MEDICAL SCIENCE

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*F*UNCTIONAL CHARACTERISTICS OF THE MASTICATORY AND TEMPORAL MUSCLES IN CHILDREN WITH DENTITION DEFECTS IN MIXED DENTITION

Abstract

Defects in the dentition during the formation of a mixed dentition occur in 17.65–50% of children. Premature removal of temporary teeth leads not only to various morphological, but also functional disorders in the dentofacial system, which initially are adaptive in nature, but over time become an etiological factor in the development of dentofacial anomalies [1, 6–9].

The purpose of the study was to study functional changes in the temporal and masticatory muscles in children with dentition defects in mixed dentition. Electromyographic studies were carried out in 40 children with dentition defects of varying extent before prosthetics and 6 months after prosthetics. All children were divided into 2 groups: group 1 consisted of 25 children with dentition defects, malocclusions and dentition, group 2 (control) consisted of 15 children with dentition defects and neutral occlusion. Electromyograms were amplified and recorded using a Stotokin electromyograph (RF) at a tape drive speed of 50 mm/s. To record electromyograms, surface electrodes with an active area of 0.5 mm were used, which were applied to the area of the muscle under study, on fat-free skin at a distance of 10 mm from each other. A grounding electrode with paste was fixed on the dorsal surface of the lower third of the forearm. Electromyograms (EMG) were recorded in a state of relative physiological rest of the lower jaw, with maximum volitional compression of the dentition, during the chewing function, as well as during dynamic loads (alternating closure of the lips, dentition, alternating protrusion of the lower jaw), static loads (maximum volitional closure of the dentition in a state of central occlusion, protrusion of the lower jaw). The most informative test for recording the function of the masticatory muscles is chewing a hazelnut kernel weighing 0.8 g. Muscle biopotentials were recorded on both sides, both on the side with dentition defects and on the healthy side (without dentition defects). Analysis of electromyograms (EMG) was carried out based on the amplitude and time characteristics of muscle work. When analyzing the electromyograms of the masticatory and temporal muscles, we determined both time parameters: • duration of the chewing period, • time of bioelectric activity, • time of bioelectrical "rest," • time of chewing, and amplitude indicators: • EMG amplitude of the masticatory and temporal muscles. For the amplitude characteristics, the average of the three maximum amplitude values of electromyograms in the phase of bioelectrical activity of the masticatory and temporal muscles was chosen as the main value of muscle electrical activity. Amplitude indicators were expressed in microvolts. The biopotentials of the masticatory and temporal muscles were recorded on the healthy side of the jaw, which was taken as 100%. The obtained data were used for comparison with the functional state of the masticatory and temporal muscles on the side with a dentition defect. Time parameters of electromyograms were expressed in seconds. 140 electromyograms were analyzed. A comparative analysis of electromyograms of the masticatory and temporal muscles obtained from children with dentition defects of varying extent before prosthetics allowed us to identify varying degrees of functional disorders. Thus, with small defects in the dentition (1 temporary tooth is missing), the amplitude of the electromyograms of the masticatory muscles was reduced by 206.4 mkv and amounted to 53.5 ±9.90% of the amplitude of the electromyograms of the masticatory muscles on the side without a defect in the dentition, in children with large defects in the dentition (3 or more temporary teeth are missing) - by 211.2 mkv (47.8±9.9%) compared to the healthy side. The amplitude of the electromyograms of the temporal muscles on the side with a dentition defect during chewing was also reduced compared to the healthy side: in children with small dentition defects by 102.5 μV (61.5 ±9.70%), in children with large dental defects rows - by 122.7 mkv (57±9.8%) compared to the side without a dentition defect. The amplitude of the electromyograms of the masticatory and temporal muscles ranged from 163.5 to 444.7 mkv. The amplitude of the electromyograms of the masticatory and temporal muscles during chewing was greater than when closing the dentition, since during chewing the masticatory muscles expended additional contraction force due to the absence of temporary teeth. However, with maximum volitional compression of the jaws, a slight increase in the amplitude of the temporal muscles was noted, which is consistent with the data of F.Ya. Khoroshilkina . The amplitude of the biopotentials of the masticatory and temporal muscles, determined during closure of the dentition, was also significantly lower than the values on the side without dentition defects. The decrease in the amplitude of muscle biopotentials is explained by a decrease in the number of muscle motor units actively involved in the contraction process during chewing, since as a result of premature removal,

temporary teeth were excluded from the chewing function. A decrease in the amplitude of electromyograms indicates a decrease in the strength characteristics of the masticatory muscles in children with defects in the dentition, which in turn is compensated by an increase in the duration of the chewing period and chewing time . Significant changes also occurred in the activity-rest cycle: the phase of bioelectrical activity on the side with a dentition defect with small defects was lengthened in the temporal muscles by 0.18 s, in the masticatory muscles - by 0.19 s; the bioelectric rest phase increased in the temporal muscles by 0.10 s, in the masticatory muscles - by 0.10 s compared to the side without a dentition defect. With large defects in the dentition, the phase of bioelectrical activity in the temporal muscles increased by 0.12 s, in the masticatory muscles - by 0.1 s, the bioelectric rest phase increased in the temporal muscles by 0.10 s, in the masticatory muscles - by 0.11 s . However, the clear rhythm of dynamic cycles (activity - rest) was disrupted: in some cases, there was a loss of biocurrents in the phase of bioelectrical activity and the appearance of additional "volleys" of bioelectrical activity in the resting phase. During the entire period, right up to swallowing, chewing was performed on one familiar side (without dentition defects). This fact had a significant impact on the reflex restructuring and subsequent formation of the type of chewing, making one side of the dentition predominant when chewing food. A comparative analysis of electromyograms obtained from patients before prosthetics and after replacing dentition defects with spacers and partial removable plate dentures indicated that such prosthetics helps reduce the time of bioelectric activity in the temporal muscles by 0.18 s and masticatory muscles by 0.11 s and reduces the time of bioelectric rest in the temporal muscles by 0.12 s and in the masticatory muscles by 0.13 s. Along with this, there was a decrease in the time of the entire chewing period from 21.5 to 16.5 s in the temporal muscles and from 18.9 to 17.4 s in the masticatory muscles and chewing time from 0.80 to 0.50 s in the temporal muscles and with 0.73 to 0.60 s in the masticatory muscles. As for the amplitude of biopotentials after 6 months of using partial removable plate dentures, as children adapted to the dentures, there was a gradual equalization of the amplitude of muscle biopotentials on the side with a dentition defect and on the healthy side . However, no changes in the chewing period and chewing time were detected in either the temporal or masticatory muscles in children with small dentition defects replaced by fixed spacers. In the control group of children with small defects in the dentition and with a neutral occlusion, 6 months after prosthetics with fixed spacers, there was no improvement in either amplitude or time indicators of the condition of the temporal and masticatory muscles. In children with large dentition defects replaced with partial removable laminar dentures, an increase in the amplitude of electromyograms of both the temporal and masticatory muscles was observed - by 112.5 (38.1±9.71%) and 225.4 μV (54.5 ±9.95%) respectively. The time of bioelectrical activity in the temporal muscles decreased by 0.15 s and the masticatory muscles by 0.17 s, and the time of bioelectrical rest in the temporal muscles decreased by 0.13 s and the masticatory muscles by 0.10 s. In addition, chewing time and the time of the entire chewing period were reduced - in the temporal muscles by 0.19 and 2.11 s, in the masticatory muscles - by 0.10 and 2.15 s, respectively. Thus, dentition defects in children with a mixed dentition cause significant functional disorders in the temporal and masticatory muscles. The neuro-reflex regulation of the activity of the masticatory and temporal muscles is disrupted. The force of contraction of the masticatory and temporal muscles decreases, the phase of bioelectrical activity and bioelectrical rest increases, and the symmetry of chewing is disrupted (the child chews on the healthy side). A decrease in the duration of the chewing period and the number of chewing movements 6 months after replacing dentition defects with partial removable laminar dentures showed that prosthetics helps restore neurodynamic processes in the masticatory and temporal muscles, improve the flow of bioelectric processes in the masticatory and temporal muscles during chewing, and as a result, chewing the pressure is evenly distributed between the mucous membrane of the alveolar processes and the teeth. The bioelectrical activity of the masticatory and temporal muscles increases significantly, and the time characteristics improve compared to the initial data. A significant increase in the biopotentials of the masticatory and temporal muscles is revealed compared with the indicators before treatment .

References

1. Alimova M.Ja. Klinika, profilaktika i lechenie anomalij i deformacij, vyzvannyh rannim udaleniem vremennyh zubov: Avtoref. dis. …kand. med. nauk. — Voronezh, 2000. — 26 s.

2. Erohina I.G. Jelektromiograficheskoe issledovanie zubocheljustnoj sistemy u detej 4–6 let pri ortognaticheskom prikuse: Avtoref. dis. … kand. med. nauk. — M., 1981.

3. Omarov O.G., Persin L.S., Omarova H.O. // Stomatologija. — 2002. — №3. — S. 49–50.

4. Persin L.S., Ushakova I.V. Jelektrofiziologicheskie issledovanija v klinike stomatologii detskogo vozrasta. Metod. rekomendacii. — M., 1980. 5. Persin L.S., Farizova E.N. Metodika registracii jelektromiogramm myshc cheljustno-licevoj oblasti, ih rasshifrovka i analiz na komp'jutere. Metod. posobie. — M., 1991.

6. Persin L.S. Ortodontija. Diagnostika, vidy zubocheljustnyh anomalij. — M., Ortodent-info, 1999. — 273 s.

7. Tagvimi Farid. Ortodonticheskoe lechenie pacientov s rannej poterej vremennyh zubov: Avtoref. dis. … kand. med. nauk. — M., 2001. — S. 19.

8. Tril' S.I. Klinika, diagnostika i ortopedicheskoe lechenie vkljuchennyh defektov zubnyh rjadov u detej i podrostkov: Avtoref. dis. … kand. med. nauk. — Kiev, 1992. — S. 19.

9. Horoshilkina F.Ja. Rukovodstvo po ortodontii. — M., 1999.