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Orthodontic mini-implants as part of an interdisciplinary approach to a patient with advanced periodontal disease – own observations

Ortodontyczne miniimplanty w interdyscyplinarnym leczeniu pacjentów z chorobą przyzębia – obserwacje własne

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ABSTRACT

Periodontal disease is a multibacterial infection causing the host's immune response destructive to the supporting structures of teeth. Many behavioural, genetic or environmental risk factors, such as nicotine dependence, influence the development of periodontal disease. The factors modify the immune response, which leads to more serious consequences of the disease. Currently, orthodontic treatment is more and more often applied as part of an interdisciplinary approach to an adult patient aged over 50.

The aim of the study was to present interdisciplinary treatment, including advanced orthodontic techniques, of an adult patient manifesting advanced periodontal disease.

During the orthodontic treatment for which some subtle forces were applied, no resorption of the burdened teeth was observed as evidenced by the lack of statistically significant differences when the pre-treatment T1 measurement is compared to T2 made just before the appliances were removed.

To sum up, orthodontic techniques can be successfully used in patients with advanced, chronic, general periodontal disease on condition that the patient's oral hygiene is good, the active phase of the periodontal disease is in remission and the patients have their teeth regularly cleaned by a professional.

Keywords: case report, orthodontic treatment, periodontal disease, orthodontics, mini-implants.

STRESZCZENIE

Zapalenie przyzębia jest infekcją wielobakteryjną, która powoduje destrukcyjną odpowiedź układu immunologicznego gospodarza na aparat podtrzymujący uzębienie. Na rozwój choroby przyzębia mają wpływ behawioralne, genetyczne i środowiskowe czynniki ryzyka, takie jak np. nikotynizm. Modyfikują one odpowiedź immunologiczną, co powoduje poważniejsze skutki choroby. W obecnych czasach leczenie ortodontyczne coraz częściej wykorzystywane jest jako część interdyscyplinarnego podejścia do dorosłego pacjenta będącego w grupie po 50 roku życia. Celem pracy było zaprezentowanie interdyscyplinarnego leczenia dorosłej pacjentki z zaawansowaną chorobą przyzębia z zastosowaniem zaawansowanych technik ortodontycznych.

Słowa kluczowe: opis przypadku, leczenie ortodontyczne, choroba przyzębia, ortodoncja, miniimplanty.

Introduction

Periodontal disease is a multibacterial infection causing the host's immune response destructive to

the supporting structures of teeth. Many behavioural, genetic or environmental risk factors, such as nicotine dependence, influence the development

of periodontal disease. The factors modify the immune response, which leads to more serious consequences of the disease.

Currently, orthodontic treatment is more and more often applied as part of an interdisciplinary approach to an adult patient aged over 50. It is a result of increased awareness, as well as aesthetic and functioning demands. Patients in this age group require periodontal therapy, prosthetic rehabilitation and aesthetic improvement. That is why, before proper treatment can be administered, advanced orthodontic techniques are frequently applied. The first information concerning an attempt to stabilize teeth in advanced periodontal disease dates back to 1930 and was included in the systematic literature review by Zasciurinskiene et al. who wrote about the consequences of orthodontic treatment in periodontitis for years from 1965 to 2014 [1]. It was proved that there was no evidence indicating that orthodontic treatment improves or deteriorates the condition of teeth with periodontal disease [2].

Clinical relevance

- extends the current knowledge about the prevalence, diagnosis, clinical view and course of periodontal disease and its modern treatment using bony anchorage (mini-implants),
- combines interdisciplinary periodontal and orthodontic treatment, which is necessary for a patient with an advanced periodontal disease,
- shows the psychological aspects before and after orthodontic treatment and the benefits of improved self-confidence in patients insecure about their smile attractiveness,
- addresses the psychological aspects during orthodontic treatment, especially in patients with many psychological problems,
- indicates that a combination of orthodontic treatment using mini-implants and psychological support could be proposed as a standard protocol.

The aim of the study was the case description and the analysis of the bone tissue of periodontium before and after complex dental therapy.

Case description

A 48-year-old female presented to the outpatient clinic of the Poznan University of Medical Sciences Department of Maxillofacial Orthopaedics and Orthodontics to undergo comprehensive treatment. The patient showed a strong determination to improve the aesthetics of her teeth and smile. In

a clinical examination, the patient was diagnosed with diastemas of approx. 4 mm in the anterior upper jaw and approx. 8 mm in the anterior lower jaw, loss of teeth 16, 26, 35, 45 and 47, horizontally atrophied alveolar bone leading to root exposure, fetor ex ore, massive amounts of supra- and subgingival tartar, tooth mobility (grades I - II). The patient had a 15-year-long history of periodontal disease. Moreover, for 5 years her teeth started to progressively migrate. The patient denied having any co-existing diseases or disorders. To enable the development of an interdisciplinary treatment plan, the impressions were taken to obtain diagnostic casts. Also, a panoramic radiograph (**Figure 1**) and photographs were taken for documentation.

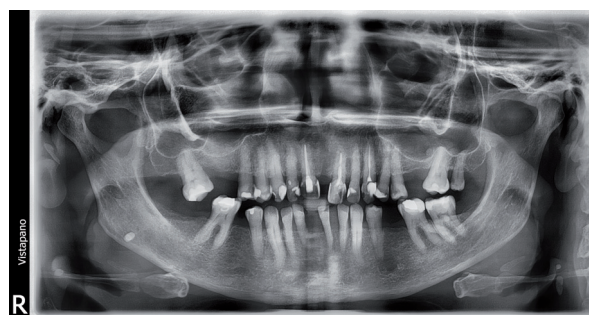


Figure 1. Panoramic radiograph before treatment

The patient was referred for a periodontal consultation to be included in the preparatory treatment. The periodontist diagnosed the patient with chronic, general, advanced periodontal disease. The patient had her teeth professionally cleaned, which included subgingival curettage and scaling. When the active phase of the disease was in remission, based on the gathered data, a team of orthodontists presented a detailed plan of treatment including teeth alignment and space closure involving mild intrusion of lateral teeth using orthodontic mini-implants. When the patient accepted the plan of treatment and gave her written consent to undergo the therapy, a fixed appliance was first placed on the patient's lower dental arch (**Figures 2 and 3**) and after 4 months – on the upper dental arch using low profile metal brackets with 0.22-inch slots. Spaces were closed using lace-back ligature wire, which was accurately activated during every appointment to obtain maximally parallel tooth movement. Before the steel 16x22 inches archwires were applied, self-drilling and self-tapping mini-implants produced by Dentos, sized 6 mm, were placed in the area behind teeth 15 and 25 in the toothless sockets owing to the loss of teeth 16 and 26. The implantation was performed under local anaesthetic infiltration with Citocartin

100, ¼ amp., using a minimally invasive protocol. No pilot drill was used and no soft tissues were cut. A control panoramic radiograph was taken for documentation (**Figure 4**). Mini-implants were immediately burdened with an elastic chain changed every 6 weeks. The cortical anchorage was aimed at the anchored intrusion, which improved the stability and retraction of largely inclined maxillary teeth. During treatment, the patient had her teeth professionally cleaned every 3 months. Following 3-month schedules was biologically justified by an observation that the re-colonisation of pathogenic subgingival bacteria usually lasts from 6 to 8 weeks after gingival pockets have been carefully cleaned. Meeting every 3 months prevents the chronic inflammatory state from aggravation [4]. The treatment was completed after 2 years with very good effects, both aesthetic and functional. Once again, a panoramic radiograph and photographs were taken before the appliances were removed (**Figures 5, 6 and 7**). Both the orthodontists responsible for the applied treatment and the patient herself were satisfied with the final effect. The patient gained not only a more aesthetic smile but also self-confidence. For the aesthetics of the patient's teeth and smile, the patient received removable retainers in the form of thermoplastic plates.



Figure 2. After placing the fixed appliance in the lower dental arch – left profile



Figure 3. After placing the fixed appliance in the lower dental arch – right profile

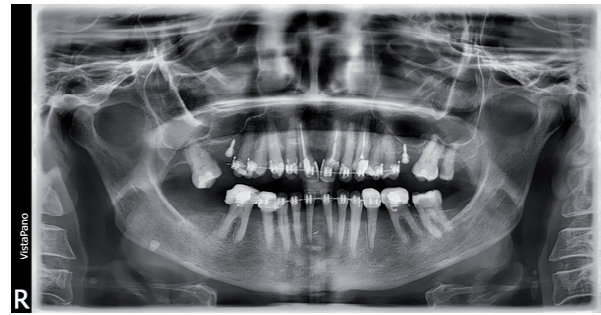


Figure 4. Panoramic radiograph after placing mini-implants

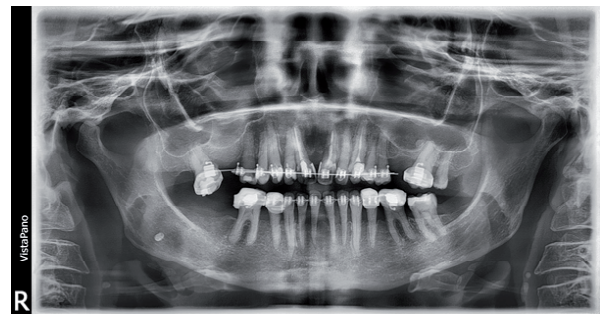


Figure 5. Panoramic radiograph before the removal of both fixed appliances



Figure 6. Final effect post-treatment – left profile



Figure 7. Final effect post-treatment – right profile

Metric analysis of the bone tissue of periodontium

To evaluate the alveolar bone before and after the orthodontic treatment and to assess the impact of intrusion via mini-implants on teeth placement,

a measurement coefficient applied among others by Nelson and Artun was used [4]. The height of the alveolar process was measured using standardized radiographs taken by means of the same device. The distance between the cemento-enamel junction (CEJ) on the mesial of a tooth and the mesial alveolar crest (AC) of the tooth was measured in millimetres (Figure 8). Both panoramic radiographs were taken with the head placed in the same position and using the same device produced by DurrDental. The measurements were made with the aid of a compatible program VistaPro by the same producer. The following teeth were chosen for the measurement: 13, 11, 21, 23, 33, 31, 43, 41. The initial distance in millimetres was labelled as D1, whereas the final distance as D2. The results were presented in Table 1.

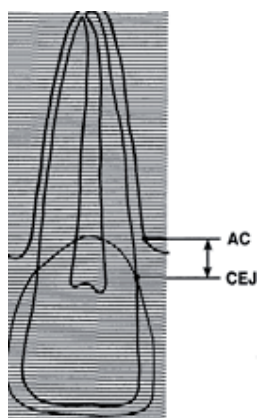


Figure 8. Measuring the height of the alveolar process

Table 1. Distance between the cemento-enamel junction (CEJ) on the mesial of a tooth and the mesial alveolar crest (AC) of the tooth (initial [D1] and final [D2] distance in millimetres)

Tooth	D1 [mm]	D2 [mm]	Difference [mm]
13	2.7	2.0	0.7
11	2.2	1.9	0.3
21	1.7	1.6	0.1
23	2.3	1.6	0.7
33	4	3.8	0.2
31	4.5	4.3	0.2
41	5.1	4.8	0.3
43	3.7	3.1	0.6

To objectify the results, additionally a ratio commonly used in many scientific publications was used [5, 6]. Assuming that the width of a tooth's crown is the value that remained constant during the treatment, the ratio of width (crown) to length (root) was calculated. Based on the gathered data,

the values of the width-length ratio pre- and post-treatment were determined (Figure 9). The width-length ratio was calculated as follows:

$$\text{ratio} = \text{crown's width[mm]} / \text{root's length[mm]}$$

The ratio was supposed to eliminate any possible mistakes resulting from root resorption or tooth inclination, which might have affected the results of the first evaluation. Before [T1] and after [T2] treatment ratios in millimetres were compared in Table 2.

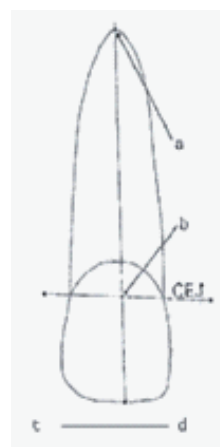


Figure 9. Measuring the ratio of the crown's width to the root's length. A – root apex, B – cemento-enamel junction, long tooth axis

Table 2. Comparison of pre-treatment [T1] and post-treatment [T2] ratios in millimetres

Tooth	T1 [mm]	T2 [mm]	Difference [mm]
13	0.37	0.36	0.01
11	0.51	0.49	0.02
21	0.46	0.45	0.01
23	0.35	0.35	0
33	0.33	0.31	0.02
31	0.31	0.31	0
41	0.31	0.30	0.01
43	0.30	0.30	0

Patient perspective

The patient (woman) presented depressive symptoms associated with the facial traits and the fact that she disliked her smile. She estimated her quality of life as poor and experienced some difficulties in finding a new job. The patient's trouble with looking for work was directly connected to the negative perception of her face and teeth. She estimated the treatment as extremely effective. The depressive symptoms disappeared shortly after the treatment.

Discussion

The variety of patients willing to undergo orthodontic treatment is large. Many patients are over 40 years old. Currently, in the United States more than 20% of orthodontic patients are adults and undoubtedly the number is going to grow as a result of increasing average population age. In their epidemiological studies, Ramfjord et al. showed that over 75% of adults aged above 40 suffer from periodontal disease [7]. Published papers also emphasize the fact that periodontal diseases may negatively affect the patient's well-being and in particular his or her oral health-related quality of life (OHRQoL). The OHRQoL evaluation is based on patient reported outcomes showing the patient's subjective feelings about symptoms such as pain intensity and general discomfort, functional impairments (e.g. affected speech or mastication), physical disability, mental state or disease impact on his or her social relationships. The research done by Zanatta et al. is particularly interesting [8]. The study was performed on a relatively large group (>300 subjects) of adult patients manifesting no co-existing diseases or disorders who underwent long-term orthodontic treatment owing to the advanced periodontal disease. It was observed that factors such as the rate of gingival swelling or enlargement and orthodontic treatment duration negatively influenced patients' oral health-related quality of life. No significant correlation between OHRQoL and gender was seen. The study by Zachrisson et al. conducted on a group of 51 adolescent patients, mean age 16, showed that also in this age group periodontal connective tissue was slightly reduced when a fixed appliance was used for orthodontic treatment [10]. The results gathered in Table 1 show that the fixed appliance used for our patient's treatment caused no significant changes in the height of the alveolar crest when compared to CEJ. The greatest improvement in teeth placement was observed for teeth 13 and 23. Intrusive forces were applied to these teeth using cortical anchorage. Some experimental studies on animals were published, including those aimed at examining orthodontic movement in dogs. The scientists came to the conclusion that healthy and inflamed periodontal tissues react differently. When the periodontium was reduced but healthy, the orthodontic movement led to no further bone tissue reduction. However, when there was an inflammatory state, the bony defects were significant [3].

During the orthodontic treatment for which some subtle forces were applied, no resorption of

the burdened teeth was observed as evidenced by the lack of statistically significant differences when the pre-treatment T1 measurement is compared to T2 made just before the appliances were removed.

Conclusions

1. Orthodontic techniques can be successfully used in patients with advanced, chronic, general periodontal disease on condition that the patient's oral hygiene is good, the active phase of the periodontal disease is in remission and the patient has their teeth regularly cleaned by a professional.
2. It should be emphasized that it is key to implement precise and advanced biomechanical techniques based on orthodontic mini-implants usage.

Oświadczenia

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