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# PERIODONTIUM INFLAMMATORY DISEASES IN ORTHODONTIC TREATMENT WITH FIXED DENTURES. LITERATURE REVIEW

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**ABSTRACT** — The article offers a review of research literature containing data on treating the occlusion pathology with fixed orthodontic equipment, as well as details regarding potential complications affecting periodontium tissues, with a clinical case offered as an example. Statistical reviews suggest high prevalence of this pathology and its significance in the structure of dental diseases. Analysis suggests that there is a need to study the available research and knowledge accumulated in the field of dentistry, which may contribute to the development and implementation of the most effective preventive measures.

**KEYWORDS** — periodontal disease, occlusion anomaly, dental anomalies prevalence, hygiene indices.

Periodontal tissue diseases are common among adult population. Periodontal tissue damage may be due to genetic predisposition, other diseases such as diabetes or issues affecting the cardiovascular, gastrointestinal or respiratory system; disturbed hormonal status; chronic intoxication, etc., as well as can be attributed to local factors such as poor oral hygiene, prominent filling edges, orthopedic structures that do not meet the manufacturing and fixing requirements, eating foods rich in carbohydrates, or things like malocclusion, abnormal position of teeth, which are to be found in most people, as well as wearing orthodontic devices. In this article, we will focus on periodontal diseases that occur at the stage of orthodontic treatment in adult patients using fixed orthodontic equipment and have no concurrent diseases, as well as we will take a look at methods of prevention and treatment for such issues.

Orthodontic treatment has both indications and contraindications. Absolute contraindications for treatment with a bracket system include immune system diseases; malignant tumors and some oncological diseases; cardiovascular system issues; blood diseases; certain diseases of the bone system involving the healing process; endocrine system issues; tuberculosis; neuro-mental diseases; HIV; STDs; lack of numerous teeth. This issue has been covered in a work focusing on studying periodontal diseases [8]. Some of the relative contraindications include poor oral hygiene, as claimed by Yu.M. Glukhova, A.I. Kiryutin [1], and periodontal diseases, which tend to affect more and more of younger patients in Russia, while the share of these aged 15–19 years is 55–89%, and in the adult population this figure goes up to 99%. A number of authors [2] point at the patient's unwillingness to undergo treatment. However, be that one way or another, all these factors can be eliminated.

One of the methods employed to prevent the aggravation of mild periodontitis into its generalized chronic type is orthodontic treatment. Orthodontic treatment can only be performed in case of a healthy periodontium or when periodontal diseases is in remission (lasting for at least 2 years). Our major task is to find out what periodontal diseases occur during orthodontic treatment, and whether there is any connection with a specific maxillofacial pathology (MFP).

When keeping the patient's medical record, the orthodontist collects carefully the patient's history of life and illness because it is important to identify and evaluate the patient's health status, detect concomitant diseases, which may appear as a contraindication to orthodontic dentures installation. Such diseases have already been mentioned in this article [3–6].

After making sure there are no contraindications, orthodontic treatment can be started, which in Russia is carried out in adult patients with removable and non-removable dentures that being the most common type of treatment. The type of technique often depends on the gum phenotype,

the mechanics of treatment, its duration, and most importantly, the type of MFP. According to [7], the dental anomalies prevalence in the adult population is 30–55%.

In this country, the most common type of occlusion is neutral with a close position of the teeth; the most common pathology is distal occlusion; the second most common is deep occlusion; there are fewer patients featuring mesial, open and cross occlusions. Similar data were obtained by [8], where the authors found that the share of neutral occlusion accounts for 43.11 % of those who were identified as in need of dental care; 25.52% had a distal occlusion, whereas another 4.99% had a mesial occlusion.

The most common type of occlusal ratio disturbance is a combination of distal and deep, which, under the effect caused by plaque microorganisms, serves an obstruction to proper individual cleaning of the oral cavity from plaque. This situation is aggravated by a bracket system installed on the outer or inner surface of the teeth.

All patients with healthy periodontium feature changes in the blood microcirculation parameters in the gums (by 79% in the first 7 days from the moment elastics were applied to non-removable orthodontic equipment). This conclusion was offered by K. A. Evnevich [9], who confirmed his study outcomes with the LAKK-01 device at the square arcs stage.

There is research data available indicating the appearance of generalized catarrhal gingivitis signs within 2 months after the installation of non-removable orthodontic equipment in all patients [10, 11].

Also, a factor triggering periodontal diseases is nocturnal and diurnal jaw compression, which is most often observed in patients with a deep bite [12]. An important factor that has an impact on the periodontal status is smoking [13]. Nicotine changes the subgingival microflora composition, suppresses protective mechanisms that promote the elimination of periodontal pathogens. Patients report bleeding gums, bad breath, changed gum color and pain when cleaning. In 80% of cases, following a professional oral hygiene procedure, patients complain of tooth sensitivity [14].

The next most common MFP in the sagittal plane is mesial occlusion, which is often accompanied by multiple recessions of the gingival margin, especially at the central lower incisors, the reason behind that being their inverse ratio and traumatic occlusion [15].

Regardless of the location, soft plaque turns into calcified deposit, which exacerbates the degree of gingivitis. Given the periodical frequency of ap-

pointments that orthodontic patients follow (once a month, once every 2 months), gingivitis, if other conditions are in place, can turn into a more severe stage — periodontitis, which features symptoms like bleeding gums, destructed alveolar partitions, development of dental-gingival pockets, purulent discharge, abnormal tooth mobility, as well as appearance of bacteria like *Streptococcus mutans*, *S. sanguis* and *S. oralis*, *Porphyromonas gingivalis*, *Treponema denticola*, *S. sobrinus*, *Streptococcus salivarius*, and *S. macacae*, which, together with orthodontic displacement, can change the bone tissue structure in the alveolar process of the upper and lower jaw, as well as irreversible tooth mobility, and make the gingival papilla disappear, which in modern dentistry can only be restored with hyaluronic acid, except cases where surgical reconstruction is to be employed, as stated by [16–19].

The dentist will evaluate the patient's periodontal status from a clinical stance, which, according to a number of authors [20], typically has the following characteristics: a healthy periodontium when probing the gingival groove; no bleeding from the gingival papilla; the groove depth in the formed periodontal front teeth — 0.5 mm, in the side teeth — up to 3.5 mm. In the event the parameters do not fall within the specified normal range, additional evaluation is to be performed: periodontal status evaluation based on periodontal indices; computer diagnostics for examining periodontal tissues; X-ray examination; CBCT; measurement of the periodontal pocket depth; biomicroscopy; polarography; laser tissue oximetry; laboratory research methods, etc [21–24].

In conclusion, it is to be emphasized once again the importance of collecting data regarding the patient's life and illness, complaints, basic and additional methods of examination prior to the orthodontic treatment, since this information is important when it comes to selecting the right tool to correct malocclusion and ensure excellent outcome, keeping the patient's periodontium healthy. To support all of the above, here we offer a clinical case description.

## CLINICAL CASE REPORT

Patient M., 25 y.o., came to the clinic with complaints of poor dental aesthetics. Following the complaints, anamnesis of life (general diseases and allergy — negative) and diseases (previous orthodontic treatment — not performed), objective and additional research methods (CBCT, side TRG), the diagnosis was set: distal deep incisor occlusion; narrowing and shortening of both dental arches; abnormal position of teeth on both jaws; tooth

erasability on both jaws; displaced central line on the lower jaw to the left (by 2.5 mm). A treatment plan was developed, which included oral sanitation and professional hygiene, followed with installation of fixed orthodontic equipment designed as a self-ligating bracket system, after correcting the teeth position and the bite; installation of retention devices and rational prosthetics aimed at raising the bite and eliminating its deep overlap. For the entire period of treatment, the patient was given a memo with recommendations for dental, and for the bracket system care.

At the time the patient came to seek assistance and prior to the installation of the bracket system, the patient's periodontal status (Fig. 1) was evaluated based on 4 indices:



**Fig. 1.** Patient M., 25 y.o. The periodontium status at the moment the patient came to seek help prior to installing the bracket system

1. The Green-Vermillion hygiene index — 0.83, which indicates a good hygiene value.
2. The gingivitis index PMA = 0, which is indicative of the absence of gingivitis.
3. The periodontal index CPITN = 0.0: a low level of periodontal diseases intensity.
4. The gum recession index points at no recession.

At the orthodontic treatment stage, the patient underwent repeated professional dental cleaning (once every 3–4 months), yet the individual hygiene was assessed as poor. The patient was told repeatedly about the level of dental cleaning; after 15 months the periodontal status was assessed through the same indices, which revealed a deterioration in the indicators (Fig. 2). The study showed that:

1. The Green-Vermillion hygiene index was 2, which means a satisfactory hygiene index.



**Fig. 2.** Patient M., 26 y.o. The periodontium status after 15 months of orthodontic treatment

2. The gingivitis index PMA = 55%, which indicates the average degree of gingivitis.
3. The periodontal index CPITN = 0.6 — corresponds to the average intensity of periodontal diseases.
4. The gum recession index = 1.0, which means a mild degree of gum recession.

The data offered by respective literature and clinical research suggest that oral hygiene in patients with fixed orthodontic appliances may get worse during orthodontic treatment and result in periodontal diseases, subsequently causing the need for premature removal of the bracket system.

## REFERENCES

1. **GLUKHOVA YU.M., KIRYUTINA A.I.** Clinical substantiation of the diagnostic and therapeutic complex for patients with dentoalveolar anomalies complicated by periodontal diseases. Institute of Dentistry. – 2012. – No. 1. – P. 92–93.
2. **ZAYDULLIN I.I., BAKIROV A.B., VALEEVA E.T.** Risk factors for the development of periodontal disease in the population. Public health and habitat. – 2017. – No. 3 (288). – P. 7–10.
3. **AVANISYAN V., AL-HARAZI G., KONDRATYEVA T., HARUTYUNYAN YU.** Morphology of facial skeleton in children with undifferentiated connective tissue dysplasia. *Archiv EuroMedica*. 2020. Vol. 10; 3: 130–141. <https://dx.doi.org/10.35630/2199-885X/2020/10/3.32>
4. **HARUTYUNYAN YU.** Undifferentiated connective tissue dysplasia as a key factor in pathogenesis of maxillofacial disorders in children and adolescents // *Archiv EuroMedica*. 2020. Vol. 10; 2: 83–94. <https://dx.doi.org/10.35630/2199-885X/2020/10/2.24>
5. **SHKARIN V.V., IVANOV S.YU., DMITRIENKO S.V.** Morphological specifics of craniofacial complex in people with various types of facial skeleton growth in case of transversal occlusion anomalies // *Archiv*

- EuroMedica. 2019. Vol. 9; 2: 5–16. <https://doi.org/10.35630/2199-885X/2019/9/2/5>
6. **DAVYDOV B.N.** Modern possibilities of clinical-laboratory and x-ray research in pre-clinical diagnostics and prediction of the risk of development of periodontal in children with sugar diabetes of the first type. Part I. Periodontology, 2018; Vol. 23; 3–23(88): 4–11. DOI:10.25636/PMP.1.2018.3.1
  7. **GANZHA I.R., POSTNIKOV M.A., MODINA T.N.** Planning of treatment and prevention of mucous-gingival complications at the stages of orthodontic rehabilitation. Pacific Medical Journal. 2020; 2: 71–3. doi: 10.34215/1609-1175-2020-2-71-73.
  8. **FLEECE PS, MYO H.E.** The prevalence of dentoalveolar anomalies, deformities and defects in the dentition among patients seeking orthodontic care. Dentistry Bulletin. – 2012. – No. 4 (81). – P. 91–94.
  9. **EVNEVICH K.A.** Assessment of blood microcirculation in the gums during orthodontic treatment of patients with periodontal disease. Bulletin of the Smolensk State Medical Academy. – 2018. – No. 3. – P. 222–225.
  10. **KOSYUGA S.YU., BOTOVA D.I.** The condition of the oral cavity in patients undergoing orthodontic treatment. Modern problems of science and education. – 2015. – No. 6. – P. 215.
  11. **DOMENYUK D.A., DAVYDOV B.N., DMITRIENKO S.V.** Changes of the morphological state of tissue of the paradontal complex in the dynamics of orthodontic transfer of teeth (experimental study). Periodontology, 2018; Vol. 23; 1–23(86): 69–78. DOI:10.25636/PMP.1.2018.1.15
  12. **GALEBSKAYA K.YU.** Modern view of the etiology and treatment of temporomandibular joint dysfunction. Scientific notes of St. Petersburg State Medical University n.a. Academician I.P. Pavlov. – 2015. – No. 4. – P. 8–12.
  13. **FUCHS E.I. FUKS E.I., KAREVA YU.A., GALIZINA O.A., TABOLINA E.S.** Modern aspects of the etiology and pathogenesis of periodontal diseases // Russian Medico-biological Bulletin n.a. Academician I.P. Pavlov. – 2013. – No. 3. – P. 153–160.
  14. **BLASHKOVA S.L., MAKAROVA N.A.** Increasing the effectiveness of the treatment of hypersensitivity of dental hard tissues in patients with periodontal disease // Periodontology. – 2017. – No 1. – 37–40.
  15. **FADEEV R.A.** An alternative approach to the treatment of skeletal forms of the mesial ratio of the dentition in patients with completed growth // R.A. Fadeev, N.V. Prozorova, M.R. Fadeeva [et al.] // Institute of Dentistry. – 2018. – No. 4. – P. 44–47.
  16. **TAMAROVA E.R., BAIMIEV A.KH., SHVETS K.YU., MAVZYUTOV A.R.** Molecular genetic characteristics of the composition of the microbiota of saliva and gingival pockets in periodontitis / E.R. Tamarova, K.Yu. Shvets, A.R. Mavzyutov // Clinical laboratory diagnostics. – 2015. – No 12. – P. 56–59.
  17. **KHETAGUROV S.K., BASIEVA E.V., GATSALOVA A.O.** Evaluation of the effectiveness of the use of hyaluronic acid for the reconstruction of the interdental gingival papillae. Journal of Scientific Articles on Health and Education in the XXI century. – 2017. – No. 2. – P. 15–16.
  18. **GAVRILOVA O.A.** Specific features of oral cavity microbiocenosis in children using non-removable orthodontic appliances. Archiv EuroMedica, 2018; 8(2): 91–92.
  19. **GAVRILOVA O.A.** Microbiological verification for the use of thermoplastics in prosthetic treatment of dentition issues in children. Archiv EuroMedica, 2018; 8(2): 88–90.
  20. **REDINOVA T.L., VERSHININA T.N., BULAVINA A.L.** The frequency of diagnostics of various conditions of periodontal tissues at the reception of a dentist-therapist and risk factors for periodontitis. Pacific Medical Journal. – 2020. – №2 (80). – P. 153–18.
  21. **DAVYDOV B.N.** Peculiarities of microcirculation in periodont tissues in children of key age groups sufficient type 1 diabetes. Part I. Periodontology, 2019; Vol. 24; 1–24(90): 4–10. DOI: 10.25636/PMP.1.2019.1.1
  22. **DAVYDOV B.N., KOROBKEEV A.A., ARUTYUNOVA A.G.** Morphological peculiarities of facial skeleton structure and clinical and diagnostic approaches to the treatment of dental anomalies in children in the period of early change. Pediatric dentistry and prophylaxis. 2019; Vol. 19; 1 (69): 26–38. (In Russ.) DOI: 10.33925/1683-3031-2019-19-69-26-38
  23. **DAVYDOV B.N.** Cephalometric features of connective tissue dysplasia manifestation in children and adolescents. Pediatric dentistry and dental prophylaxis. 2020;20(3):174–183. (In Russ.) <https://doi.org/10.33925/1683-3031-2020-20-3-174-183>
  24. **DAVYDOV B.N., GILMIYAROVA F.N., IVCHENKO L.G.** Optimization of diagnostics of type I diabetes in children according to the results of cytomorphological studies of buccal epithelium and processes of oxidative stress in the oral cavity. Pediatric dentistry and prophylaxis. 2017; Vol. XVI; 3(62): 9–18. (In Russ.).
  25. **ULM C., TEPPER G., BLAHOUT R., RAUSCH-FAN X. ET AL.** Characteristic features of trabecular bone in edentulous mandibles. Clin. Oral. Implants Res. 2009; 20(6): 594–600. DOI: 10.1111/j.1600-0501.2008.01701.x
  26. **ALI I.M., YAMADA K., HANADA K.** Mandibular antegonial and ramus notch depths and condylar bone change. J. Oral. Rehabil. 2005; 3(2):1–6. <http://dx.doi.org/10.1111/j.1365-2842.2004.01381.x>
  27. **CAKUR B., SAHIN A., DAGISTAN S. ET AL.** Dental panoramic radiography in the diagnosis of osteoporosis. J. Int. Med. Research. 2008; 36: 792–799. DOI: 10.1177/147323000803600422
  28. **GENCO, R.J.** Periodontal disease and overall health: a clinician's guide / R.J. Genco, R.C. Williams. – Professional Audience Communications, Inc. Pennsylvania, USA. – 331 p.

29. **GE, Z.** Assessment of local hemodynamics in periodontal inflammation using optical spectroscopy / Z. Ge [et al.] // *J. Periodontol.* – 2011. – 82. – No 8. – P. 1161–1168. <http://dx.doi.org/10.1902/jop.2011.100632>
30. **ROEYKENS, H.** Use of laser Doppler flowmetry in dentistry / H. Roeykens, S. Nammour, R. De Moor // *Rev. Beige. Med. Dent.* – 2009. – V. 64. – № 3. – P. 114–128.
31. **SCARDINA, G.A.** Oral microcirculation observed in vivo by videocapillaroscopy: a review / G.A. Scardina, A. Ruggiere, P. Messina // *J. Oral Sci.* – 2009. – No 51. – P. 1–10. DOI: 10.2334/josnurd.51.1