.

Ten days following the apicectomy we asked our patients to attend another electromyography session. We



Fig. 1. The position of the electrodes on the patient

asked them to bite normally, in maximal intercuspal position, after which they bit on a cotton roll positioned exactly between the incriminated tooth and the antagonist tooth.

Statistics

After the centralization of all of the measurements we processed them to find out if our theoretical affirmations have any practically proved basis.

To demonstrate the existence of any significant difference ($p < 0.05$) between the two compared data groups (before and after the surgery) we used the nonparametric Wilcoxon test (small batch, without difference them by gender, age, teeth type).

Results

The results of electromyographic registration are presented in Table I.

Table I. Electromyographic registration data

| No. | Patient | Tooth | Before apicectomy | | After apicectomy | |
|-----|---------|-------|-------------------------------------|------------------------------------|-------------------------------------|------------------------------------|
| | | | M. masseter right (μV) | M. masseter left (μV) | M. masseter right (μV) | M. masseter left (μV) |
| 1 | G.C. | 2.2 | 45 | 4 | 47 | 25 |
| 2 | L.C. | 1.3 | 71 | 13 | 86 | 21 |
| 3 | S.M. | 2.3 | 41 | 6 | 67 | 18 |
| 4 | Sz.F. | 2.4 | 33 | 19 | 38 | 60 |
| 5 | B.M. | 1.1 | 19 | 35 | 37 | 58 |
| 6 | C. A | 1.4 | 38 | 44 | 78 | 66 |
| 7 | T.B. | 1.2 | 6.7 | 9.9 | 9.2 | 14.7 |
| 8 | V.D. | 1.5 | 95.7 | 72.3 | 105.8 | 71.9 |
| 9 | D.L. | 4.4 | 7 | 8.8 | 35.1 | 11.2 |
| 10 | S.L. | 1.5 | 132 | 70.3 | 162 | 77 |
| 11 | F.L. | 4.5 | 42.3 | 14 | 58.7 | 30.3 |

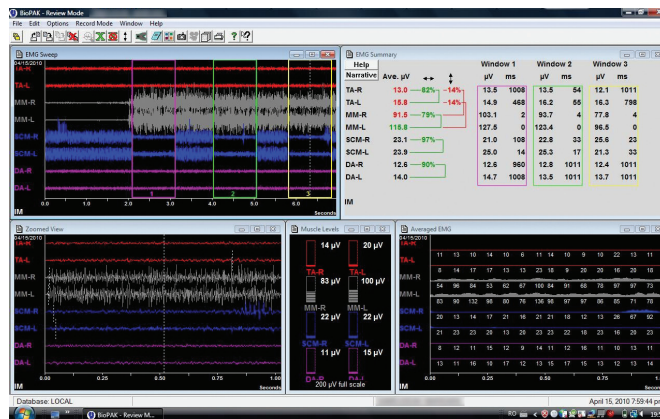


Fig. 2. Electromyographic registration

In this study, it was observed that the electromyographic signal before the apicectomy on the studied side, on the masseter muscle is between 132 and 4 μV . The mean we got for these results is 40.064 (SD 42.507).

The measurements done after the apicectomy on the involved side gave us a mean of 61.345 (SD 44.947) with maximum value of 162 and the minimum value of 9.2. (Figure 1).

The confidence interval for data registered before the surgery: lower 11.51; upper 68.62, after the surgery: lower 31.15; upper 91.54.

After the use of the statistic test resulted a significant difference between the two registered groups ($p = 0.001$).

Discussions

Unfortunately we found only a few relevant facts in the studied international literature about this exact problem.

Although the importance of surface electromyography in dentistry has been employed by researchers and clinicians for over twenty years.

Measuring the bite force in different situations correctly, monitoring the activity of the masseter muscle, evaluating muscle activity in different occlusional circumstances using electromyography is something already done by Chong-Shan S [4], Dahlstrom et al [1], Nielsen et al [5], Rodrigues et al [6], Haraldson et al [7].

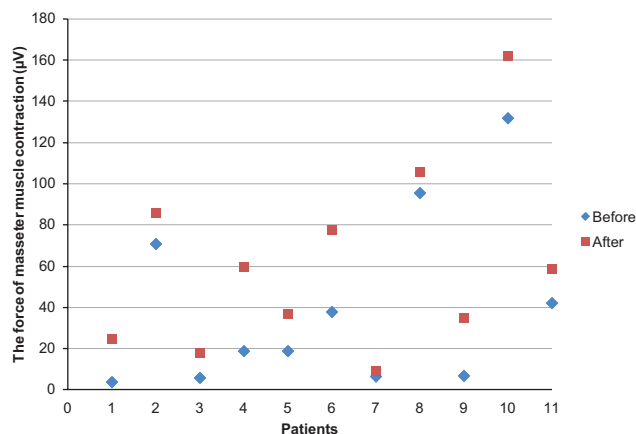


Fig. 3. The difference between the two groups

The accuracy of measurements and the reability of surface electromyography have been investigated and proven by Farella et al [8], Lassauzay et al [9].

The location of the proprioceptors in the periodontal tissues around the apical third of the tooth root has been suggested by some authors [10,11].

The surgical removal of mechanoreceptors from the tooth root area and using electromyography to detect any changes in muscular activity following the surgical procedure, is a field in the specific literature that wasn't investigated extensively, yet.

The conducted research is opening new fields in the literature, because until now we could not find any evidence of somebody studying this correlation. This research is part of a wider study in which we want to expand the study group and profoundly investigate the problem.

Conclusions

The achieved results suggest that the proprioceptors localized in the apical third of the root are important in controlling the force of contraction in the masticatory musculature.

Within the limits of the present study, it was concluded that the fixed partial dentures performed on teeth with apicectomy, will have a poor prognosis, not just because the short length of the root, but mostly because of the non-existent inhibitory action of the proprioceptors on muscular contraction.

These findings need to be considered in the context of implant dentistry. Implant supported prostheses will generate non-inhibited, high intensity masticatory forces, be-

cause implants are like teeth without any periodontal tissue (without any proprioceptors). To avoid this problem, it is necessary to have an appropriate occlusal surface, without premature contacts and interferences in functional movements of the mandible.

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