Protet Stomatol, 2022; 72(1):33-39
DOI: 10.5114/ps/147498

Reimplantation, bone augmentation and implantation procedures for maxillary canines. A long-term follow-up: A clinical report

Replantacja, augmentacja i implantacja w miejscu kłów szczęki. Wieloletnie obserwacje: opis przypadku

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KEY WORDS:
reimplantation, bone augmentation, canine implantation

HASŁA INDEKSOWE:
reimplantacja, augmentacja, implantacja w miejscu kłów

Summary

This case report describes a long-term follow-up of the treatment using two maxillary single tooth implant-supported restoration in canine region placed after unsuccessful reimplantation and successful bone augmentation procedures. In spite of the complicated procedures presented, a good long-term clinical result was achieved.

Streszczenie

Przedstawiono opis przypadku z długoterminową obserwacją leczenia z zastosowaniem odbudowy protetycznej na implantach w szczęce w okolicy kłów, umieszczonych w augmentowanej kości po nieudanej reimplantacji. Pomimo wdrożenia skomplikowanych procedur osiągnięto dobry odległy wynik kliniczny.

Introduction

The impacted permanent teeth other than third molars usually involve canines (2% of the population).[1] Orthodontic treatment is most frequently applied in an attempt to restore the proper position of impacted teeth. This approach is supported by a repeated surgical procedure to expose the tooth or to facilitate the placement of attachment. However, in some locations of impacted teeth precludes their positioning into the arch, which could result in the distortion of surrounding tissue structures. Therefore, the only solution would be extraction followed by the orthodontic or orthodontic-prosthetic treatment. In such cases autotransplantation is an alternative technique of treatment.[2-9]

Autotransplantation is the most common procedure applied after traumas within the anterior maxillary region and its application to restore missing teeth (hypodontia) with other tooth germs is still growing.[8] When orthodontics

or autotransplantation fails to correct tooth defects related to impaction, implant techniques may be used to restore edentulous areas.

The aim this clinical report is a long-term follow-up (more than 20 years) for reimplantation, bone augmentation, and implantation in the maxillary canines areas. Previous results were published in the Journal of Prosthetic Dentistry.[10]

Clinical report

Rehabilitation of a female patient started in the Department of Prosthodontics in January 1994. The patient presented at the Department three months after a bilateral reimplantation of two impacted canines after earlier unsuccessful attempt to obtain their optimal position by applying the orthodontic treatment. The reimplanted canines were splinted with composite to the adjacent teeth. The surrounding periodontal tissues had probing depths that extended to the apex of the roots (Fig. 1). Panoramic radiographic examination demonstrated the lack of bone around the canines. Unsuccessful teeth autotransplantation was the reason for teeth extraction and the patient had an immediate interim removable partial denture (RPD) to replace the teeth.

Postextraction healing proceeded uneventfully, but six months after extraction

Fig. 1. Bone resorption around reimplanted canines.

Fig. 2. Significant bone resorption in the area of extracted canines.

a panoramic radiograph revealed a significant amount of bone resorption (Fig. 2). Then, the bone grafting procedures were performed (July 1994). Autogenous bone, removed from iliac crest, was surgically implanted in the maxillary canine sites bilaterally. Prosthodontic treatment included the fabrication of a clasp-less metal base RPD.

Fourteen months later the canine site augmentation, two hydroxyapatite-coated titanium dental implants, 3.5mm in diameter and 15mm in length (TBR, Sudimplant, Toulouse, France) were placed in the maxilla of the patient who was then18 years of age.

Six months after implant placement, periapical and panoramic radiography revealed adequate osseointegration and implant location. One month after the second-stage surgery, the implant-supported restorations were fabricated, metal ceramic complete crowns (Vita VMK porcelain, Vita, Bad Sackingen, Germany). The implant-supported crowns were cemented using zinc phosphate cement (Harvard, Richter&Hoffmann, Harvard Dental GmbH, Berlin, Germany) in March 1996 (Fig. 3). The group function occlusal scheme was selected, without canine guidance and loading.

Implant mobility was subsequently measured over 20 years, digitally and using the Periotest device (Periotest, Medizintechnik Gilden,

Bensheim, Germany). One year after implant placement and restoration, a slight amount of resorption was observed around the neck of the implants (Fig. 4). The greatest amount of resorption occurred 2 years after implant placement (Fig. 5). After the next 6 years the resorption appeared to be minimal (Fig. 6). Periapical and panoramic radiography 20 years after implants placement revealed adequate osseointegration and implant location (Figs. 7, 8). This means that after six and following 14 years of observation the bone resorption was minimal.

In 1996 periotest readings for the adjacent teeth were +9 for the maxillary left central incisor, and +11 for the maxillary left lateral incisor, +9 for the maxillary right central incisor, and +20 for the maxillary left lateral incisor. The periotest readings for the right and left canines were +6 and +5 in 1996, +5 and +7 in 1999, and +4 and +5 in 2002, respectively. The periotest readings for the adjacent teeth were the same for the whole period of observation.

After 10 years periotest readings for the right and the left canines were +0.8 and +0.6 respectively, and for the adjacent teeth were +0.8 for the maxillary left central incisor, +2.4 for the maxillary left lateral incisor, +1.2 for the maxillary right central incisor, and +1.5 for the maxillary right lateral incisor.

Performed during this period periodontal examination with a probe (Florida Probe, Florida Probe Corp., Gainesville, Fla) was used to determine the gingival status of the tissue in six sites around the two implants and the teeth adjacent to the implants, premolars and incisors bilaterally. Three of the 36 sides (8%) demonstrated an increase depth in probing up

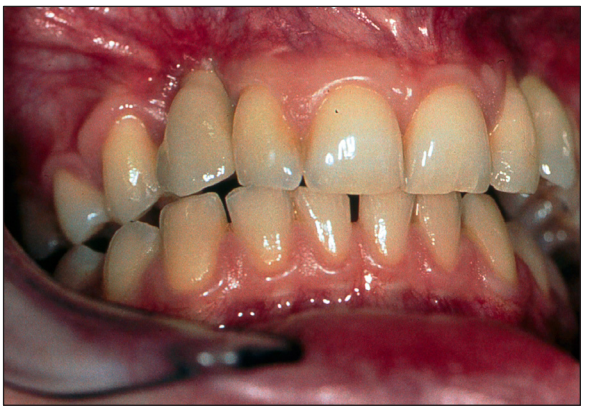

Fig. 3. Definitive restorations.

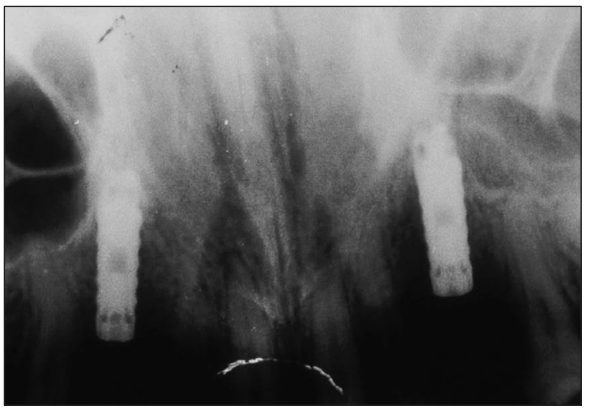

Fig. 4. Bone level 1 year after implants placement.

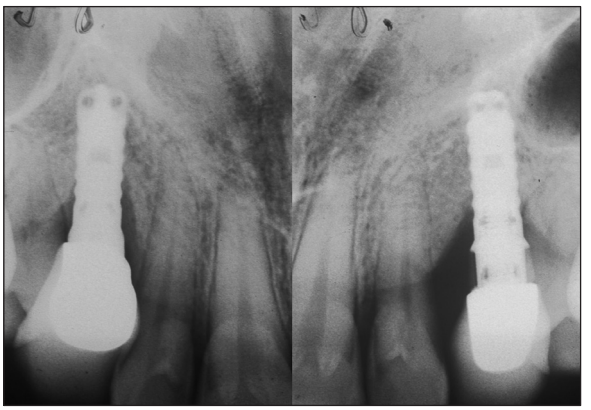

Fig. 5. Bone level 2 years after implants placement.

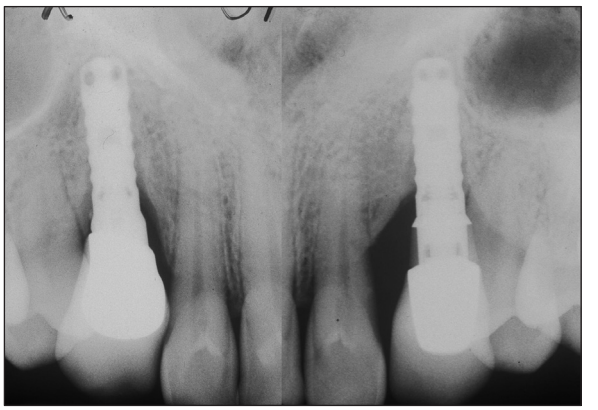

Fig. 6. Bone level 6 years after implants placement.

Fig. 7. Panoramic image. The condition after more than 20 years of observation.

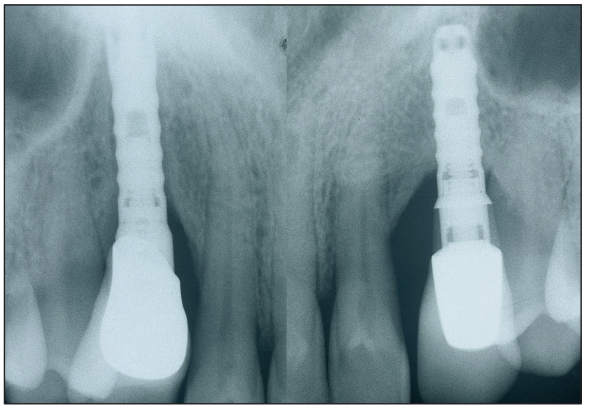

Fig. 8. Periapical radiography – bone level after more than 20 years of implant placement in augmented bone.

to 3mm (22% – 2mm; 70% – 1mm). A lower number of deep gingival pockets was observed compared to the 2002 results, where the results were as follows: three of the 36 sides (8%) demonstrated an increase depth in probing up to 4mm (22% – 4mm; 70% – 2mm).

Over 20 years of observation pathologic wear within lateral teeth in the maxilla, wear of the anterior upper incisal edges, gingival recession within the site of lateral incisors in the maxilla and slight recession at upper first premolars were found. The static occlusion analysis revealed multipoint contacts within the lateral and anterior teeth in the Class II division 2 (distocclusion with retruded maxillary central incisors). The assessment of dynamic occlusion displayed the guidance on incisiors during both lateral movements and protrusion with complete disclusion of lateral teeth. No dental calculus formation was observed.

Discussion

A long-term good clinical result was achieved in the patient with impacted canines, after unsuccessful reimplantation followed by tooth extraction, necessary bone augmentation and then the implementation of implantation procedures. Over 20 years the control examinations showed a satisfactory outcome of the applied treatment from the functional and esthetic points of view. Unfortunately, the unsuccessful reimplantation with complications, leading to the extraction of canines, has become an inherent part of findings reported by other authors indicating potential risk of complications in this type of cases (4, 5). The current literature data on a possible evaluation of periodontal biotype[11] or tissue regeneration[12,13] allow, first of all, a more precise classification for reimplantation treatment or make it easier to achieve effective reconstruction of lost tissues. Moreover, a transplanted tooth diminishes the extent of newly formed alveolar bone.[9]

Implant placement in augmented bone indicates a positive outcome of this type of procedures.[14,15] The survival rate of implants inserted in autogenous bone blocks, reported in the literature, ranges from 73 to 100%. In a 12-16-year observation period these data falls between 73% and 86%. However, in the literature there is only few reports allowing for a comparative evaluation of the dental implant survival rate in the bone augmented and without augmentation. A five-year implant survival without augmentation is observed in 97.2% [15] while a 10-year survival in 94.6% with bone edge atrophy of 1.3mm, on average.[16] In the

presented clinical case the most extensive bone atrophy was observed two years after implant insertion in the augmented bone. Then atrophy was reduced to a minimum. Reports in literature indicate that failures occur significantly more frequently in the graft implant group of patients than in the nongraft group in the incisor region, but not in the canine, premolar, or molar regions,[17] which is in line with our observations.

In our patient the mode of implant loading in the static and dynamic occlusion was implemented according to general recommendations.[18,19] The described implants were not loaded in the teeth maximum intercuspation, like in the case of patient's own teeth, and during lateral movements the group and not canine guidance was implemented.[10] This was in line with recommendations concerning the implant occlusion, in which it is indicated that canine guidance may be a risk factor for screw loosening.[20] The reason for bone atrophy between implants and lateral incisors and a significant gingival recession in the region of lateral incisors in presented case are rather interpreted as overloading of lateral incisors during excursive movements in the distocclusion with retrusion. Presented in this paper results do not indicate implant autogenous resorption owing to successful implant stabilization over the observation period (+6, +5 and +0.8, +0.6, respectively).

Bearing in mind the canine augmentation and implantation, also the cases with no bone augmentation, it is worth considering the guidance on first premolars, leaving the guidance in the site of upper lateral incisors during protrusion only. Currently, this occlusion scheme has been planned to unload anterior teeth and protect lateral teeth from wear and gingival recession. Moreover, the decrease in the part of coronal lateral teeth due to wear (degree I according to Brock classification) was found, which additionally loaded anterior teeth.

On control examination the static and dynamic occlusion was analysed with respect to central relation in temporomandibular joints (TMJ) through determining the reference position optimal for TMJ, its registration and transfer to an articulator. Occlusion assessment, clinical and in the articulator, allowed for planning correction of the occlusal area in the region of lateral teeth and the guidance in the sites of anterior teeth and first premolars. Diagnostic waxing and then occlusion reconstruction with use of composites was scheduled due to low invasive approach to vital teeth on the one hand and a small site of reconstruction on the other. The production of the upper relaxation Michigan occlusal splint is also planned to assure an even distribution of occlusal loads during grinding and clenching of teeth at night. In such cases it is also important to pay attention to behaviours related to the mandible position during a day, e.g., maintaining teeth apart, food biting, bilateral mastication and so forth. These assumptions result from the current clinical condition of the patient and literature reviews, which indicates that there are no explicit recommendations for the type of occlusion on implants, underlying the reconstruction dissimilarities and loads in the maxillae and mandible.[18] The present clinical state of the patient indicates that her mastication cycle (pattern of movement, axigraphy) should be analysed to exclude a protruded position of the mandible during lateral movements and loading of incisors. To confirm the rationale for the determined procedures we can refer to the findings reported by *Carlsson's* et al. that the principles applied in conventional prosthodontics can, in general, be also used for implant prostheses.[21] The observations gathered during the implementation of this type of procedures will be the subject of subsequent reports on this study case.

Summary

The lack of therapeutic effectiveness of the applied reimplantation procedures forced the implementation of bone augmentation, which enabled the next stage of treatment. The long-term of observations of implantation in the augmented bone (over 20 years) confirm the effectiveness of a multi-stage, complicated procedure and the use of subsequent procedures in order to achieve an appropriate therapeutic effect.

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Zaakceptowano do druku: 4.03.2022 r.

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