

<http://dx.doi.org/10.35630/2199-885X/2020/10/2.21>

EFFECT OF MAXILLARY ANTERIOR BRIDGEWORK ON PHONETIC ADJUSTMENT

Received 01 April 2020;
Received in revised form 6 May 2020;
Accepted 17 May 2020

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ABSTRACT — The paper presents results of prosthetic reconstruction in patients with anterior maxillary defects using sound analyzer software. The research was carried out involving spectrograms and sonograms acquired from patients prior to, and after the treatment. The data obtained by instrumental acoustic analysis of the spectrograms and sonograms conducted with our computer technology will help orthopedic dentists in planning and conducting respective orthopedic treatment and it will also help them avoid possible complications, thus increasing significantly the effectiveness of orthopedic treatment of the defects in the anterior dentition.

KEYWORDS — sound analyzer software, sonography, spectrography, acoustic analysis, permanent denture.

INTRODUCTION

The relevance of modern diagnostic methods in applied dentistry is determined by the high prevalence and intensity of dental diseases. The knowledge of diagnostic approaches, the principles of constructing and making a diagnosis is of great importance for medical practice, since the formulated diagnosis is the rationale for the tactics of therapeutic and preventive measures.

Loss of teeth is associated with various factors — complicated caries, trauma, severe periodontitis, removal of the *trouble* tooth through the inflammation (periostitis, osteomyelitis), etc. However, the effect is only one — a dentition defect development. The issues arising at treating such defects with prosthetics depend on the cause behind the loss of teeth; the time after their removal; the TMJ structural features [1, 7, 8], as well as other specifics of the body [2, 3]. In case of a lateral defect development, patients tend to take such issues in a more tolerant fashion, and treatment with

prosthetics can be delayed indefinitely, which is not the case with a defect in the anterior dentition, which requires immediate replacement.

While restoring a single tooth typically will pose no trouble, dealing with defects of medium length can raise a number of questions, one of which is identifying the inclination angle of the maxillary anterior teeth palatal surfaces, thus, apart from aesthetics, to recover the speech function hence facilitating the patient's adjustment to the prosthesis [4, 5, 9]. Answers to these questions allow the orthopedic dentist and dental technician to obtain fundamental basic information concerning the ratios within the patient's dentofacial system, which is needed to make high-quality orthopedic prostheses featuring proper functional and aesthetic specifics.

The methods for phonetic quality control in prosthetics that are available from respective literature, focus on improving the pronunciation of speech sounds while using removable dentures [6, 10]. Searching through literature, we failed to find any sufficiently reliable methods and criteria for assessing the quality of prosthetics with a fixed structure. At the same time, more and more attention is paid to the improving the quality of dental treatment.

Aim of study:

to increase prosthetics effectiveness for patients with anterior maxilla dentition defects.

MATERIALS AND METHODS

Depending on the anterior dental arch status, we identified 3 groups of patients. Group 1 — 30 people with intact dentition, orthognathic bite and with no articulation issues, which made up the control group. Group 2 — patients with restored defects of the anterior dentition who had bridge work installed previously and who complained of diction issues — the comparison group. Group 3 — patients who underwent examination and orthopedic treatment in view of the upper jaw morphometric features — the main group.

To identify the relationship between the palatal vault configuration and the anterior teeth palate surface inclination angle in case of articulation issues, we developed a measuring device (Patent RU 53141 U1), as well as a method for identifying the palatal vault angles and the anterior teeth palate surface inclination angles (Patent RU 2314060 C1). The measurements were

done based on graphic displays of the palatal vault and teeth curved sections in the sagittal plane with respect to the horizontal plane. The length of the palatal vault was measured from the interdental papilla (at the central incisors approximal surfaces) to the line formed by the intersection of the median palatine suture with a line drawn at the level of the alveolar processes apex between the second premolars and the first molars (the depth of the palatal vault). This length was divided into three equal parts: alveolar, middle and palatal.

RESULTS AND DISCUSSION

Through the study, we found that the inclination angle of the anterior teeth palatal facings varied from 34° to 55° with an average of 45.6°, while the inclination angle of the anterior palatal vault middle third was equal to the inclination angle of the palatal facings of the anterior teeth with an accuracy of 84%, to range between 32–57°, whose average value was 45.1°.

Therefore, in 84% of the cases, the inclination angle of the anterior palatal vault middle third was equal to the inclination angle of the anterior teeth palatal facings. To obtain an objective assessment of the phonetic adjustment to the installed bridgework, we opted for spectrographic and sonographic analysis of the speech produced by patients (software — sound analyzers Steinberg Wavelab V5.01b, and Algorithmix renovator 2.1). The nature of the deficient pronunciation changed depending on the upper anterior teeth palatal facings inclination angle, and on the inclination angle of the palatal vault middle third.

In case of the upper front teeth retrusion, when the cutting edge can touch the inside lower lip rather low, we observe an additional overtone and a linkage sounding close to the German [pf] pronunciation (affricate). This is to be observed clearly on the spectrogram of the Russian word transcribed as [ˈflanets] uttered by a patient wearing a prosthesis installed previously in an outpatient setting. This overtone lies within a range of 3 to 10 kHz, which is perceived by a common ear as German [pf].

Similar issues lie behind the vowel overtone appearing through transition from the dorsal [t] / [d] to the non-dorsal [də], so instead of pronouncing it like [dɔr], we would get something like [dəwɔr], or [təɔs] rather than [trɔs], etc.

In patients who had the palatal vault inclination angle of the prosthesis significantly below the inclination angle of the anterior palatal vault middle third, up to 15°, with the upper front teeth protrusion, the pronunciation of [z] / [s] was perceived as flat-aperture, as if hissing.

The spectrogram of the word [trɔs] pronounced by a patient with a bridgework made in an outpatient

clinic shows clearly that the sound [s] takes a frequency of 0.5 through 10 kHz, which is more typical of the sound [ʃ] (-sh-). The orthopedic treatment helped eliminate the defect, and the control spectrogram shows a narrowing spectrum of the sound [s], as well as its shift towards higher frequencies, which corresponds to the pronunciation norm.

CONCLUSION

In view of the above, the instrumental acoustic analysis data obtained by sound analyzer software confirms significant improvements in the pronunciation of sounds whose development is associated with the anterior upper dentition. Spectrogram and sonogram acoustic analysis done via computer technology will help orthopedic dentists in orthopedic treatment, as well as may help them avoid possible complications, which will contribute significantly to the effectiveness of orthopedic treatment offered for anterior upper dentition defects.

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