Guided Bone Regeneration Simultaneously with Implant Placement Utilizing an Alloplastic Putty

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Background

In edentulous sites where the residual ridge exhibits significant reduction in the orofacial plane that compromises the placement of an implant surrounded by adequate bone volume, ridge augmentation procedures should be employed. When guided bone regeneration (GBR) is performed simultaneously with implant placement to compensate for horizontal ridge deficiencies that leave implant threads exposed, it can significantly reduce healing time and eliminate the need for a second surgery, thus increasing patient acceptance. The aim of this case series is to report the clinical outcome of GBR with a calcium phosphosilicate (CPS) alloplastic putty bone substitute performed simultaneously with implant placement.

Methods

Twelve patients presenting with Class I Seibert defects in 14 edentulous sites were treated with GBR using a CPS putty with a collagen membrane (CM) or titanium mesh (TiM) following implant placement. In order to be included in the study, at least one implant thread had to be exposed on the facial aspect of the implant following implant placement. During 1st stage surgery, the distance from the most apical level of the bone crest on the facial aspect of the implant to the platform of the implant was estimated. The same measurement was retaken during second stage surgery. All patients were followed-up at least 6 months after delivery of the implant-supported restorations.

Representative Case 1

A 22 yr old male patient presented with an edentulous area in the lower left first molar area. The ridge width as measured at the crest was 3mm. A 4.2 mm x 11.5mm MIS Seven implant was placed in the area. A 4mm dehiscence defect was noted after implant placement. The area was decorticated to facilitate bleeding and a macroporous titanium mesh (0.1mm) was placed over the implant and contoured to adjacent bone envelope. The mesh was stabilized with titanium tacks. CPS Putty was injected inside the mesh through the sides using the unique cartridge delivery system. Tissues were approximated to get complete primary closure. There was no exposure of the titanium mesh during healing and second state re-entry was performed at 4.5 months for mesh removal.

Upon mesh removal, complete ridge regeneration in the area was noticed. The cover screw had to be exposed by scraping the newly formed bone using Piezo surgery. The implant was restored with PFM crown.

Representative Case 2

A 30 yr old female patient presented with edentulous area in the lower left first molar region. The buccolingual width was measured at 3mm at the crest of the ridge. A MIS Seven 4.2mm x 10mm implant was placed in the area. A dehiscence defect exposing approximately 4 mm of the implant was noticed. The area was decorticated to facilitate bleeding and a titanium mesh was placed and contoured to adjacent bone. The mesh was stabilized with titanium tacks and CPS putty was injected underneath the mesh through the sides and complete primary closure was achieved. Titanium mesh exposure was noticed 4 months post operatively and re-entry showed complete bone regeneration in the area. The cover screw was exposed by scraping the bone with Piezo instruments. The area was restored with PFM crowns.

Representative Case 1

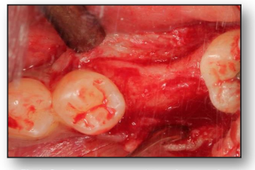

Fig 1: Surgical exposure of the site showing Buccolingual deficiency

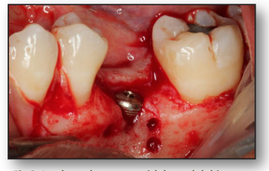

Fig 2: Implant placement with buccal dehiscence and decortication

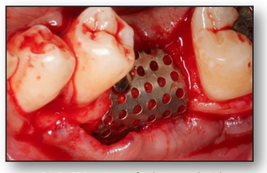

Fig 3: CPS putty grafted, covered with Titanium mesh and stabilized by titanium tacs

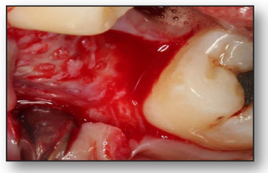

Fig 4: Second stage surgery after the removal of mesh showing complete bone formation over the dehiscence

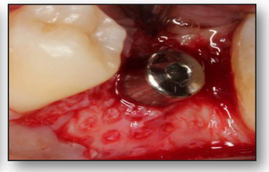

Fig 5: Note the complete reconstruction of the lost buccal contour

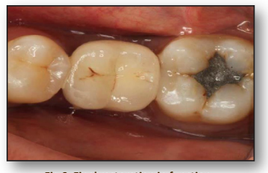

Fig 6: Final restoration in function

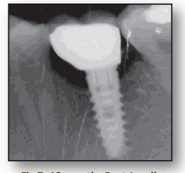

Fig 7: 18 months Post-Loading

Representative Case 2

Fig 1: Pre operative view showing Buccolingual contour deficiency

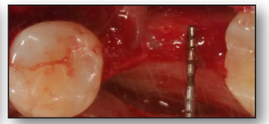

Fig 2 : Surgical exposure of the site showing buccolingual ridge width of 3mm

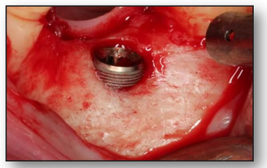

Fig 3: Implant placement with buccal dehiscence

Fig 4: Decortication around the dehiscence defect

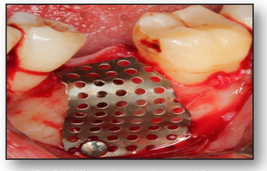

Fig 5: Mesh contouring to correct the Buccolingual ridge deficiency

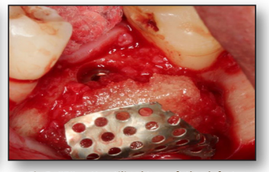

Fig 5: CPS putty utilized to graft the defect

Fig 6: Titanium Mesh exposure at 4.5 months

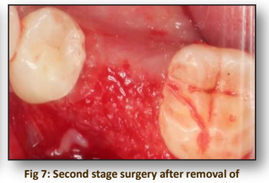

Fig 7: Second stage surgery after removal of mesh showing complete bone reformation

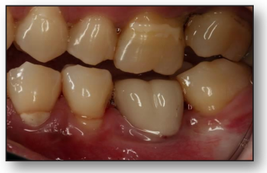

Fig 8: Final restoration

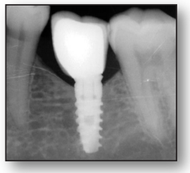

Fig 9: 14 months Post-loading

Results

In this study 6/14 sites were augmented with CPS putty and TiM while 8/14 were augmented with CPS putty and a CM. The average intra-operative defect measurement during 1st stage implant surgery was 4.57mm (±2.50). After a median healing time of 5 months (range: 4-7 months) patients were scheduled for 2nd stage surgery. Intra-operative measurements showed the average defect distance to be 0.14mm (±0.36), (P<0.01). Implants were not surrounded by hard tissue, resistant to probe penetration only in two sites that accounted for the above mentioned mean defect value measured at 2nd stage surgery. In one of the two cases with a remaining defect, a CM that was prematurely exposed had been used, while in the second case, a TiM had been utilized. In total, premature membrane exposure was noted in 2/6 cases with TiM and in 1/8 cases with CM. New tissue was almost completely covering the osseointegrated implant in the cases where premature TiM exposure occurred. All implants were successfully osseointegrated (14/14) at the time of 2nd stage and maintained successful osseointegration after a follow-up of at least 6 months post loading for a cumulative success rate of 100%.

Discussion

Guided Bone Regeneration is a very technique sensitive surgical procedure that requires the right combination of surgical techniques and biomaterial selection. Results from this 14 case series indicated that CPS Putty in combination with either a CM, or a Ti-mesh produced excellent bone regeneration in GBR surgeries.

CPS Putty is a third generation synthetic bone graft substitute. The material is cohesive and provides adequate retention at the defect site. Various studies indicate a capability possessed by CPS particles to stimulate differentiation towards cell lineage with therapeutic potential in tissue engineering.[1, 2] This unique phenomenon (osteostimulation) occurs exclusively with CPS based substitutes and has been shown to be superior to conventional osteoconduction. Recently several publications have been published on the bone regeneration efficacy of CPS Putty in a variety of indications. [3-5]

Conclusion

Calcium phosphosilicate putty can be a successful scaffold for new bone growth in GBR procedures. Both a collagen membrane and a titanium mesh can be employed in conjunction with CPS putty for bone regeneration around implants. TiM may exhibit a more frequent exposure rate, which was not found to compromise the clinical outcome in this study. Further randomized, controlled clinical trials are required to validate our results.

References

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