

Case Report**THE INFLUENCE OF DENTAL HYGIENE ON ANATOMICAL STRUCTURES OF THE PERIODONTIUM UNDER ORTHODONTIC TREATMENT****Mária Matuševská¹, Eva Kovalova¹, Jana Ferkova², Kvetuse Lovasova³, Darina Kluchova³**¹*Department of Dental Hygiene, University of Prešov, Slovakia*²*Dental Clinic, Slovakia*³*Department of Anatomy, University of Pavol Jozef Safarik, Slovakia***RESUMEN**

La lesión más común del tejido periodontal se produce por la acción de la placa microbiana. Un porcentaje menor de lesión proviene de factores no microbianos (irritación física y química). Entre el periodonto y la pulpa existe una conexión. Por lo tanto, es necesario conocer la relación entre el periodoncio y la pulpa dental para prevenir la lesión. Se obtuvieron resultados positivos mediante el tratamiento apropiado, el cual influyó en la inflamación del periodonto. También es necesaria la cooperación entre el dentista y el higienista dental. Es importante para los pacientes conocer la causa de su enfermedad para poder cooperar con la lucha contra la enfermedad de los dientes. Esta enfermedad es causada por la inflamación resultante de la placa dental. La bacteria está integrado en la placa y excretan las sustancias nocivas que resultan de la disolución de los tejidos periodontales. Por otra parte, es importante para los pacientes de enfoque individual. Dependiendo de la etapa de la enfermedad del paciente, se puede determinar el plan correcto de tratamiento ortodóncico. La higiene dental se realiza en primer lugar, seguido por el tratamiento conservador de los dientes afectados. Si es necesario, el tratamiento quirúrgico está indicado. Finalmente, el paciente debe someterse a la comprobación regular para arriba. Guardar encima de estos procedimientos antes, después y durante el tratamiento periodontal dramáticamente puede disminuir la gravedad de la enfermedad y mejorar el pronóstico de pacientes con periodontitis.

Palabras clave: *Periodoncio; ligamentos; hueso alveolar; periodontitis, ortodoncia.*

ABSTRACT

The most common periodontal tissue damage occurs by the action of microbial plaque. A smaller percentage of damage comes from non-microbial factors (physical and chemical irritation). Between the periodontium and the pulp exists a connection. Therefore, it is necessary to know the relationship between periodontium and pulp in order to prevent damage. Positive results were achieved by the appropriate treatment influencing on the inflammation of the periodontium. Also, cooperation between the attending dentist and dental hygienist is needed. It is important for patients to know the reason of their illness in order to be able in cooperation of fighting against the disease of their teeth. This disease is caused by the inflammation resulting from the dental plaque. The bacterium is embedded in the plaque and it excretes harmful substances which result in dissolving of the periodontal tissues. Moreover, it is important to approach patients individually. Depending on the stage of the patient's illness, the correct orthodontic treatment plan can be determined. The dental hygiene is performed at first, followed by the conservative treatment of affected teeth. If necessary, the surgical treatment is indicated. Finally, the patient should undergo the regular check up. The keeping up of these procedures before, after and during periodontal treatment may dramatically decrease the severity of disease and improve the prognosis of patients with periodontitis.

Key words: *Periodontium; ligaments; alveolar bone; periodontitis, orthodontics*

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INTRODUCTION

The periodontium is a set of tissues, which function is to keep the tooth in the tooth socket and isolate the organism's internal environment from the external. To the periodontal tissues belong cementum, alveolar bone, superior alveolar ligaments, intraalveolar ligaments and gingivae. Periodontium has two basic functions: it is a fixation between the tooth and the alveolar bone, and it is also a defense mechanism of the organism against the intrusion of foreign substances. This function is fulfilled by the junctional epithelium, superior alveolar ligaments, sulcular liquid, and oral and sulcular epithelium of the gingivae (Pagel, 2014).

The periodontal health depends mostly on regular care. Cells and tissues of such periodontium avoid the entry of bacteria and their toxins inside our organism. The most common periodontal tissue damage occurs by the action of microbial plaque (Kinane and Zhao, 2012). Its pathogenicity is determined by its volume, composition and bacterial metabolism (Kilian, 1999).

Between the periodontium and the pulp exists a connection. These two tissues are connected together through the apical foramen (foramen apicis dentis) on the tip of the root and through adjacent ducts (Lovasova and Kluchova, 2010). The root duct of the tooth is directly connected with the periodontium, while adjacent (side) ducts arise from the root duct of the tooth and connect it with periodontal ligaments as well. Because of this matter, the inflammation process can easily migrate from one area to another. The spread of infection may progress through an opening in the root tip and dentin tubules that are found in the entire length of the tooth root (Hellwig et al, 2003).

The instruction and motivation of oral hygiene should be performed after placement of the orthodontic appliances. During each visit, it is important to make sure that adequate plaque control is performed by the patient. The orthodontic appliances usually have a negative effect on the oral hygiene. It should be kept in mind that orthodontic retainers, both removable and fixed, are potentially plaque retentive devices and as such have potential risk for periodontal tissues (Levin et al, 2012).

The orthodontic treatment plan, biomechanics, and appliance system may need to be modified to deal with the teeth having reduced periodontal support. With proper force application and oral hygiene maintenance, orthodontic tooth movement is possible without any deleterious effect in the tooth with reduced bone support. With proper motivation and interdisciplinary approach,

orthodontic treatment is possible in patients with controlled periodontitis. The loss of attachment is the main factor leading to pathologic tooth migration and clinically seen as extrusion, proclination, rotation and diastema. Altered level of the incisal edge and space between anterior teeth leads to unaesthetic appearance and is the prime reason for seeking orthodontic treatment. (Gyawali and Bhattarai, 2017).

The decrease in the height of the alveolar bone around the affected teeth demands change in orthodontic treatment plan. As the bone surrounding the root surface is decreased, the periodontal ligament area also gets decreased. Therefore, even less force applied may produce greater pressure in the periodontal ligament and thus increases the extrusive component of the applied force. For that, light force should be used to move the tooth with reduced bone support (Gyawali and Bhattarai, 2017).

By Al-Anezi (2015) "the special periodontally friendly bands" are being designed which is more hygienic than the conventional bands. Bondable Buccal tubes are preferred over bands because they have minimal negative effects on the periodontium as they are at a greater distance from the gingival margins. The orthodontic treatment should be done with the use of simplest system avoiding multiple wires, loops, and multiple attachments to allow better oral hygiene (Gkantidis et al, 2010).

CASE REPORT

A female patient who was 40 years old, was sent to us by her dentist asking for periodontal examination. On the basis of full examination, we made a diagnosis and suggested alternative treatment plan based on four phases: the preparatory, the hygiene, the definitive and the maintenance phase.

In the preparatory phase, a comprehensive examination of the patient was conducted. First of all the patient had to fill a history questionnaire. Clinical examination included full-mouth probing using a standard periodontal probe and tooth mobility assessment. Plaque and gingival indices, gingival recession, probing of periodontal pocket depth was measured as well as the bleeding of gingivae was checked. Afterwards an extraoral examination of the patient was performed finding an asymmetry of the left side caused by the position of tooth number 21. The following step was the intraoral examination of the patient, which consisted in analyzing: the dental status, the state of hygiene, the state of muco-gingival area (pathological move of frenulum labii

superioris) the width of the attached gingiva at dN° (tooth number) 31 and dN° 41 was 0, presenting a gingival recession), the state of periodontium (an active periodontal pocket with purulent exudation at dN° 21 was found) and the condition of the mucosa (without pathological finding). In addition, dental radiographies were taken as a complementary study. Radiographic evaluation included vertical bitewing radiographs

for the molar and premolar area combined with parallel periapical radiographs of the incisors (maxillary and mandibular). The pathologic periodontal pockets were observed and bone loss was detected in the radiographs (Fig.1). Based on these information, we were able to diagnose the patient: cariologically and periodontally active with generalized aggressive periodontitis form.

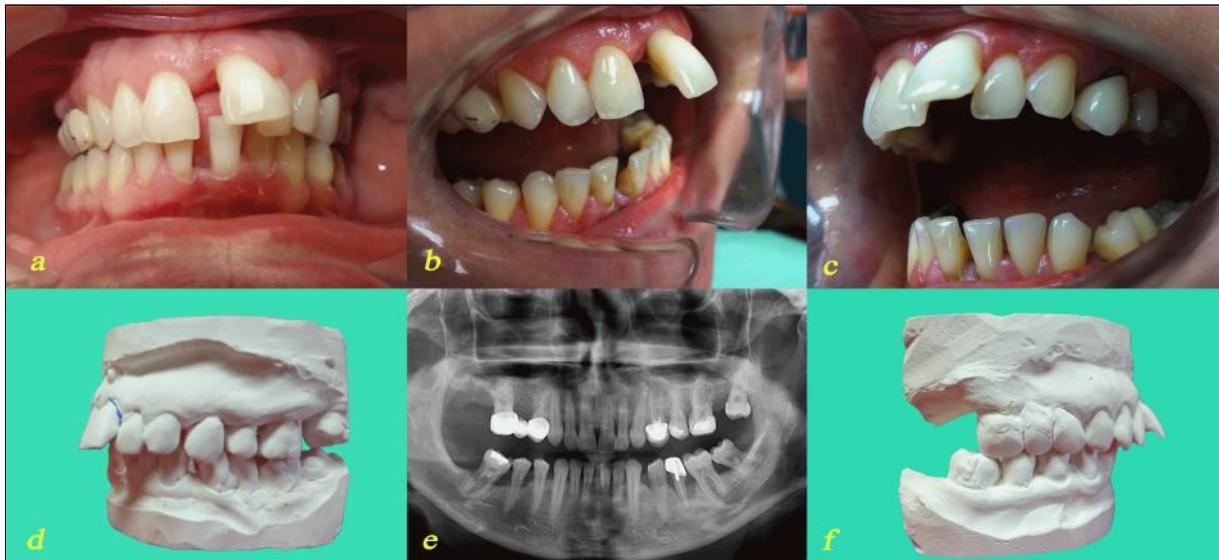


Figure 1- a. b. c. Photographic documentation of the patient before treatment with an asymmetry of the left side. d. Plaster model of the left side. e. The radiograph of the patient with periodontitis. f. Plaster model of the right side.

We suggested an alternative possible treatment depending on the time and the financial costs of the patient.

The hygienic phase started with periodontal treatment in cooperation with the dental hygienist:

During the first visit, the patient was motivated and instructed on tooth brushing Bass technique and the proper use of interdental brush in interdental spaces and periodontal pocket (dN° 21). Dental hygienist conducted scaling and root planning of dN° 21. We rinsed the periodontal pocket of dN° 21 with a chlorhexidine solution. Also, the patient was recommended to apply the chlorhexidine gel into periodontal pocket for 14 days. Furthermore, an antibiotic treatment was prescribed by a combination of Ciprofloxacin and Entizol for 7 days (250 mg/12 hours).

Along the second visit, we re-motivated and re-instructed the patient on Bass technique (for tooth brushing), and on the use of interdental brush in interdental spaces and periodontal pockets of the maxillae. The instructions were granted to the patient based on the shortcomings identified during the examination of

plaque index. Dental hygienist conducted the scaling and root planning in the maxillae, then he flushed periodontal pockets with chlorhexidine solution before, during and after the treatment. As well, the disinfection of the mouth was also made with chlorhexidine solution.

The third visit was devoted to finding of deficiencies occurred during the examination of plaque index of the patient. So, the same steps of the second visit were followed. The patient was repeatedly motivated and instructed on Bass technique and on the use of interdental brush in interdental spaces and periodontal pockets both in maxillae and in the mandible. Dental hygienist conducted the scaling and root planning in the mandibulae. Periodontal pockets were flushed with chlorhexidine solution before, during and after treatment. Dental hygienist also disinfected the mouth with chlorhexidine solution.

Also, during this hygienic phase root channel treatment of dN° 21 was accomplished.

The patient's condition was re-evaluated 14 days after last visit of the hygienic phase. The re-evaluation consisted in the observation of the cooperation and reaction of the patient's teeth

and periodontal tissues to the actual treatment. The dental hygienist investigated the state of hygiene and the state of periodontium (finding a reduction of the activity of periodontal pockets, without purulent exudation). We remotivated and reinstructed the patient on the tooth brushing Stillman technique. Dental hygienist conducted root planning in the maxilla and mandible, and then he purified and fluorided all the teeth. Due to the gingival recession the patient felt sensitivity of

dental cervix, therefore a fluoride preparations were prescribed. Also, it was necessary to indicate irrigations with anti-inflammatory tooth water and the application of chlorhexidine gel into the periodontal pockets during 10 days repeated every month. The state of hygiene was checked and state of periodontium was planned to be checked during the next two months. In the definitive phase, we carried out a treatment plan:

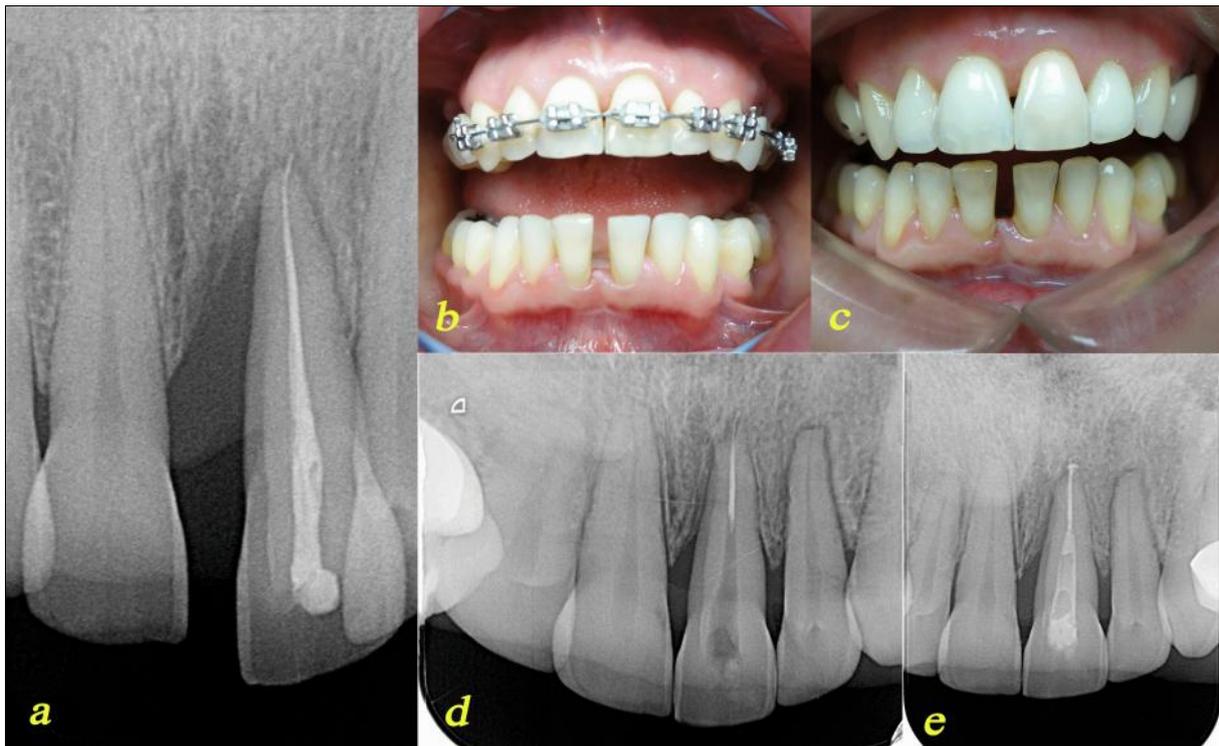


Figure 2- a. X-ray image dens number 21 after root treatment. b. Fixed apparatus to the upper set of teeth. c. Removed of the fixed apparatus. d. Control radiograph after removed of the apparatus. The apical resorption of the root is present. e. The repeated root treatment.

The frenectomy surgery from the upper frenulum was performed. Following, the patient was sent to undergo the orthodontic treatment with the application of fixed apparatus in the upper set of teeth for two months (Fig.2).

During orthodontic treatment, the patient came to control the plaque at regular intervals. Patient's orthodontist removed the fixed appliance 10 months after deployment. After removal of the fixed appliance, we reassessed the patient's condition. The X-ray image of dN° 21 was taken. The radiographies shown the resorption of the root apex, made by the pressure. The tooth was slightly pigmented. We have repeatedly treated the tooth with root treatment and with internal bleaching. At the end, a splint of glass fibers was made for the teeth (Fig.3).

The dental hygienist checked the state of periodontium in the maintenance phase. Based on these findings, a plan of control visits was prepared. For this patient, it was every 2-3 months.

DISCUSSION

Periodontal status depends on the quality of its treatment and the patient's compliance in the implementation of oral hygiene. Based on this knowledge, we can positively influence on periodontal therapy. There is also a need for cooperation between the attending dentist and dental hygienist. When these conditions are

fulfilled with a healthy patient we can accurately predict periodontal status after retreatment. Early diagnosis and treatment are essential for

successful long-term prognosis in patients with periodontitis (Levin et al, 2012).



Figure 3- a.The state of patient after bleaching teeth. b.The teeth with splint of glass fibers. c.The splint of glass fibers from palatal side. d.The state of patient after 2 month in control visit.

Slovakia is among the countries with a high prevalence of untreated periodontitis. Periodontal treatment is given to very few dentists due to the lack of awareness of periodontium. This issue can be addressed using the model of developed countries unless appropriate preventive measures are taken. Solution requires a certain sequence, that's why we want to point out the possibility of an appropriate procedure for treatment of periodontium.

A patient with a treated periodontium can undergo orthodontic treatment practically at any age, assuming that the inflammatory reaction was suppressed. So, before the orthodontic treatment, the patient must have been treated periodontally and it is recommended that the alveolar resorption of the bone does not exceed 2/3 of lengths of the root, optimally less than 50% of loss. Furthermore, to begin with the orthodontic treatment is recommended to wait at minimum 3 months after the periodontium gets into the stable state (no active symptoms observed). During orthodontic treatment, its

necessary to check the plaque by dental hygienist at minimum once per two months (Zetu et al, 2011).

As for the change in the periodontal tissues, histological findings and clinic studies show that redevelopment of the atrophic alveolar ridge accompanies the movement of teeth. This happens because of bone apposition which allows the alveolar projection to be reconstructed vestibule-orally as well as mezio-distally. In addition, extrusion of teeth supports also the treatment of periodontal pockets causing coronary relocation of a healthy ligament, while the distance between cementum–enamel line and the edge of the bone does not change (Kumar, 2006).

The intrusion of teeth in supra-occlusion in suitable conditions possibly profit binding attachment and remodeling of the alveolar bone. It results in plunging the teeth into the bone and thus improve the anchoring of the root in the bone. Necessity for this performance is the constant monitoring of the plaque because its

presence causes a further loss of connective tissue of attachment and a deepening of periodontal pockets. It is essential to select a proper amount of force and spread it evenly to avoid resorption of the tooth's apex (Novackova et al., 2007).

The goal of orthodontic treatment is the movement of the tooth to a right position. For a tooth to move into the right position it has to support a set forces by the apparatus developing pressure, that results in the bone resorption in one of the sides next to the tooth's root to create a space for the tooth's movement. In the opposite side, without pressure applied, an empty space is created in which a new bone could grow which fills the place left after the moved tooth (Czochrowska, 2007).

On the side where pressure is applied results into resorption of the bone and on the side without pressure the bone remodeling produces the growth of alveolar bone (Cassafesta, 2007).

To conclude, it is important to point out that orthodontic treatment is often used in periodontological patients for completion of alveolar bone. The success condition is the stability of inflammation. Periodontium must be pathological plaque-free. Incorrect cooperation is the most often complication and reason of fail to succeed on orthodontic treatment. Bacteria present in the periodontal pocket in area of alveolar bone are the reason that new bone development does not take place, in addition the opposite effect occurs: the resorption of the bone. Remodeling of the bone is interrupted by inflammation (Cernochova et al, 2007). By Olympio et al. (2006), the use of dentifrices containing chlorhexidine seems to be effective for the treatment of periodontitis in orthodontic patients.

Conflict of interests

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Funding

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Ethical approval

Does not correspond.

Informed consent

Informed consent was obtained from the patient. The patient provided us by the official permission for the publication of her treatment.

REFERENCES

- Al-Anezi SA.* 2015. The effect of orthodontic bands or tubes upon periodontal status during the initial phase of orthodontic treatment. *Saudi Dental Journal*: 27: 120-24. doi: 10.1016/j.sdentj.2014.11.010.
- Cassafesta V.* 2007. Lecba dospelych s onemocnenim parodontu. *Ortodoncie*, 5: 34-38.
- Czochrowska E.* 2007. Ortodonticka lecba pacientu s chorobami parodontu jako soucast interdisciplinarniho pristupu. *Ortodoncie*, 5: 13-17.
- Cernochova P, Izakovicova-Holla L, Augustin P, Fossman A.* 2007. Vyskyt parodontalnich patogenu u pacientu lecenych fixnim ortodontickym aparatem. *Ortodoncie*, 5: 53-59.
- Gkantidis N, Christou P, Topouzelis N.* 2010. The orthodontic-periodontic interrelationship in integrated treatment challenges: a systematic review. *Journal of Oral Rehabilitation*: 37: 377-90. doi: 10.1111/j.1365-2842.2010.02068.x.
- Gyawali R, Bhattarai B.* 2017. Orthodontic Management in Aggressive Periodontitis. *Int Sch Res Notices*: 8098154. doi: 10.1155/2017/8098154.
- Hellwig E, Klimek J, Attin T.* 2003. *Zachovna stomatologie a parodontologie*. Praha, Grada Publishing a.s., 1-332.
- Kilian J.* 1999. *Prevence ve stomatologii*. Praha 5: Galen, 1-239.
- Kinane JA, Zhao J.* 2012. Porphyromonas gingivalis influences actin degradation within epithelial cells during invasion and apoptosis. *Cellular Microbiology*, 14: 1085-96.
- Kumar V.* 2009. Reaktivni repozice patologicky vyputovaneho zubu pomoci parodontologicke lecby. *Quintessenz*: 69-74.
- Levin L, Einy S, Zigdon H, Aizenbud D, Machtei EE.* 2012. Guidelines for periodontal care and follow-up during orthodontic treatment in adolescents and young adults. *Journal of Applied Oral Science*: 20: 399-403. doi: 10.1590/S1678-77572012000400002.
- Lovasova K, Kluchova D.* 2010. *Topographical anatomy of hardly accessible and clinically significant areas of head*. Kosice: Typopress, 1-178.
- Novackova S, Marek I, Kaminek M, Langova K.* 2007. Tvorba kosti ortodontickym posunem zubu a jeji stabilita v case. *Ortodoncie*, 5: 21-29
- Olympio KP, Bardal P, Bastos JRM, Buzalaf MAR.* 2006. Effectiveness of a chlorhexidine dentifrice in orthodontic patients: a randomized controlled trial. *J Clin Periodontol*: 33:421-426.
- Pagel DA.* 2014. *Die Prothetik im parodontal geschädigten Gebiss*. Spitta Verlag GmbH, 7-9.
- Zetu I, Ogodescu E, Zetu L.* 2011. Interdisciplinarny pristup ku komplexnej ortodontickej liecbe parodontu u dospelych pacientov. *Rev Med Chir Soc Med Nat Lasi*, 4: 1226-6.