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Vertical Ridge Augmentation Using "Bone Ring" Technique along with Simultaneous Implant Placement in Patient with Nephrectomy- A Case Report

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Abstract

Although chronic kidney disease (CKD)has been considered a global publichealth problem, itseffect on dental implanttreatmentis largely unknown. Atrophic or severely deficient edentulous single tooth dental implant sites require osseous augmentation before any dental implant placement.However, due to complications of CKD, bone grafting procedures, and dental implant treatment for renal failure patients and patients with nephrectomy is more challenging. This article presented a successful case of vertical ridge augmentation using DFDBA allograft "Bone ring" along with simultaneous implant placement in a patient with nephrectomy.

Introduction

A nephrectomy is a surgical procedure for the removal of a kidney or a section of the kidney. Kidney removal is performed on patients with severe kidney damage from disease, injury, or congenital conditions. In CKD patients, the normal physiological mechanisms regulatingblood levels of calcium, phosphate, vitamin D, parathyroid hormone(PTH), and fibroblast growth factor 23 (FGF23) are disturbed, whichsubsequentlyimpactthebonestructuralintegrity[1,2]andleadtochronickidneydisease-mineralandbonedisorders(CKD-MBD).[3]A recent study examined the characterization of themandibularboneinamousemodelofchronickidneydisease,andtheresultsshowedasignificantreduction incorticalbonethickness.[4]Thechronickidneydiseaseisalsoregardedasariskfactorforperiodontitis.[5,]

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[6]Borawskiet al.reportedthatthelossofclinicalattachment leveloftheCKDpatientswassignificantlyhigherthanthatofgeneralpopulationsubjects,indicatingahigh severityofperiodontitisintherenalfailurepatients.[7]Although chronic kidney disease has been considered a worldwide publichealth problem, itseffect on dental implanttreatmentis largely unknown. Oral andnephrological literature suggests that osseous periodontal surgical proceduressuchasbonegraftingordentalimplantsmaybecontraindicated in patients with significant renal osteodystrophy.[8,9] Others,however,investigatedthequantityandqualityofthealveolarboneofdialysispatients,whichshow edthattheresidualbonevolumeswereadequate for implant insertion, suggesting this type of treatment appliestoCKD and nephrectomypatients.[10]

One of the most crucial requirements for endosseous implant placement is sufficient width and height of the alveolar ridge at the implantation site.Various techniques have been proposed in the literature for vertical and horizontal bone augmentation which include bone block grafts, particulate biomaterials, bone in combination with either sandwich osteoplastic or membrane technique, distraction osteogenesis.[11]The main drawback with these techniques is that the implant cannot be placed simultaneously at the same time and requires around 6 months for healing after bone augmentation, thus requiring more time for overall treatment. Therefore, to reduce the overall treatment time and difficulties in the management of bone defects, a new technique was introduced using the bone ring transplantation procedure developed by Bernhard Giesenhagen.[12]

The “bone ring” technique is a surgical methodology that allows bone augmentation and implant placement in a one-stage procedure. Compared to the more conventional two-stage augmentation procedure, the main advantage of “bonering” is the significant reduction of treatment time. This technique enables vertical/horizontal augmentation & formation of new bone, thereby simplifying the surgical treatment of three-dimensional bone defects.The present case report aimed to evaluate the success of extensive bone reconstruction of the atrophic maxillary alveolar ridge using DFDBA allograft bone ring and simultaneous implant placement in a patient with nephrectomy.

Case Report

An 18-year-old male patient reported to the department with a chief complaint of missing natural teeth in the upper front region of the jaw. (Figure 1)The patient gave a history of trauma 3 years back and a nephrectomy procedure 7 years back. Radiographically, CBCT examination showed the horizontal and vertical bone loss in the maxillary right central incisor region. (Figure 2)Three-dimensionalreconstruction of bone defects using DFDBA allograft bone ring and simultaneous implant placement was planned.Routine pre-operative blood investigations and urine examination were carried out. The patient was informed about the potential risks and benefits of the procedure, and consent was obtained. A physician’s consent was obtained

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regarding the fitness of the patient for surgery. Preoperative cone beam computed tomography was carried out to evaluatethe surgical site, amount of augmentation required, and decide the length and diameter of the implant to be used based on the regional anatomy.After proper examination and diagnosis, initial therapy consisting of supra and subgingival scaling was performed to achieve a plaque control score of <1, and oral hygiene instructions were given.

Surgical procedure

Before the surgery, 500 mg amoxicillin was given to the patient and instructed to rinse the mouth with 0.2 % chlorhexidine gluconate. After achieving profound anesthesia, a full-thickness flap with vertical releasing incisions was reflected to expose the vertical defect. The bony defect was measured using a trephine drill (Jalandhar Surgical, Mumbai)to determine the DFDBA allograft bone ring. (Tata Memorial Hospital Mumbai) The diameter of the bone ring was 8 mm. (Figure 3) At Next, the ideal implant position was determined by pilot drilling. For preparation of the bed for the bone ring, a trephine according to the chosen ring size was used for circular osteotomy at the defect site.The implant bed was prepared through the bone ring with a sequential drilling technique following implant protocol. The implant (Myriad Plus, Netherlands) of dimension 3.3/11 mm was then inserted through the bone ring subcrestally, obtaining primary stability from the local bone and using its crestal portion to keep the bone ring in place. Then the cover screw was placed. (Figure 4) The implant was inserted at least 3 mm deep into the local bone through the bone ring into the native bone. After the implant placement,the primary stability of the implant was assessed using the Ostell device. ISQ score after the implant placement was 57. The implant shoulder was placed about 1.5 mm below the cranial surface of the bone ring to compensate for possible resorption. Then, the edges of the bone ring were smoothened to prevent perforation of the soft tissue. The defect was then covered with osseograft particles (DMBM xenograft, Advanced Biotech Product, Chennai, India)(Figure 5). After that, the augmented ridge was covered with healiguide (Absorbable collagen membrane, Advanced Biotech Product, Chennai, India)(Figure 6)Flap closure & suturing was done once the implants were inserted & the cover screw secured, and the augmented ridge was covered with membrane. The interrupted sutures were placed using 4-0 vicryl suture material. Immediate postoperative radiographic examination showed complete filling of the defect and the proper implant position. (Figure 7) The patient was followed up for 6 months. (Figure 8)

Figure 1: Pre – operative clinical photograph

Figure 2: Pre – operative radiographic photograph

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Figure 3: Intra-surgical measurement of defect site

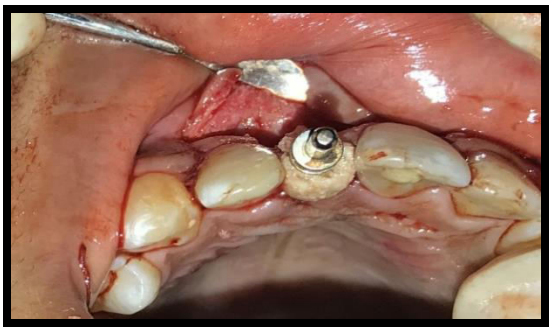

Figure4: Fixation of bone ring at defect site with placement of implant

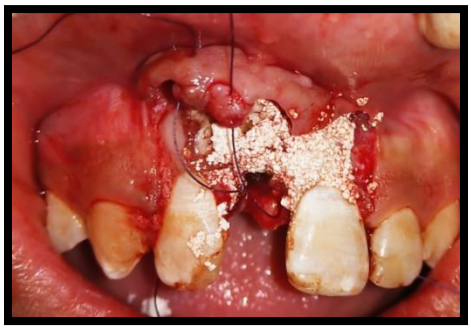

Figure5: Covering of the defect with particulate bone graft

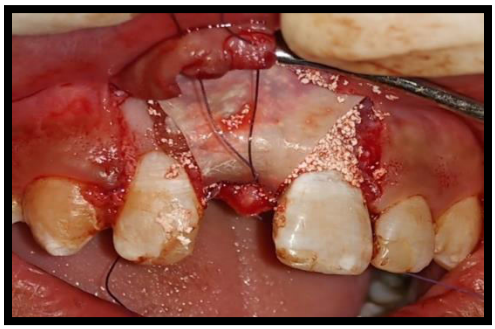

Figure6: Placement of the barrier membrane

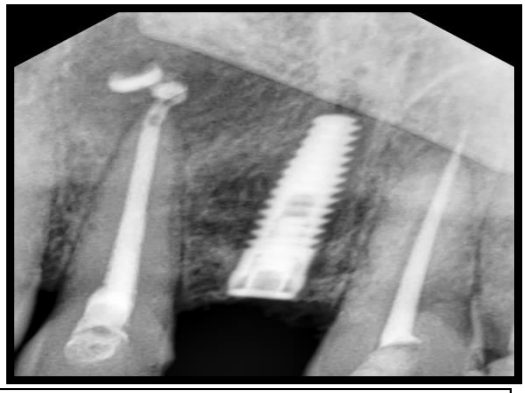

Figure7: Immediate Post-operative Radiographic view

Figure8: 6 months post – operative view – gingival former placement

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Figure9: Final restoration

Treatment outcome

At the 6th monthfollow-up, clinical and radiographic examination was performed. The implantwas osseointegrated without any clinical sign of graft exposure or infection. The implant stability (ISQ) score at 6 months was 68. The radiographic examination at the follow-up showed crestal bone loss of 1.06 mm on mesial and 1.12mm at the implant site. After radiographic examination,the cover screw was replaced with a gingival former. One week later final prosthesis was successfully placed. The patient was satisfied with the outcome of the therapy. (Figure 9)

Discussion

In this article, a unique case of asuccessful three-dimensional bone augmentation using bone ring technique and simultaneous implant placement in a patient with nephrectomy was presented. An in vivo experiment carried out by HuaweiZou et al.[13] to evaluate the effectofCKDonosteogenicdifferentiation of bone marrow mesenchymal stem cells andperi-implant bone formation, the X-ray examination and histological evaluation confirmed the successful osseointegration of titanium implants, indicating that dental implant treatment is applicable in patients with CKD and nephrectomy. However,data from this experimentsuggestthatCKDimpairedtheosseointegrationoftitaniumimplantsatthe earlyhealingstage.

There was a controversy inliterature regarding bone grafting procedures and implant placement in patients with nephrectomy or renal failure.Literature suggests that osseous periodontal surgical proceduressuchasbonegraftingordentalimplantsmaybecontraindicated in patients with significant renal osteodystrophy.[8,9]Others,however,investigatedthequantityandqualityofthealveolarboneofdialysi spatients,whichshowedthattheresidualbonevolumeswereadequate for implant insertion, suggesting this type of treatment appliestoCKDpatients.[10]

Vertical ridge augmentation is one of the greatest challenges for bone regeneration in implant dentistry. This is primarily due to technique sensitivity and, consequently, frequent intra and post-operative complications. It is biologically demanding also.[14,15] DFDBA allograft ring was

used in the present case for vertical ridge augmentation. Demineralized freeze-dried bone allograft is osteoinductive, thus helps in bone regeneration.

In this case, graft stability was achieved through the preparation of the sites using a trephine bur and placing the bone ring of slightly lesser diameter than the dimension of the prepared osteotomy site, thus allowing the bone ring to be snuggly fitted in its recipient site with adequate stability and maximum surfaces of bony contact. This agreed with the findings of Marx[16]who emphasized the importance of graft stability during the early phases of bone healing and the reflection of this on early vascularization and graft incorporation.

Previously, the bone ring technique was performed with an autogenous bone graft. But the necessity of a second surgical site and to avoid postoperative discomfort to the patient allogeneic bone ring was used for vertical bone augmentation in the present case. A recent in vivo study carried out by S Neto et al.[17] compared autologous bone block to allogenic bone block for lateral ridge augmentation and found allogenic blocks to be a good option for lateral ridge augmentation and gain in marginal bone level, as there were no significant differences found between the autologous and allogenic groups. Thus, allograft may substitute autogenous bone.The radiographic examination at 6 months follow-up showed crestal bone loss of 1.06 mm on mesial and 1.12mm at the implant site. The result of this case is in accordance with the study done by Omara et al.[18]who examined the bone ring transplant cases radiographically immediately and at 6 months postoperatively. They measured crestal bone changes and reported minimal crestal bone resorption in the linear measurement during the follow-up period.

Conclusion

This case study recorded, for the first time, the effect of nephrectomy on osseointegration of titanium implant and bone grafting procedure. We achieved successful osseointegration of implant without any clinical and radiographic sign of failure. Thisdataimpliesthatdentalimplanttreatmentmightbeapplicablefor nephrectomypatients,butspecialrequirementsinbonehealingtimemayneedtobeconsidered. This technique showed promising results in managing bone defects and implant placement in nephrectomy patients, but further research isrequired to be carried out to prove this concept.

Conflict of Interest: None

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References

1. Pelletier S, Chapurlat R. Optimizing bone health in chronic kidney disease. Maturitas 2010;65(4):325-33.
2. Dalle Carbonare L, Valenti MT.[Bone biopsy in the Chronic Kidney Disease (CKD)]. G Ital Nefrol 2017;34(6):1-6.
3. Moe S, Drüeke T, Cunningham J, Goodman W, Martin K, Olgaard K, et al.

ISSN 2515-8260 Volume 08, Issue 03, 2021

KidneyDisease: Improving Global Outcomes (KDIGO). Definition, evaluation, and classification of renal osteodystrophy: a position statement from Kidney Disease: Improving Global Outcomes (KDIGO). Kidney Int 2006;69(11):1945-53.

4. Lee MM, Chu EY, El-Abbadi MM, Foster BL, Tompkins KA, Giachelli CM, et al. Characterization of mandibular bone in a mouse model of chronic kidney disease. J Periodontol 2010;81(2):300-9.
5. Chen LP, Chiang CK, Chan CP, Hung KY, Huang CS. Does periodontitis reflect inflammation and malnutrition status in hemodialysis patients? Am J Kidney Dis 2006;47(5):815-22.
6. Cengiz MI, Sümer P, Cengiz S, Yavuz U. The effect of the duration of the dialysis in hemodialysis patients on dental and periodontal findings. Oral Dis 2009;15(5):336-41.
7. Borawski J, Wilczyńska-Borawska M, Stokowska W, Myśliwiec M. The periodontal status of pre-dialysis chronic kidney disease and maintenance dialysis patients. Nephrol Dial Transplant 2007;22(2):457-64.
8. Craig RG, Kotanko P, Kamer AR, Levin NW. Periodontal diseases--a modifiable source of systemic inflammation for the end-stage renal disease patient on haemodialysis therapy? Nephrol Dial Transplant 2007;22(2):312-5.
9. Stellingsma C, Vissink A, Meijer HJ, Kuiper C, Raghoebar GM. Implantology and the severely resorbed edentulous mandible. Crit Rev Oral Biol Med 2004;15(4):240-8.
10. Dijakiewicz M, Wojtowicz A, Dijakiewicz J, Szycik V, Rutkowski P, Rutkowski B. Is implanto-prosthodontic treatment available for haemodialysis patients? Nephrol Dial Transplant 2007;22(9):2722-4.
11. Esposito M, Grusovin MG, Felice P, Karatzopoulos G, Worthington HV, Coulthard P. The efficacy of horizontal and vertical bone augmentation procedures for dental implants - a Cochrane systematic review. Eur J Oral Implantol 2009;2(3):167-84.
12. Oncu E. Bone Ring Autogenous Graft Transplantationing one Stage Technique and Early Implant Placement: A Case Report. J Dent App 2015;2(3):174-177.
13. Zou H, Zhao X, Sun N, Zhang S, Sato T, Yu H, et al. Effect of chronic kidney disease on the healing of titanium implants. Bone 2013;56(2):410-5.
14. Rocchietta I, Fontana F, Simion M. Clinical outcomes of vertical bone augmentation to enable dental implant placement: a systematic review. J Clin Periodontol 2008;35(8 Suppl):203-15.
15. Tinti C, Parma-Benfenati S. Vertical ridge augmentation: surgical protocol and retrospective evaluation of 48 consecutively inserted implants. Int J Periodontics Restorative Dent 1998;18(5):434-43.
16. Marx RE. Bone and bone graft healing. Oral Maxillofac Surg Clin North Am 2007;19(4):455-66
17. Spin-Neto R, Stavropoulos A, Coletti FL, Faeda RS, Pereira LA, Marcantonio E. Graft incorporation and implant osseointegration following the use of autologous and fresh-frozen allogeneic block bone grafts for lateral ridge augmentation. Clin Oral Implants

ISSN 2515-8260 Volume 08, Issue 03, 2021

Res 2014;25(2):226-33.

18. Omara M, Abdelwahed N, Ahmed M, Hindy M. Simultaneous implant placement with ridge augmentation using an autogenous bone ring transplant. Int J Oral Maxillofac Surg 2016;45(4):535-44.