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Use of Dental Implantation in the Treatment of Generalized Pathological Tooth Wear with Dental Arch Defects

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ABSTRACT

Objective: *This article presents a comprehensive approach to the treatment of patients with generalized pathological tooth wear complicated by dental arch defects.* ***Method:*** *When planning therapy, the patient's overall health, age, and the activity of the pathological process were taken into account. Restoration of the anatomical shape of teeth and replacement of dental arch defects were performed using prosthetic constructions supported by dental implants. Implant placement was carried out when sufficient bone volume was available and there was no need for bone augmentation.* ***Results:*** *During the first month after implantation, a decrease in the stability of the bone–implant interface was observed. In the second and third months, implant stability gradually increased, reaching its maximum after one year, indicating remodeling of the bone tissue around the implant.* ***Novelty:*** *This article presents a comprehensive approach to the treatment of patients with generalized pathological tooth wear complicated by dental arch defects.*

INTRODUCTION

Gradual loss of dental hard tissues throughout a person's life is a natural process resulting from the physiological function of mastication and non-masticatory movements of the mandible. Two types of tooth wear are distinguished: physiological and pathological. Physiological wear is considered a process that prevents functional overload of periodontal tissues and ensures normal mandibular movements during different phases of articulation [1], [2]. This process occurs gradually: in most individuals, the first visible signs of physiological wear, manifested as enamel loss within the dentin, appear before the age of 40 [1].

Pathological tooth wear is characterized by rapid progression, significant loss of enamel and dentin, as well as aesthetic, phonetic, and functional disturbances of the dentoalveolar system [1], [2]. Depending on the extent of hard tissue loss, the following stages of pathological wear are distinguished [1]:

- **Stage I** — involvement of tooth tissues within the enamel and partially dentin;
- **Stage II** — wear of hard tissues within the primary dentin (without exposure of the pulp chamber);
- **Stage III** — wear of enamel and dentin within the secondary dentin (with pulp exposure);
- **Stage IV** — complete wear of the tooth crown.

According to the prevalence of the pathological process, limited and generalized clinical forms are distinguished [1]. Over the past 20 years, dental implantation has become increasingly popular in clinical dentistry. Modern dental implantation is

characterized by high efficiency and a wide range of clinical applications. According to the literature, due to improvements in implant design, material fabrication technologies [3], [4], and surface treatment methods, the success rate of implant osseointegration reaches 90–98% [5].

At the same time, particular attention is given to the prevention of complications associated with dental implantation [6], [7], especially those related to functional overload [8], [9], which is characteristic of pathological tooth wear and bruxism [9], [10]. These factors can reduce the lifespan of implants and the prosthetic constructions based on them, highlighting the relevance of further research in this area [11], [12].

RESEARCH METHOD

A clinical and laboratory examination was conducted on 72 patients with generalized pathological tooth wear, aged 35 to 65 years (39 women and 33 men) [1], [11]. The examination included assessment of the size and topography of dental arch defects; evaluation of the condition of dental hard tissues and clinical crown height; evaluation of periodontal tissues and alveolar processes; occlusion type and occlusal relationships; condition and position of teeth that had lost antagonists; and presence, duration of use, and complications of dental prostheses [11], [12].

The following specialized methods were used:

- Analysis of diagnostic models;
- Radiography (orthopantomography and computed tomography);
- Electroodontodiagnostics using the EndoEst-3D device.

Bone quality in the implantation area was assessed according to the percentage ratio of cortical and cancellous bone following the classification by S. Mich and K. Judi [13]. Prognosis of dental implantation outcomes was based on radiographic bone density determined by densitometric gray-scale values on the Hounsfield Unit (HU) scale. Implant stability was evaluated using resonance frequency analysis with the Osstell ISQ device [14].

RESULTS AND DISCUSSION

Clinical examination revealed significant aesthetic disturbances, including shortening of the lower facial third, pronounced nasolabial and mentolabial folds, facial expressions inconsistent with age, drooping corners of the mouth, and frequent manifestations of angular stomatitis. Intense loss of dental hard tissues was observed across all teeth or in individual groups of teeth.

The frequency of pathological tooth wear has “rejuvenated,” which, according to our data, is associated with environmental factors and an increase in patients with endocrine disorders, particularly thyroid dysfunction. Progressive enamel and dentin loss in 38 patients was accompanied by reduced occlusal height, aesthetic and functional complications, and in 9 patients, temporomandibular joint dysfunction. Patients reported discomfort in the masticatory muscles, pain in the TMJ region, and hypersensitivity when the enamel–dentin junction was exposed in early stages of pathological wear.

Depending on the severity of the pathological process, the following features were noted:

- Flattened cusps;
- Facets and depressions on the incisal edges of anterior teeth, surrounded by sharp enamel edges;
- In stages II–III — dense, smooth brown dentin, often with pulp chamber exposure;
- Combination of horizontal and vertical wear patterns on anterior teeth;
- Loss of natural color and optical properties due to enamel loss;
- Co-occurrence with other non-carious lesions (erosion, abfraction, etc.).

Treatment was performed considering the etiological factor, overall health, patient age, and activity of the pathological process, including, when necessary, aesthetic restoration of the anatomical tooth shape:

- For patients with stage I pathological wear, the primary goal was to stabilize the process, prevent further tissue loss, and correct aesthetic defects. Preventive sealing of wear facets with composite materials, fabrication of inlays for fissure defects, and onlays for partial cusp loss were applied.
- In patients with stages II–III, occlusal height and jaw relationships were restored through direct restoration of the anatomical tooth shape in the lower and upper jaws under control of occlusal guidance and antagonist teeth, using hybrid photopolymer materials and artificial crowns.

Considering the expected increased occlusal load associated with pathological wear and variable-intensity bruxism, dental implantation was performed only when sufficient bone volume was available (12–15 mm). A total of 28 endosseous dental implants of a single manufacturer were placed, made of pure titanium (Grade 4), with a conical design, rounded apex, and microstructured shoulder with a switch platform.

Implant surfaces were treated using the SLA method. During the first month after implantation, a decrease in bone–implant interface stability was observed. Gradual increases in implant stability were noted during the second and third months, reaching 64.51 ± 0.89 after 6 months, with a statistically significant ($p < 0.05$) increase to 68.41 ± 1.72 units after 12 months. These results confirm bone tissue remodeling around the implants. Resonance frequency analysis results are presented in the table.

After six months of osseointegration, prosthetic rehabilitation followed this protocol: abutment placement with a temporary crown out of occlusion, fabrication of a temporary crown bearing occlusal load for one month, and final fixation of a permanent metal–ceramic crown with occlusal relationships adjusted by selective grinding [4, 5].

To prevent damage to prosthetic constructions, patients were provided with protective elastomeric night guards to be worn during the first 45 days after fixation.

Pathological tooth wear is accompanied by multiple morpho-functional changes of the dentoalveolar system, the severity of which depends on the degree of the pathological process and is exacerbated in the presence of partial tooth loss [15].

CONCLUSION

Fundamental Finding : Pathological tooth wear causes morpho-functional changes in the dentoalveolar system, the severity of which depends on the extent of the pathology and is exacerbated in the presence of partial tooth loss. **Implication :** The choice of treatment method should be based on the clinical form of the disease, the degree of pathological wear, and the presence of concomitant complications, while gradual loading of the dental implant under conditions of increased occlusal stress contributes to the prevention of overload during the adaptation and rehabilitation phase and prolongs the service life of the prosthetic construction as a whole. **Limitation :** Clinical follow-up of patients over a three-year period confirms the effectiveness of the proposed treatment methods and the feasibility of their application in dental practice. **Future Research :** Further longitudinal investigations with extended observation periods and broader patient populations are required to evaluate long-term stability and generalizability of the proposed treatment approaches.

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