AN ALTERNATIVE SOLUTION TO ADVANCED SURGERIES FOR REHABILITATION OF BILATERAL MAXILLARY LATERAL AGENESIS NARROW DIAMETER IMPLANTS: A DETAILED CASE REPORT

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ABSTRACT

In cases of advanced alveolar crest resorption or insufficient mesiodistal distance, narrow-diameter implants can provide results as successful as standard-diameter implants and may be a good alternative to advanced bone augmentations. In a patient with bilateral maxillary tooth agenesis and horizontal bone resorption who refused advanced surgeries, two 3.0 mm narrow-diameter cylindrical implants were placed with single-stage merged surgery, and following prosthetic rehabilitation, routine follow-up was started. Throughout a 2-year follow-up period, the implants, peri-implant tissues, prosthetic success, and patient satisfaction were seen to be at an extremely good level. Narrow-diameter implants of cylindrical design can be a good alternative to advanced surgery in cases with insufficient horizontal alveolar crest and with the biomechanical methods that have been developed, extremely successful results can be obtained in cases where standard diameter implants cannot be used.

Key words: Narrow-diameter implant, cylindrical implant, minimally invasive surgery, bone augmentation, biomechanics

MAKSİLLER ÇİFT TARAFLI LATERAL DİŞ EKSİKLİĞİNDE İLERİ CERRAHİLERE ALTERNATİF BİR ÇÖZÜM: DAR ÇAPLI İMPLANTLAR: DETAYLI BİR VAKA RAPORU

ÖZ

Alveolar kemiğin şiddetli rezorpsiyonunda veya yetersiz meziyodistal mesafe varlığında dar çaplı implantlar standart çaplı implantlar kadar başarılı sonuçlar verebilir ve ileri kemik cerrahilerine iyi bir alternatif olabilir. Çift taraflı maksiller lateral diş eksikliği olan ve horizontal kemik rezorpsiyonu görülen, ileri kemik cerrahilerini kabul etmeyen bir hastada iki adet 3.0 mm çapında silindirik implantlar tek aşamalı olarak iyileşme başlığı ile yerleştirilmiş ve protetik rehabilitasyondan sonra rutin takiplere başlanmıştır. İki yıllık takip süreci sonucunda implantların, periimplant dokuların, protetik yapıların ve hasta memnuniyetinin oldukça iyi olduğu tespit edilmiştir. Silindirik tasarımdaki dar çaplı implantlar yetersiz horizontal alveolar kemik varlığında ileri cerrahilere iyi bir alternatif olabilirler. Gelişen biyomekanik yöntemlerle standart çaplı implantların kullanılamadığı vakalarda dar çaplı implantlar oldukça başarılı sonuçlar verebilirler.

Anahtar kelimeler: Dar çaplı implant, silindirik implant, minimal invaziv cerrahi, kemik augmentasyonu, biyomekanik

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INTRODUCTION

Dental agenesis is one of the most commonly seen craniofacial malformations, with a prevalence, when third molar teeth are excluded, reported to vary between 1.6% and 6.9% depending on the population examined. In the majority of individuals with dental agenesis, only one or two teeth are missing, most often the upper lateral teeth and the permanent second premolar teeth. Both genetic factors and environmental factors may play a role in dental agenesis (1). In the treatment of maxillary lateral tooth agenesis, considering the requirements of the aesthetic region, many factors are evaluated such as bone height and width, gingival papilla height and width, the periodontal health of adjacent teeth and the presence of restorations in adjacent teeth. Therefore, a multidisciplinary treatment approach is required depending on these factors (2).

Determination of implant diameter depends on the type of tooth missing, the amount of residual bone present, the area required for the prosthesis to be applied, the prosthesis emergence profile and occlusion type. When the implant diameter is 3mm-3.75mm, these are classifed as narrow-diameter implants. In cases where standard-diameter implants cannot be applied such as in the presence of decreased inter-radicular bone, when the alveolar crest width is <6mm, when there is decreased mesiodistal distance for prosthetic restoration, when there are morphological dental malformations, or for socio-economc reasons, narrow-diameter implants can be used as an alternative treatment option (3).

While standard-diameter implants are generally produced from grade-4 pure titanium composites, narrow-diameter implants are usually produced from grade-5 titanium composites to be able to increase mechanical resistance and malleability. Grade-5 titanium composites are generally formed of Ti-6Al-4V components and the content ratio is usually 6% aluminium, 4% vanadium, 0.25% iron and 0.2% oxide (4).

CASE REPORT

A patient presented with congenital bilateral maxillary lateral tooth agenesis, so a sufficient mesiodistal distance was created in the related areas with orthodontic treatment, then implant treatment was planned for rehabilitation of the missing teeth. On cone-beam computed tomography (CBCT) imaging, there was seen to be sufficient vertical height but there was horizontal resorption. There was determined to be 4.4mm residual bone width in the right maxillary lateral tooth region (Figure 1), and 4.1mm residual bone width in the left maxillary lateral tooth region (Figure 2).

For the treatment of insufficient horizontal bone, a treatment plan was explained to the patient of augmentation to increase the bone volume and standard-diameter implant application, but the patient refused any surgery other than implant surgery that could be performed in a single session. Therefore, as an alternative, it was decided to apply narrow-diameter implants which could be placed in a single-stage merged operation.

Following the administration of local infiltrative anaesthesia, an alveolar crest incision was made, protecting the gingival papillae of the maxillary canine and central teeth. The implant sockets were prepared under saline irrigation. Narrow-diameter

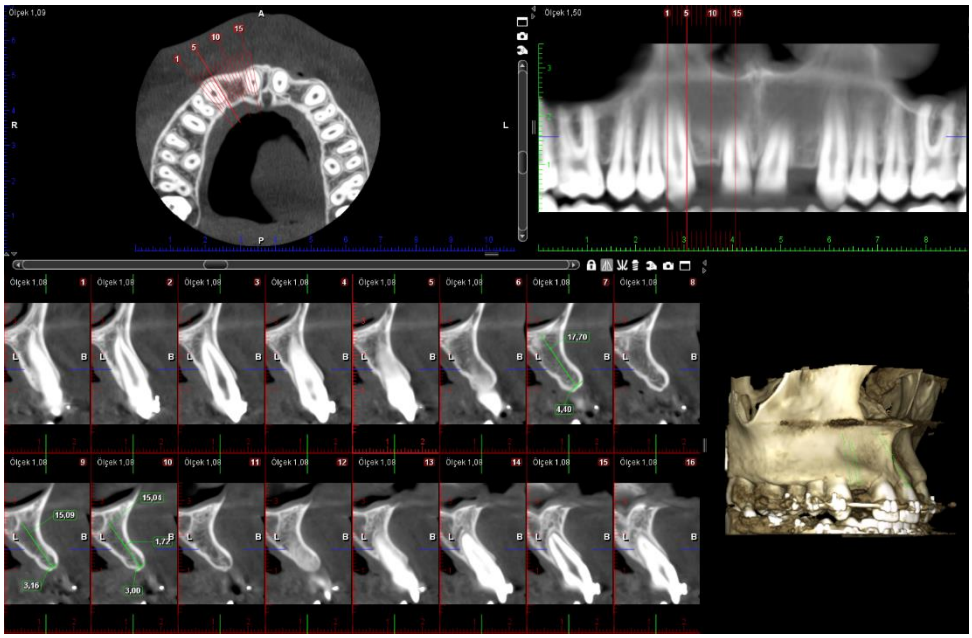

Figure 1. CBCT slices showing the maxillary right lateral incisor area

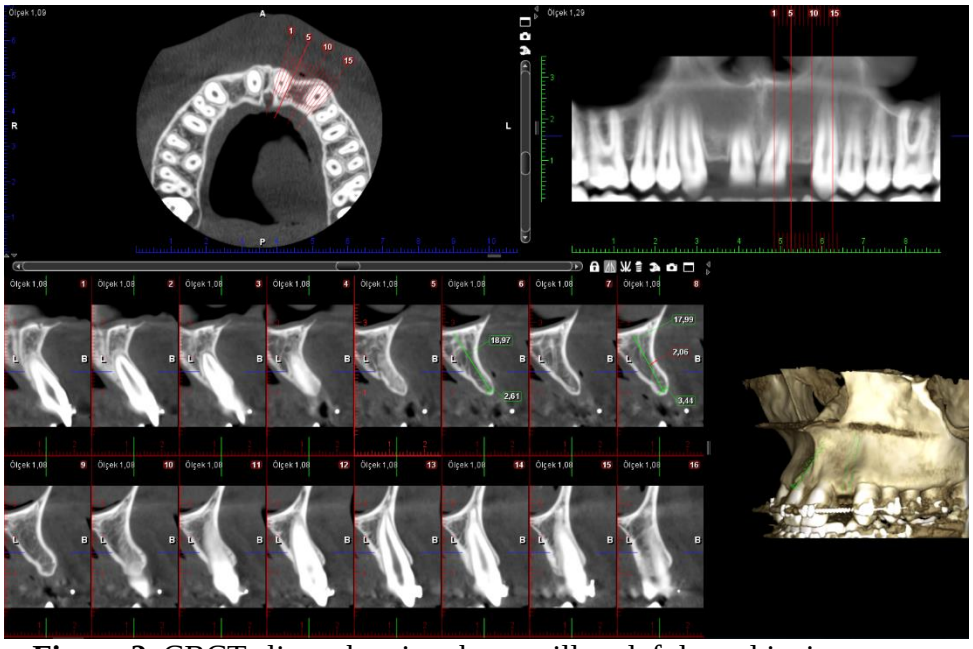

Figure 2. CBCT slices showing the maxillary left lateral incisor area.

implants were applied; a 3.0 mm diameter 13 mm length Microcone Medentika™ implant (Medentika GmbH, Hügelsheim, Germany) in the right maxillary lateral region and a 3.0 mm diameter 11 mm length Microcone Medentika™ implant (Medentika GmbH, Hügelsheim, Germany) in the left maxillary lateral region. As the patient did not wish to undergo a second operation, healing abutments were placed to shape the existing attached gingiva and reduce the possibility of crestal bone resorption, which might be created by the flap opening after osseointegration. After the operation, the patient was administered 875mg amoxicillin+ 125mg clavulanic acid and non-steroid anti-inflammatory drugs (2 x 1) for 5 days, and oral hygiene practices were explained.

After waiting 10 weeks for healing, the clinical and radiological examinations applied showed that osseointegration had occurred successfully for both implants. The buccal, mesial, distal and palatinal ISQ values of the implant were 72, 74, 74, and 78, respectively in the right lateral region, and 70, 72, 74 and 76 in the left lateral region. When the healing abutments were removed, the gingival papilla was seen to have formed a natural contour (Figures 3, 4, 5a). The vertical distance for the prosthetic restoration was seen to be limited as a result of protrusion of the mandibular incisor teeth. Measurements were taken with the open tray technique of the metal-supported ceramic crowns over the implants (Figure 5b). As the prosthetic distance was insufficient, the palatinal cingulum regions were processed as metal. An extremely aesthetic result was obtained with the prosthetic restorations. After 2 years of routine follow-up examinations, the implant success, peri-implant tissue health and prosthetic aesthetic results were observed to be stable (Figure 5c).

Figure 3. Intra-oral appearance at 10 weeks postoperatively

Figure 4. Panoramic view at 10 weeks postoperatively

Figure 5 (a,b,c). a) Healthy gingiva emergence profile formed by the healing b) Prosthetic stage c) Appearance at the end of the 2-year follow-up period

DISCUSSION

Narrow-diameter implants can provide extremely successful clinical results, just as standard-diameter implants. In a study that compared standard-diameter and narrow-diameter implants, no statistically significant difference was reported in respect of the amount of crestal bone loss at the end of 2 years after implantation (5). In a review that included 53 human studies evaluating the relationship between implant survival rates and implant diameters and lengths between 1995 and 2005, it was reported that when conditions such as bone quality and the skill of the surgeon were optimized, small-diameter implants had

similar survival rates to those of standard-diameter implants (6).

In regions with a more spongious bone structure such as the maxillary anterior region, cylindar-type implants have been shown to create less stress in the bone. Although the initial primary stability of cylindrical implants is lower than that of implants with a conical design, they have been reported to transfer equal stress to the surrounding alveolar bone (7). In areas where the bone quality is low, as in the current case, the use of cylindrical type implants is predicted to decrease neck resorption and increase the osseointegration surface area.

Ti-6Al-4V composite, which is the main material of the vast majority of grade-5 implants, shows the capability for high resistance to corrosion, low heat transmission, high osseointegration and has a low elasticity modulus. Generally, as the diameter and length of implants are increased, so the resistance to biomechanical forces increases. Although the osseointegration capacity is generally higher in standard-diameter grade-4 pure titanium dental implants, which have weaker mechanical properties, are used (8). In clinical conditions where it is necessary to use narrow-diameter implants, as in the current case, grade-5 composites are preferred to be able to increase biomechanical resistance.

The most frequently encountered problem in prosthetic restorations in the maxillary anterior region is that aesthetically the peri-implant gingival tissue cannot be fully formed. A thin gingival biotype, high smile line, and narrow mesiodistal area make aesthetic rehabilitation more difficult. To reduce gingival recession during the process of osseointegration, it has been reported that single-stage surgery is more advantageous if sufficient primary stability can be obtained (9). In a systematic review, Esposito et al. compared single-stage and two-stage surgical procedures and determined that if primary stability has been obtained and bone grafting is not to be applied, single-stage surgery shortens the treatment time and contributes to keratinized tissue regeneration (10). In the case presented in this paper, despite the use of narrow-diameter implants, by applying single-stage surgery the emergence profile of the implants was protected, the risk of resorption, which might be created by the flap re-opening, was reduced to a minimum, and there was no requirement for additional soft tissue surgery.

CONCLUSION AND RECOMMENDATIONS

Long-term success and acceptable aesthetic results in implant treatment require case-specific solutions and a multi-disciplinary treatment protocol. In cases with appropriate indications, narrow-diameter implants can provide extremely successful results. Nevertheless, there is a need for further studies with longer follow-up periods to evaluate the long-term results of the use of narrow-diameter implants in aesthetic areas.

LIMITATIONS

The limitation of our study is that it was applied only in the lateral tooth region in the mouth and evaluated in a single patient.

INFORMED CONSENT

Written informed consent was obtained from all participants who participated in this study.

AUTHOR CONTRIBUTIONS

Concept – S.P., M.E.T., O. K.; Design – M.E.T., O. K.; Supervision – S.P., M.E.T.; Materials – M.E.T., O.K.; Data Collection and/or Processing – M.E.T., O.K.; Analysis and/or Interpretation – M.E.T., O.K.; Literature Review – O.K.; Writing – M.E.T., O.K.; Critical Review – S.P., M.E.T.

DECLARATION OF INTERESTS

The authors declare that they have no competing interests.

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