Analysis of immediate implant placement tactics for maxilla central incisors replacement

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Abstract

Relevance. Immediate implant placement with immediate temporisation is method of choice in case of central incisors extractions. In nowadays there are many protocols aimed on optimisation of the immediate prosthetic result. Some of them are based on using CAD/CAM technology, others stress the importance of peri-implant grafting procedures as a means of clinical success. The aim of the study is to analyse tactic of treatment in cases of immediate implant prosthetic replacement of maxilla central incisors using assessment of clinical example and elaboration of the optimal treatment option.

Materials and methods. We conducted the evaluation of the 54 year old male patient with the use of clinical and paraclinical examination methods (OPG, CBCT). Implant placement in the position of the teeth 1.1, 2.1 was performed utilising new NobelParallel Conical Connection TiUltra (NobelBiocare, USA) 4.3*13 mm followed by implant supported Procera Zirconia prosthesis. We used international indices PES and it's modification WES for the assessment of the achieved results.

Results. The final result received following scores: PES index = 7, WES index = 8.

Conclusion. Choice of implant design is a major influencing factor on the immediate implant placement prognosis. Utilising Nobel Active implant in the described clinical situation combining its placement with grafting of the connective tissue taken from the tuberosity area led to the decrease in total treatment time and achievement of the superior esthetic and functional result.

Key words: immediate implant prosthetic replacement, esthetic zone, implant placement with immediate loading, immediate implant loading, CBCT, socket preservation

For citation: Rozov, R.A., Trezubov, V.N., Gerasimov, A.B., Fedotova, A.A., Gamborena, I. Analysis of immediate implant placement tactics for maxilla central incisors replacement. Parodontologiya.2021;26(1):33-37. (in Russ.) https://doi.org/10.33925/1683-3759-2021-26-1-33-37.

INTRODUCTION

Immediate implant placement with immediate loading is the method of choice in case of replacing severely compromised central incisors. This approach allows to avoid handicapped feeling of the patient due to quick restoring of central incisors function and favorably affects the preservation of the three-dimensional architecture of the gingival papillae, which enables to get long term stable aesthetic result. At the same time, success of the treatment depends on many factors and their combination: the presence and size of chronic infection periperiapical lesion of the extracted tooth, preservation of the vestibular compact bone plate and its marginal level, dimensions of the incisive canal lumen, soft tissue volume and quality surrounding the tooth, as well as bone anatomy and density. Based on CBCT data Soumya P (2019) showed a high variability of the incisive canal's normal anatomy, which varies with age, and should be evaluated (especially the thin anterior wall), as it is one of the influencing factors for implant placement planning and prognosis [1]. Tözüm TF (2011) demonstrated that only in 40.73% of cases the shape of an incisive canal is cylindrical. The type of implant, its dimensions, as well as primary stability values during placement, significantly affect the results of implant treatment. In the clinical practice we can see various approaches to immediate implant placement. Weigl P (2016) reviewed 17 studies dedicated to the impact of immediate implantation on soft tissues and peri-implant bone. In these studies, 97.8% of implants were not loaded after placement that resulted in a high implant survival rate (98.25%) [2]. In a big review paper Chen ST (2014) analyzes quantitative parameters of the aesthetic results of immediate implant placement and the effect of peri-implant tissue management [4]. Chen has shown that due to the risk of gingival recession we have to continue the search for optimal clinical tactics and combine of grafting procedures with immediate implant placement and loading.

Buser D (2013) evaluated the 5- and 9-year long term results of early implant placement combined with soft tissue grafting and reported about high scores of PES index and stable condition of buccal cortical bone in 95% of cases, the thickness of which based on CBCT data was on average 2.2 mm.

Today there are many methods aimed at optimizing the outcomes of immediate implant placement. Some of them involve substantial use of CAD/CAM technology; others focus on special techniques of peri-implant tissue management as the core of clinical success [3]. The lack of a single standard of immediate implant placement for central incisors replacement, as well as the multifactorial nature of achieving an aesthetic and functional optimum, led us to the detailed review of the result of the clinical case where "routine" treatment was performed . The aim was to analysis the errors in medical tactics and work out solutions for achieving optimal result. We asked Iñaki Gamborena to help us with detailed analysis of this clinical example.

MATERIALS AND METHODS

We performed examination of the 54-year-old male using clinical and paraclinical methods, including radiological (panoramic X-ray, CBCT) [Fig. 1]. Patient was diagnosed with a crown fracture of the tooth 11 and severe clinical crown destruction of the endodontically treated teeth 1.1 and 2.1. On the CBCT(Planmeca Promax 3D Mid with Romexis ver. 4.5.1) we noted atypical anatomy of the incisive canal with wide lumen, asymmetric structure with a shift to the right. Teeth 1.1 and 2.1 were extracted under local infiltration anesthesia with socket preservation using tricalcium phosphate granules and free full thickness grafts harvested from maxillary tuberosity using a tissue punch [Fig. 2, 3]. Placement of NobelParallel CC 4,3*15 implants failed due to inadequate primary stability, because of lack of a part of the distal socket wall of tooth 1.1 being at the same time anterior wall of incisive canal.

To restore function as soon as possible , we produced adhesive porcelain fused to gold alloy bridge. To ensure good fit on the natural teeth, a digital framework design was made using Exocad 2.2 program, the framework was milled in wax (CAD / CAM), with its subsequent vacuum casting. The bridge was fixed on the teeth with on a self-adhesive cement RelyX U200 (3M, Germany); the palatal surface of the teeth was sand-blasted with aluminium oxide 25 mm particles [Fig. 4]. Control CBCT after 4 months showed incomplete bone formation in sockets of teeth 11 and 21.

Control CBCT was performed 6 months after teeth extraction with immediate alveoloplasty [Fig. 5]. The bridge was successfully removed using the CORONAflex 2005 handpiece (KaVo, Germany) [Fig. 6, 7]. After verifying the sufficient volume and quality of the bone, new NobelParallel Conical Connection TiUltra implants (NobelBiocare, USA) 4.3*13 were placed in the position of 11 and 21 reaching 30 Ncm of torque [Fig. 8]. The wound was sutured; and adhesive bridge was fixed back. Control CBCT was performed 4 months after implant placement. The second step of prosthetic rehabilitation involved placement of healing abutments, that were replaced after 24 hours with provisional acrylic splinted crowns [Fig. 9, 10].

Six weeks later we mede an impression using our modification of the open tray technique (RUS patent No. 2683907, 2019); we decided to make two zirconia implant-supported restorations with titanium base using the Procera technology.

The stone model was scanned in NobelProcera 2G Scanner using conoscopic holography, and later processed in NobelProcera Software v3.1. Zirconia implant-supported restorations were partially veneered from the buccal side for greater structural strength, and were fixed with a torque of 35 Ncm [Fig. 11-14]. To evaluate the results, we used the international PES index (pink esthetic score), its modified version, for evaluation of the results of implant-supported rehabilitation of the anterior teeth (modified PES), and WES (white esthetic score) [4].

RESULTS AND DISCUSSION

The result of the rehabilitation presented in the summary from the patient's medical record cannot be called fully successful, since it was not possible to perform immediate implant placement with immediate loading. The final restoration was evaluated as PES=7 (modified PES=4), WES=8 [Fig.15, 16]. There should be performed a detailed clinical analysis of the medical tactics which led to this result. We attempted to place NobelParallel CC implants, featuring active thread only in the apical zone. At the same time, there are well-known conventional self-tapping implants like NobelActive. A retrospective study by Saridakis SK presents seven-year results of immediate placement of 207 NobelActive implants and confirms the high potential of such implants even in patients with local and general risk factors. The overall survival rate was 91.5%, and 76.5% in the group with risk factors [5]. Arnhart C performed a comparative multicenter study in 12 clinics, in which NobelReplace tapered groovy and NobelActive tapered implants were used for immediate loading; survival rate after 3 years was at a similarly high level of 95.7% [6]. At the same time, Esposito M recently reviewed 81 randomized controlled trials dedicated to the relation of missing tooth replacement results and the type of implant, and showed the absence of a significant difference between the types of implants. The only statistically significant difference was the greater loss of peri-implant bone in Nobel Speedy Groovy implants compared to NobelActive implants [7].

Bell C studied protocol of immediate and delayed implant placement using such implants and showed high success rates of 92.9% and 96.7%, respectively. Thus, with this evidence we consider NobelActive the optimal implant.

Cosyn J proposes to perform immediate placement using such implants in order to achieve an optimal result by performing a flapless tooth extraction and immediate alveoloplasty. Following the approach for 12 months in the clinical practice we managed to reach a high PES index value of 12.15 in patients with a thick biotype and intact buccal cortical bone, which was comparable to its initial values of PES = 11.86[8].

In our opinion, the optimal solution for such patients would be to use of NobelActive implants, preferably in smaller diameter of 3,5*15, and to perform immediate implant placement with immediate loading. Inaki Gamborena technique should be used for better outcomes in case of immediate implant placement. The technique involves immediate implant placement with alveoloplasty and peri-implant soft tissue management with a free de-epithelialized connective tissue graft harvested from the area of maxillary tuberosity[9]. In a group of 30 patients van Nimwegen WG performed immediate implant placement with soft tissue management, placing autograft only buccally. 12 months later test group showed significantly better results in the middle buccal zone contour of peri-implant tissues [+0.20 ± 0.70 mm (test group) and -0.48 ± 1.13 mm (control)]. In a retrospective study of immediate implant placement in patients with soft tissue recession with the follow-up period of one to eight years, Noelken R showed that the best results were achieved in immediate implant placement with simultaneous connective tissue grafting. Zucchelli G also considers the use of autografts (especially ones harvested from the area of maxillary tuberosity) to be the optimal solution for such operations [10].

In our case there was an opportunity, which we did not fulfill, to optimize the volume and condition of peri-implant tissues. During the second stage of treatment (re-entry) we should have performed tissue management with connective tissue graft harvested from the area of maxillary tuberosity and positioning of the grafted tissues on the alveolar ridge, followed by placing extra slim healing abutment (Slim Healing Abutments, NobelBiocare). Having fairly evaluated the result of the previous clinical step we can conclude that we should have performed such tissue management at the time of implant placement with fixation of temporary crowns, since the values of the primary stability made it possible to perform immediate implant placement (provided that the two implants are splinted by a temporary structure and left out of occlusion). In addition, it was possible to fix zirconia abutments and manage soft tissues around them. However, this approach does not provide significant clinical benefits, as shown by Esposito M, and requires cementing the crowns.

Special attention should be paid to the position of the frenulum of the upper lip. Clinical photographs show that frenulum is attached quite coronally, which is caused by the lack of the gingival papilla between teeth 11 and 21. The frenulum is well vascularized, therefore, it is contraindicated to excise the frenulum in this case, since it can lead to gum recession due to poor vascularisation of the adjacent tissues.

CONCLUSION

The choice of implant has a significant impact on the immediate implant placement prognosis, as well as the rational tactics that lead to an optimal result. The use of the Nobel Active implant in this clinical case combined with free connective tissue graft harvested from the area of maxillary tuberosity allowed to reduce the treatment time by half and achieve better aesthetic and functional results. Clinical analysis and extracts from the patient's medical record demonstrate the importance of customised approach to treatment. In our opinion, it is necessary to provide the patient with the best opportunities available in modern clinical practice to achieve maximum results in the shortest possible time.

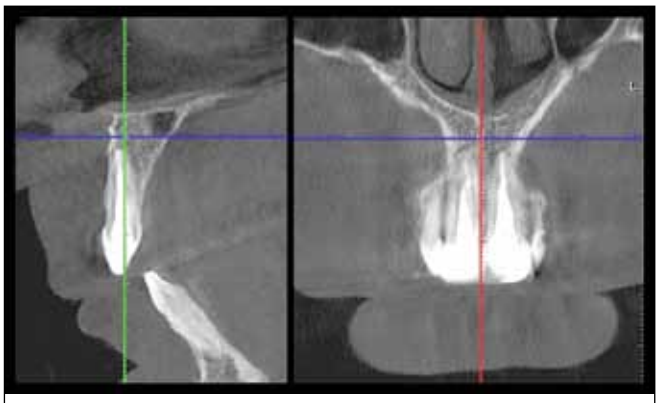

Fig. 1. **Initial CBCT of the patient: intact buccal cortical plate**

Fig. 2. **Intraoral picture of the socket preservation result of teeth 1.1, 2.1**

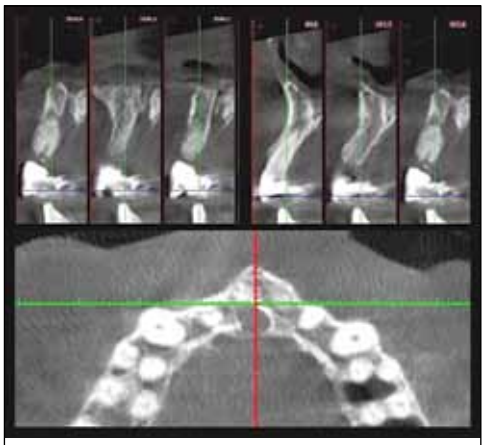

Fig. 3. **CBCT analyzes after the extraction of teeth 1.1, 2.1 with alveoloplasty: note the asymmetrical form the wide incisal canal**

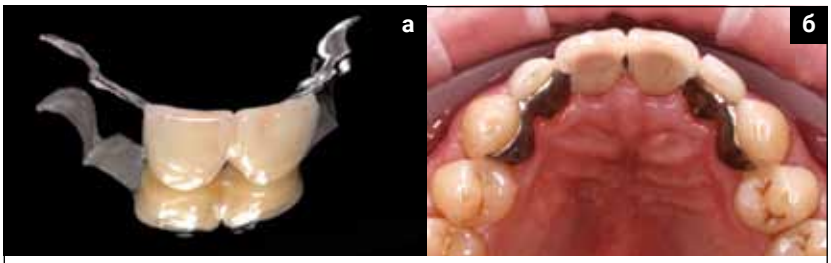

Fig. 4. **Adhesive bonded PFM bridge with gold alloy framework: a) ready to be fixed; b) fixed on the teeth**

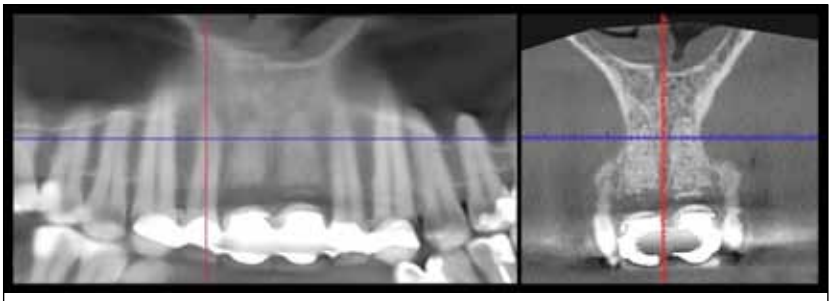

Fig. 5. **CBCT analyzes 6 months after teeth extraction with alveoloplasty: favorable conditions for implant placement**

Fig. 6. **Pneumatic crown removal device CORONflex**

Fig. 7. **Soft tissues healing 6 months after extraction of the teeth 1.1, 2.1**

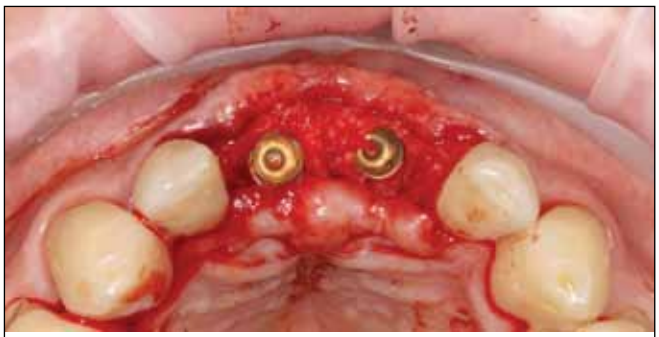

Fig. 8. **Pictures taken during surgery: only horizontal incision was made Implants NobelParallel Conical Connection (NobelBiocare, USA) are inserted. Size 4.3x13 mm, Torque value 30 N/cm**

Fig. 9. **2 horizontal incisions were made for placement of healing abutment. Near the implant 1.1 vertical releasing incision was performed mistakenly**

Fig. 10. **Peri-implant tissues condition around temporary acrylic screw retained bridge 2 months after its fixation. Missing interdental papilla, good quality of keratinized mucosa, wide upper lip frenulum**

Fig. 11. **Healthy appearance of peri-implant tissues after removal of temporary acrylic bridge 2 months after its insertion**

Fig. 12. **Procera ASC zirconia implant screw retained prosthesis with partial ceramic layering on the buccal surface**

Fig. 13. **Esthetic evaluation of the zirconia implant restorations with the use of polarizing filter**

Fig. 14. **Treatment outcome 6 weeks after placement of final implant supported prosthesis: healthy appearance of peri-implant tissues, absence of interdental papilla between 1.1-2.1, pronounced upper lip frenulum**

Fig. 15. **Index Assessment of the final result using modified PES score: 1 mesial interdental papilla = 0/1/2; 2 distal interdental papilla = 0/1/2; 3 gingiva contour concavity = 0/1/2; 4 gingiva zenith position around implant prosthetics = 0/1/2; 5 quality and convexity of the gingiva mucosa above implant = 0/1/2; Score Summary PES = 4 (Maximum score is 10)**

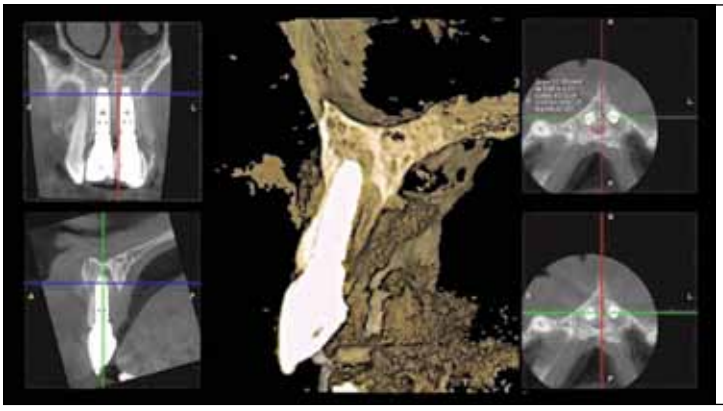

Fig. 16. **CBCT assessment 6 months after delivering final prosthetics on implants in the position of the teeth 1.1,2.1**

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Конфликт интересов:
Авторы декларируют отсутствие конфликта интересов/
Conflict of interests:
The authors declare no conflict of interests
Поступила / Article received 14.01.2020
Поступила после рецензирования / Revised 29.01.2020
Принята к публикации / Accepted 28.02.2020

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