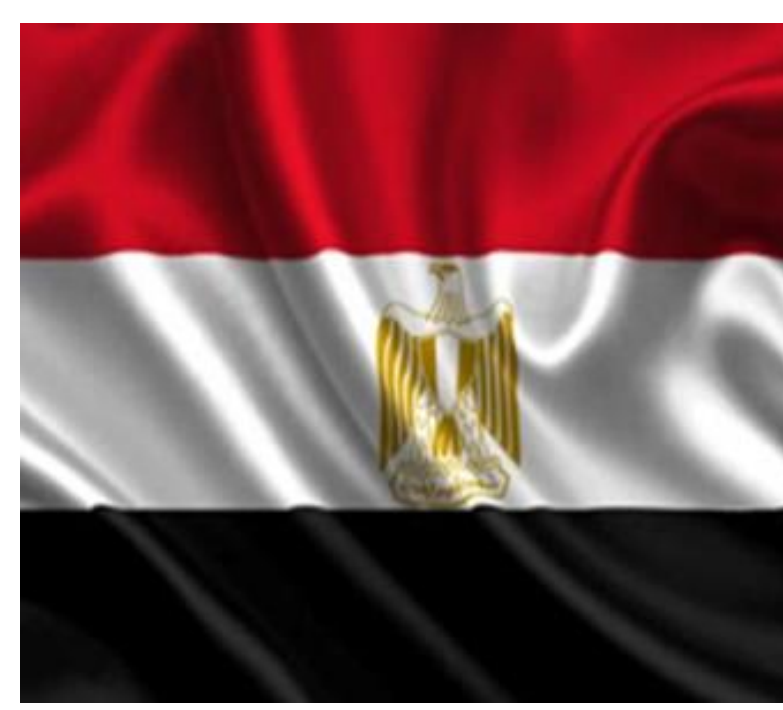
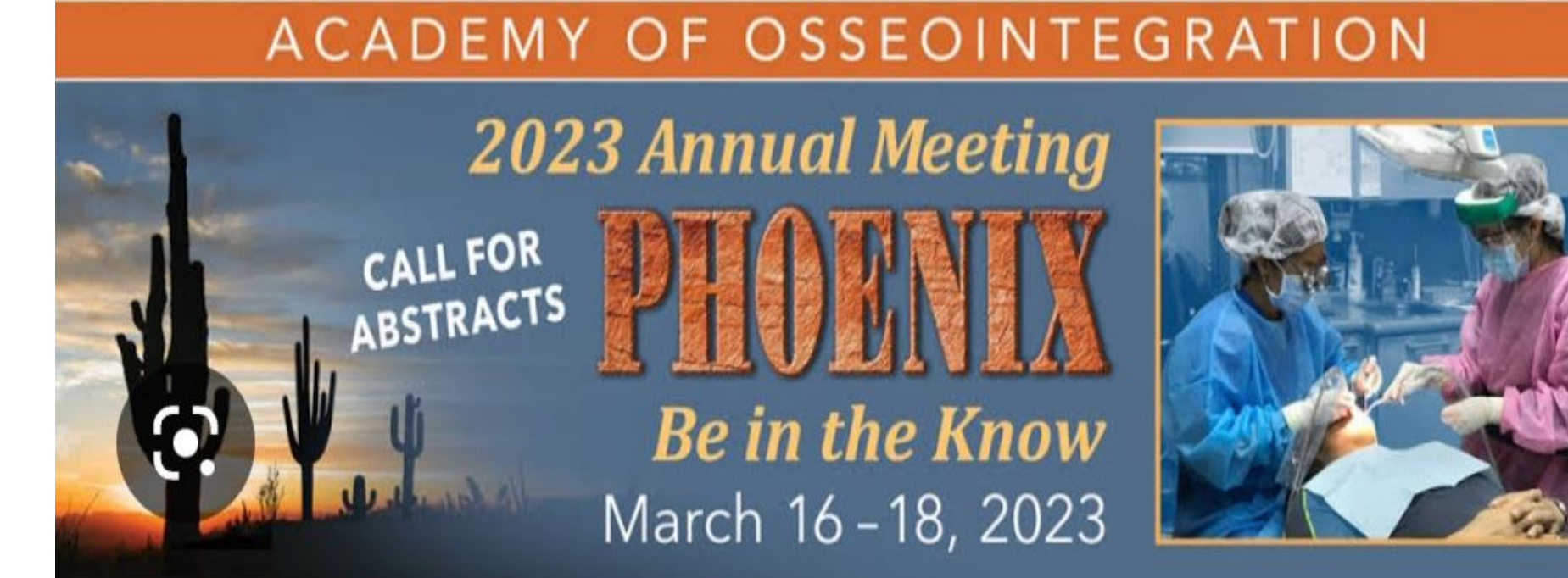




Maxillary Horizontal Alveolar Ridge Augmentation Using Computer Guided Ridge splitting with Simultaneous Implant Placement Versus Conventional Technique : A Randomized Clinical Trial.



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- Introduction:** Ridge splitting technique is considered one of the successful horizontal bone augmentation procedures specially for the maxillary bone, the aim of this study was to compare marginal bone loss using a novel ridge splitting protocol versus the conventional technique.



Figures 1,2 Case 1 : severely atrophied anterior maxilla (occlusal and facial views)

Methods: This was a randomized clinical trial including 20 patients who were randomly divided into two groups: ridge splitting with simultaneous implant placement at the anterior maxillary esthetic zone (29 dental implant) using patient specific guides (PSGs) in the study group versus conventional technique (29 dental implant). In the control group free hand ridge splitting was done, while in the study group all the splitting and drilling procedures were done through specific slits and sleeves at the patient specific guides to allow easier and handy technique and to bypass any ridge undercut or bony concavity during the procedure aiming to preserve the marginal bone surrounding the dental implants and to lower the risk of bad splits. Radiographic Assessment included measurements of linear changes in the vertical dimensions of the labial plate of bone on cross sectional cuts of computed tomography (CBCT) using special software

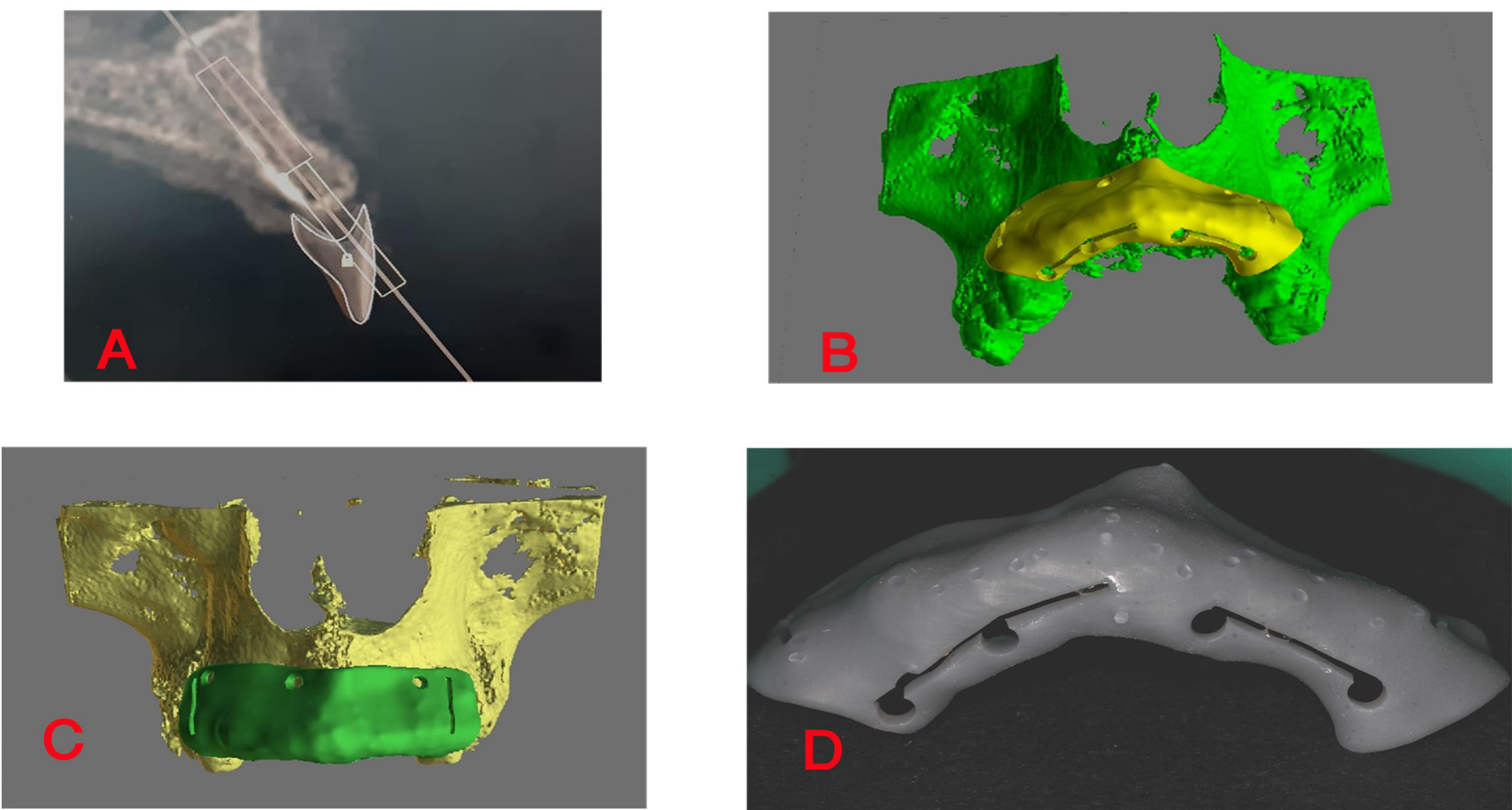


Fig 3 Case 1: F(A) preoperative cross sectional view, (B,C) virtual 3D design of the patient specific guide facial and occlusal views. (D) 3D printed Guide

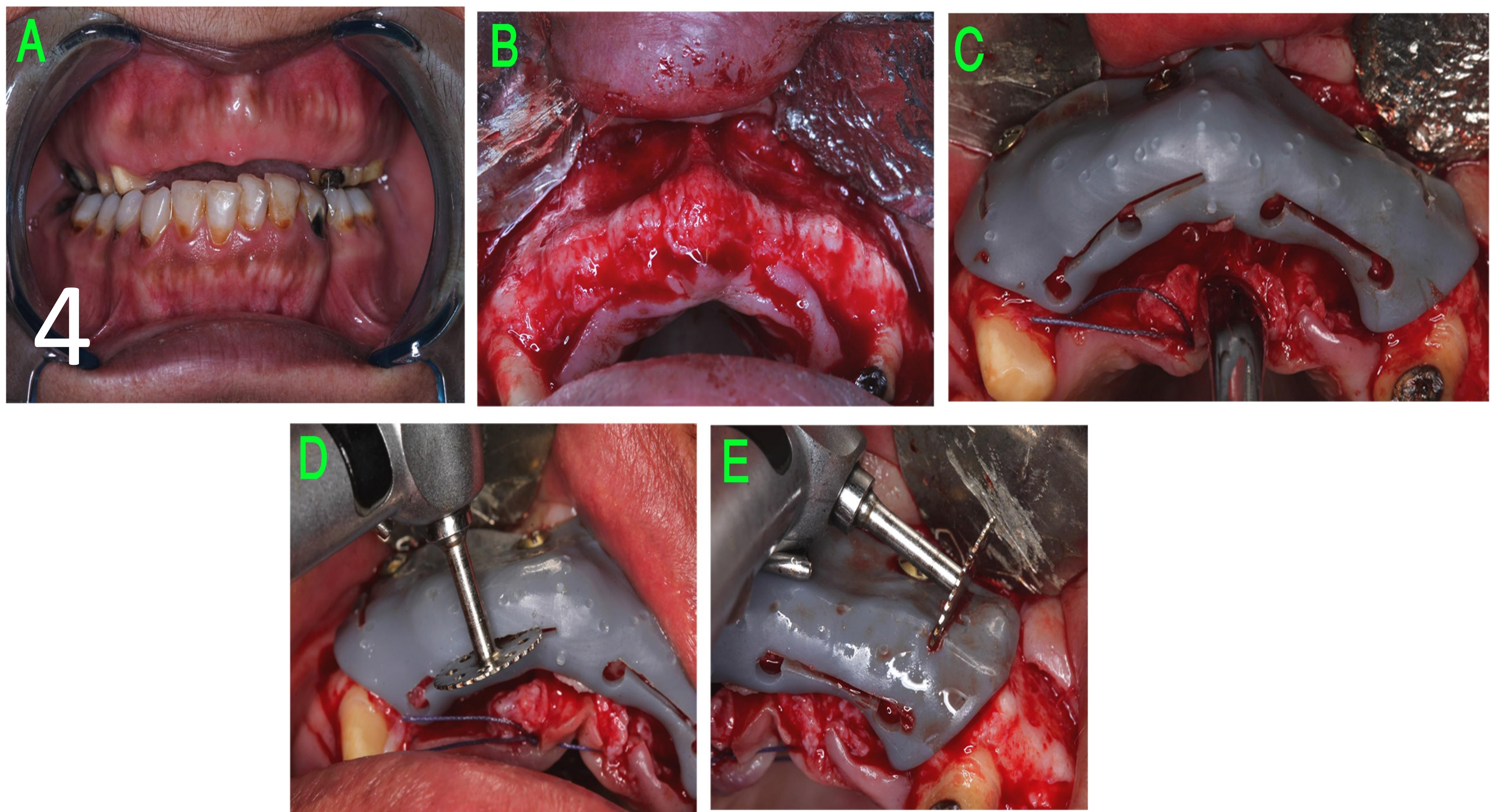


Fig 4: (A,B)full thickness flap exposure, (C) Guide in place fixed by monocortical screws, (D,E) Carbide discs in action via the midcrestal and mesial and distal opened slits to facilitate lateralization of the labial cortex

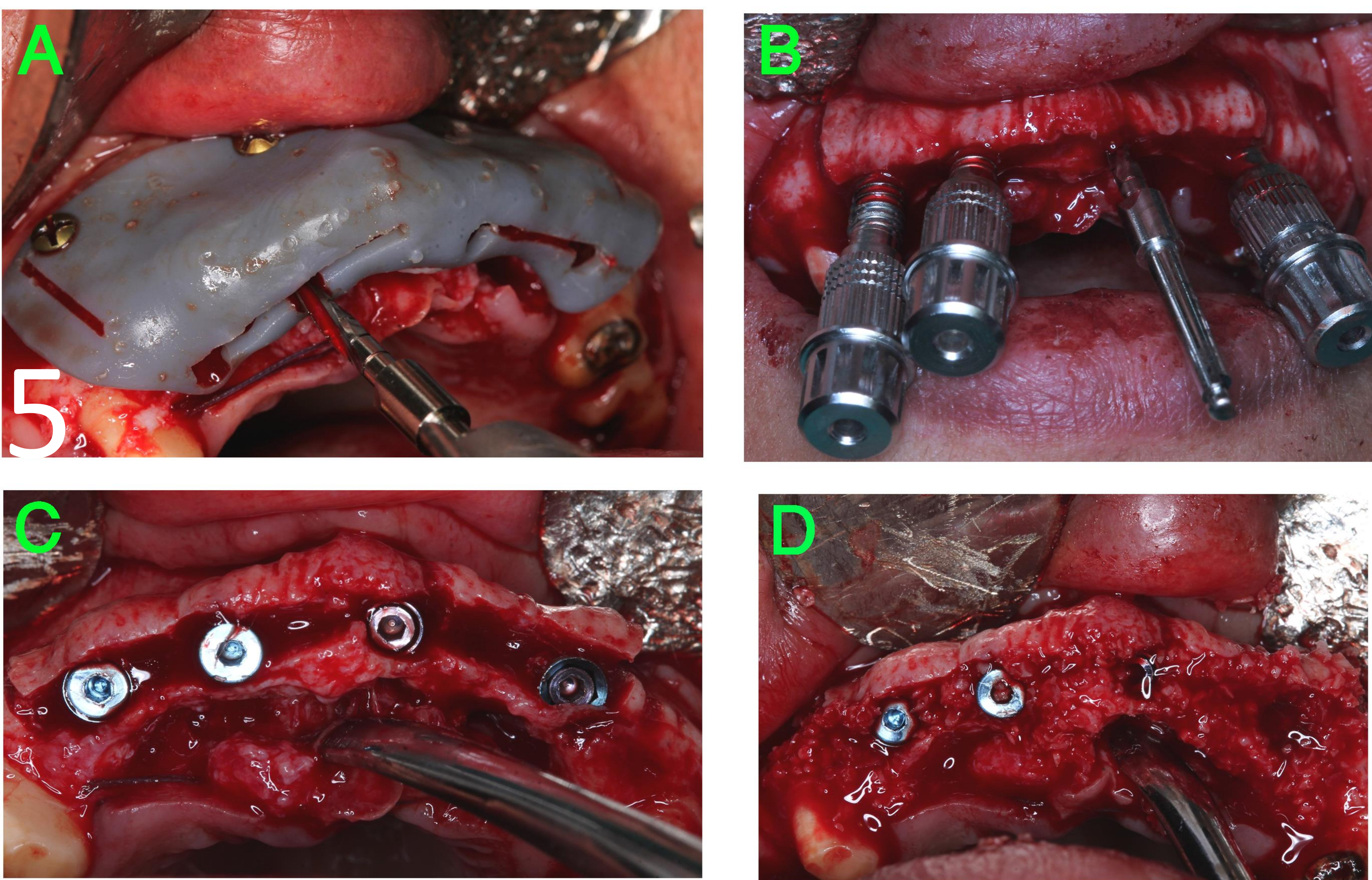


Fig 5:(A) Pilot drill for osteotomy preparation ,(B) bone expansion using expanders, (C,D) dental implant placement with interpositional particulate bone graft

Fig 6: Intra oral scanning and virtual design of a screw retained prosthesis

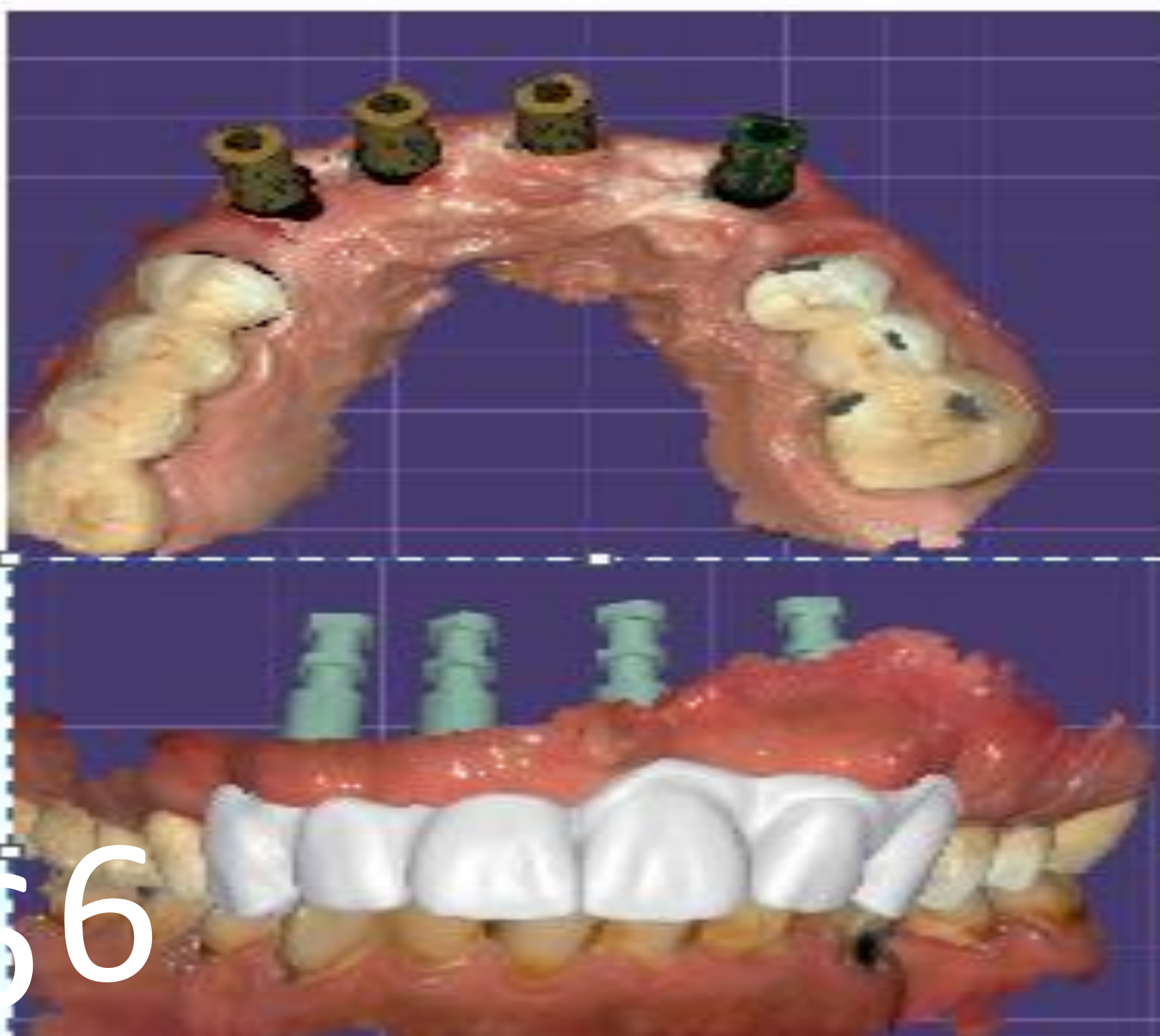


Fig 7: susper-imposition of the ridge preoperatively (Green Color)and the postoperative showing the bone Gain



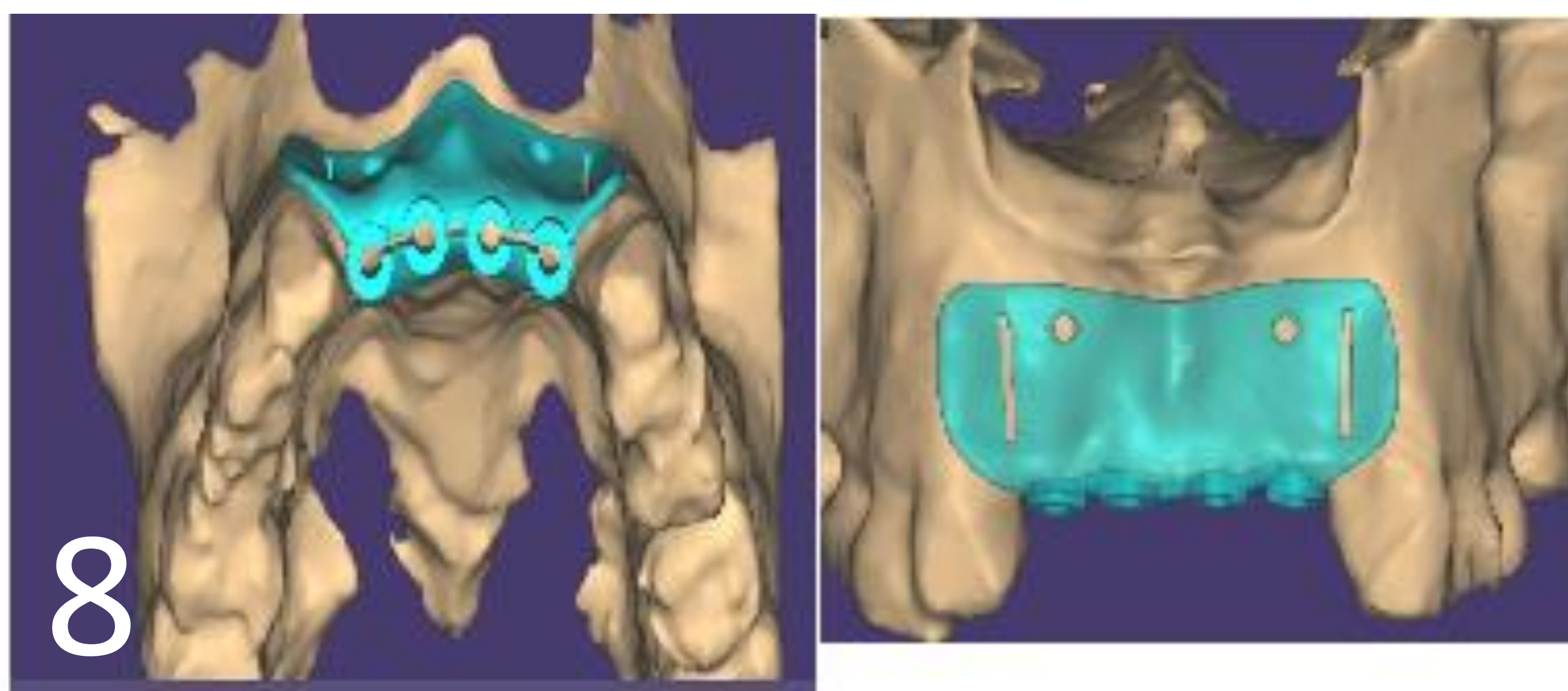


Fig 8 **CASE 2** (a,b,)) virtual 3D design of the patient specific guide facial and occlusal views

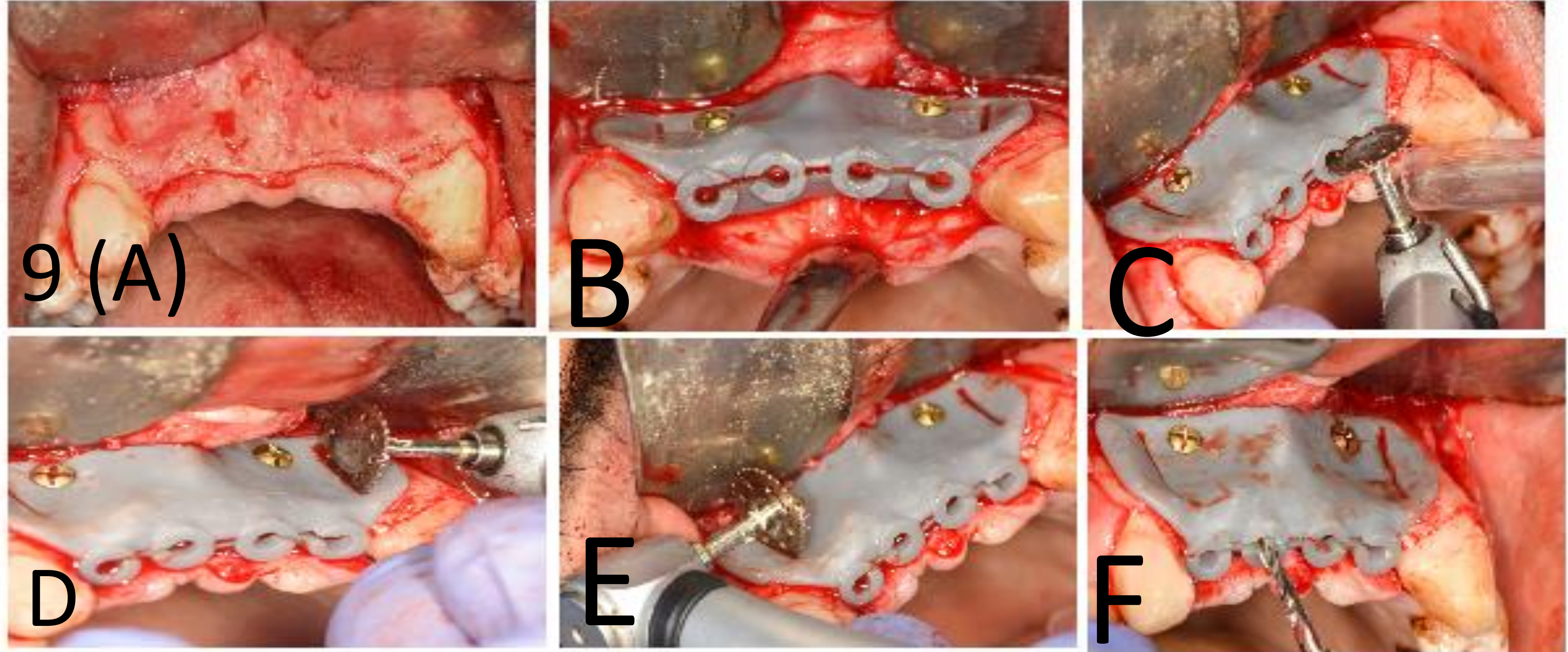


Fig 9 **CASE 2**: (A,B)full thickness flap exposure, (C) Guide in place fixed by monocortical screws, (D,E) Carbide discs in action via the open midcrestal and mesial and distal opened slits to facilitate lateralization of the labial cortex ,(f)Pilot drill preparation

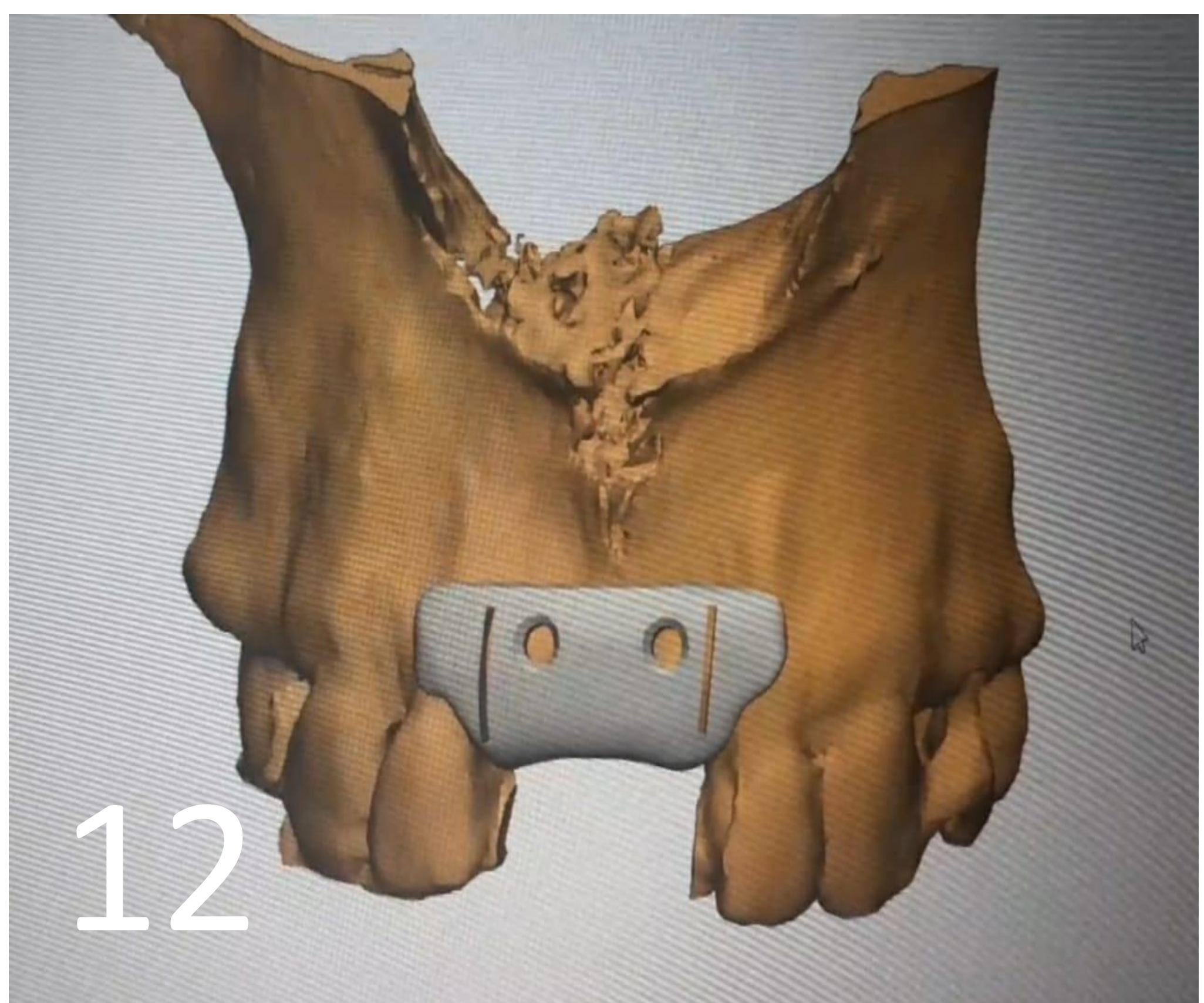


Fig 12: **CASE 3** preoperative virtual design of the patient specific guide

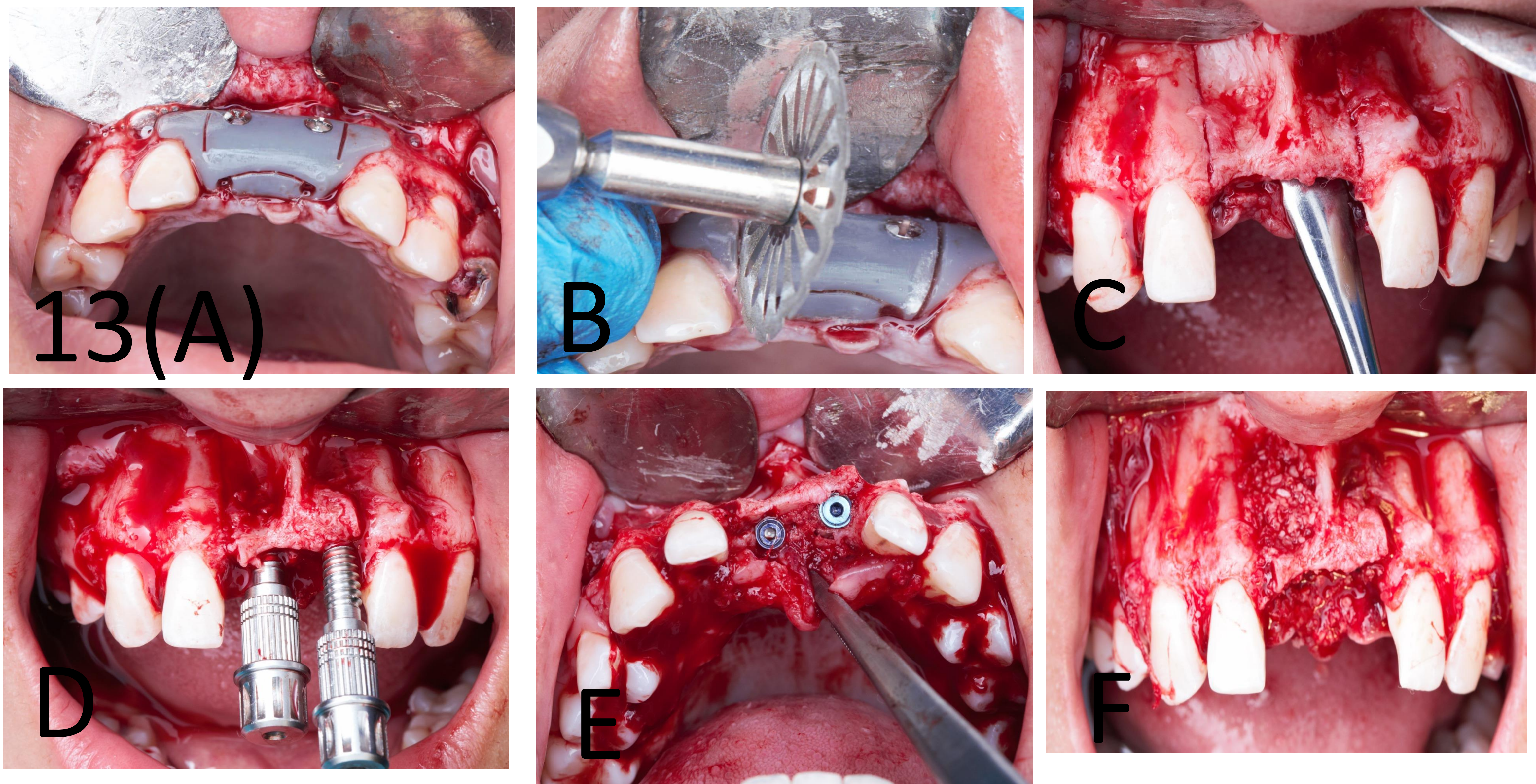


Fig 13 **CASE 3** (A,B,C) full thickness flap exposure, Guide in place fixed by monocortical screws, Carbide discs in action via the open slits for bone flap creation , (D) Bone expansion using expanders, (E) implants in place, (F)interpositional particulate xenograft.

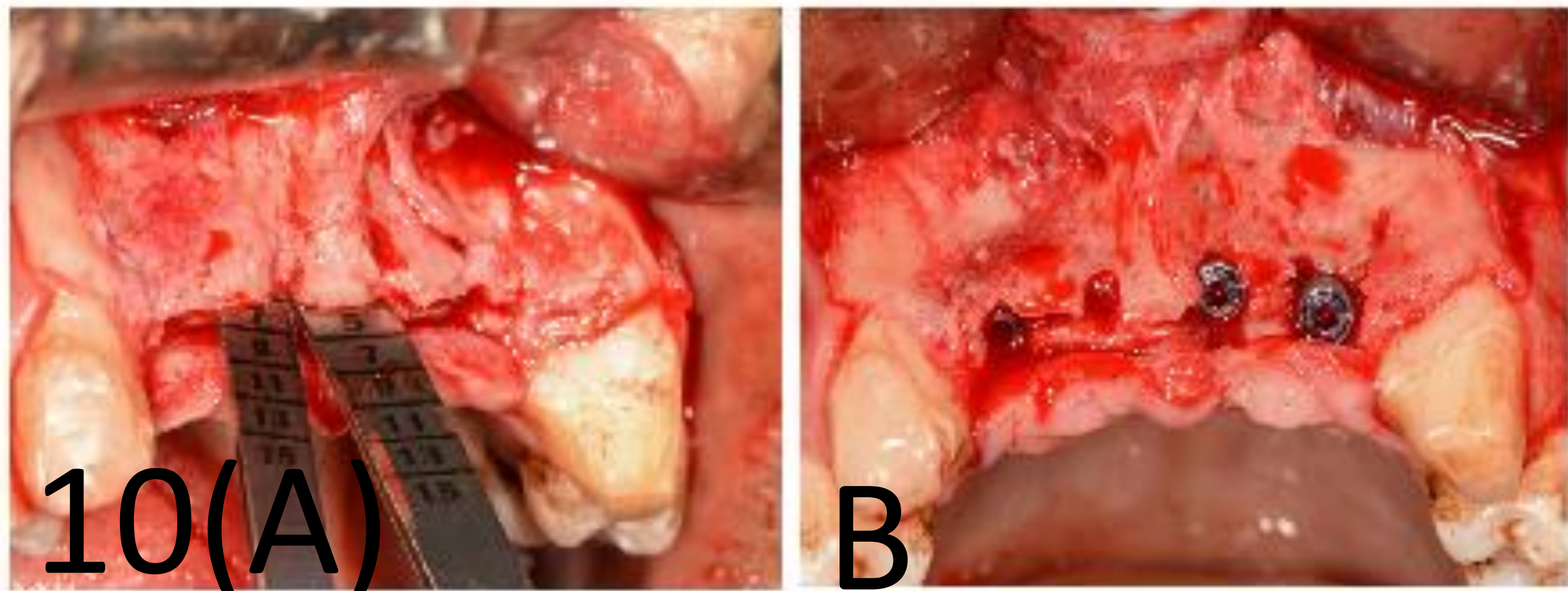


Fig 10 (A) **CASE 2**: : Ridge Splitting osteotomes in action, (B) Implants in place

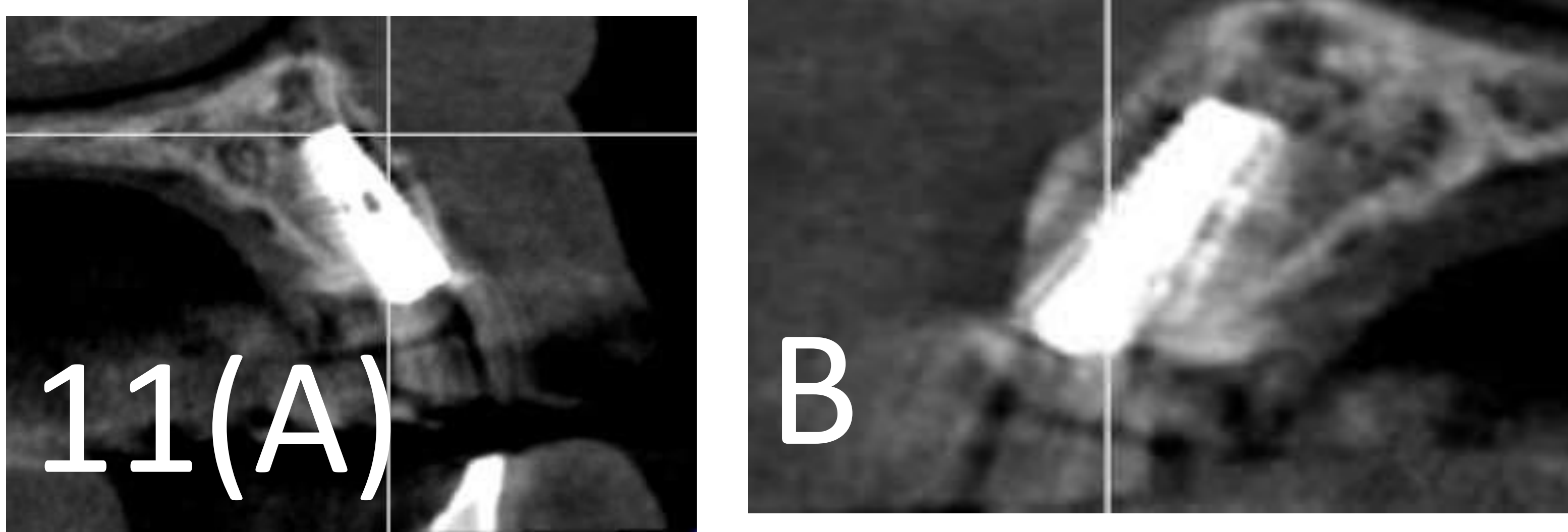


Fig 11 :postop. Cbct . **CASE 2**:
(A) immediate and (b) 6 months postoperative after implant placement .



Fig 14 **CASE 1 Free Hand Group:** (A) free hand Bone flap creation using carbide disc by placing 1 mid crestal cut and 2 vertical stop cut, (B): free hand osteotomy site preparation, (C) Implants in place

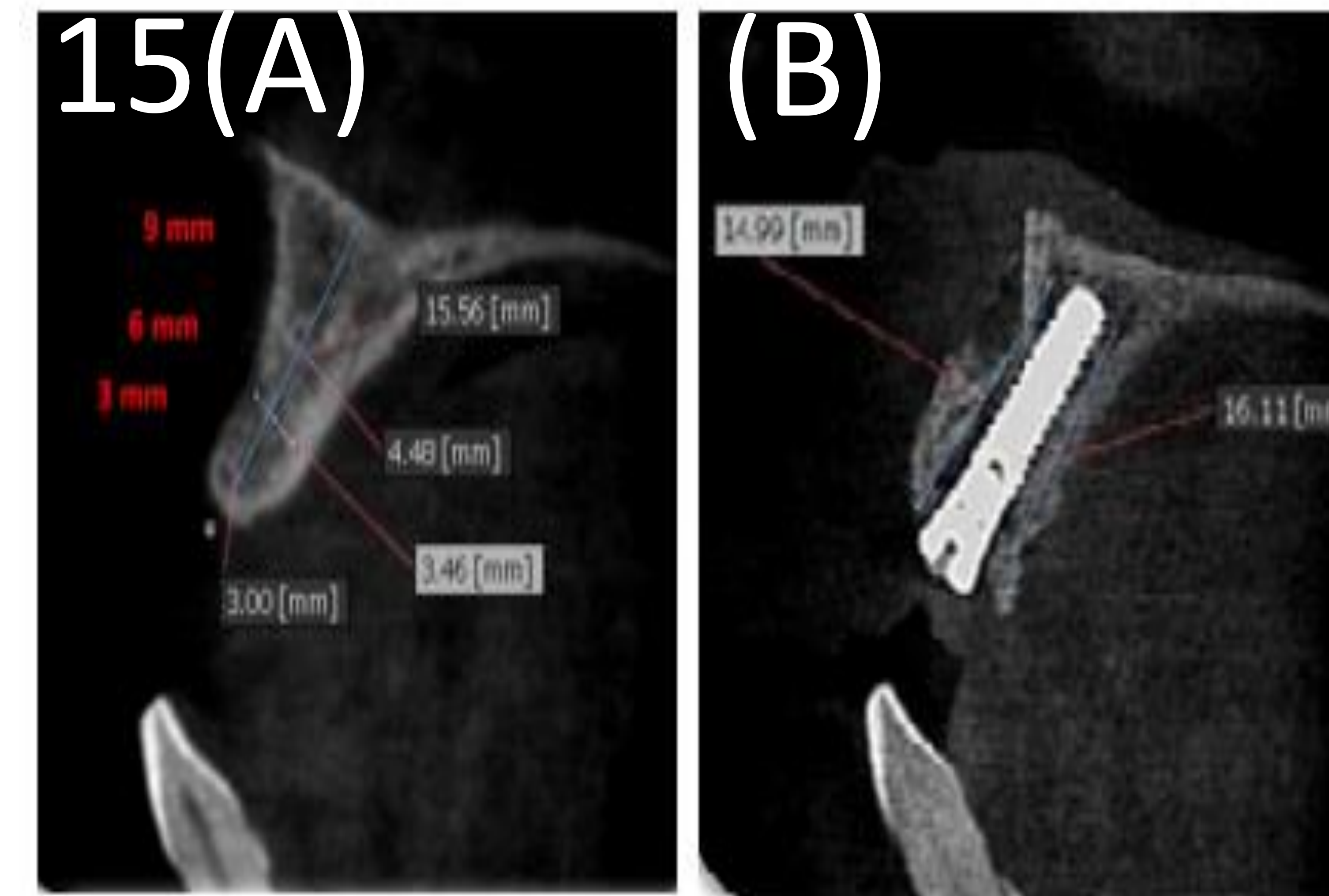


Fig 15 **CASE 1 Free Hand Group** (A) Preoperative and (b) 6 months postoperative after implant placement showing the net horizontal bone gain.

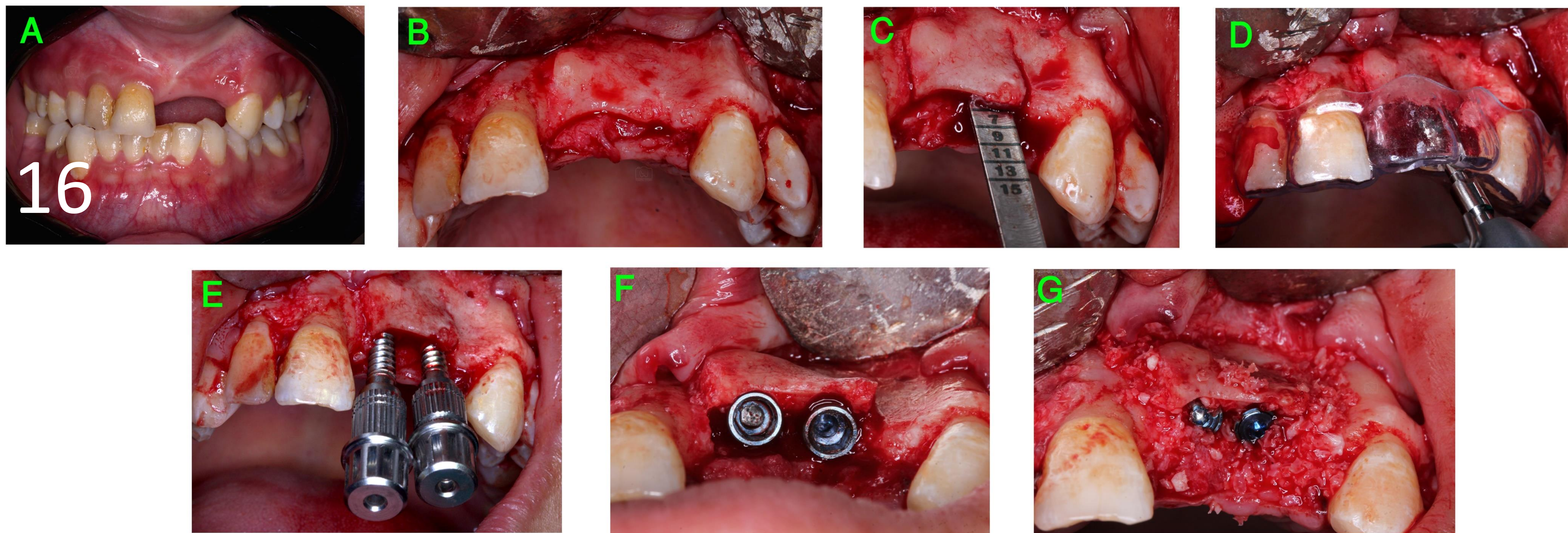


Fig 16 **CASE 2 Free Hand Group:** (A,B) free hand Bone flap creation using carbide disc by placing 1 mid crestal cut and 2 vertical stop cut, (C,D): free hand lateralization of the labial cortex , (E)osteotomy site preparation, (C) Implants in place. (F) interpositional space filled with particulate xenografts.

Results: Wound healing was uneventful for all the patients except one patient in the control group that showed bad split and another showed buccal fenestration. The study group also showed lower bone loss and loss percentage (1.38 ± 0.61 mm, 10.99 ± 4.76 %) compared to the control group (2.42 ± 0.63 mm, 19.12 ± 4.53 %), and there was statistical significance difference between the 2 groups (P value = 0.001).

Conclusion: Ridge splitting using PSGs appear to be efficient and promising than the free hand technique.

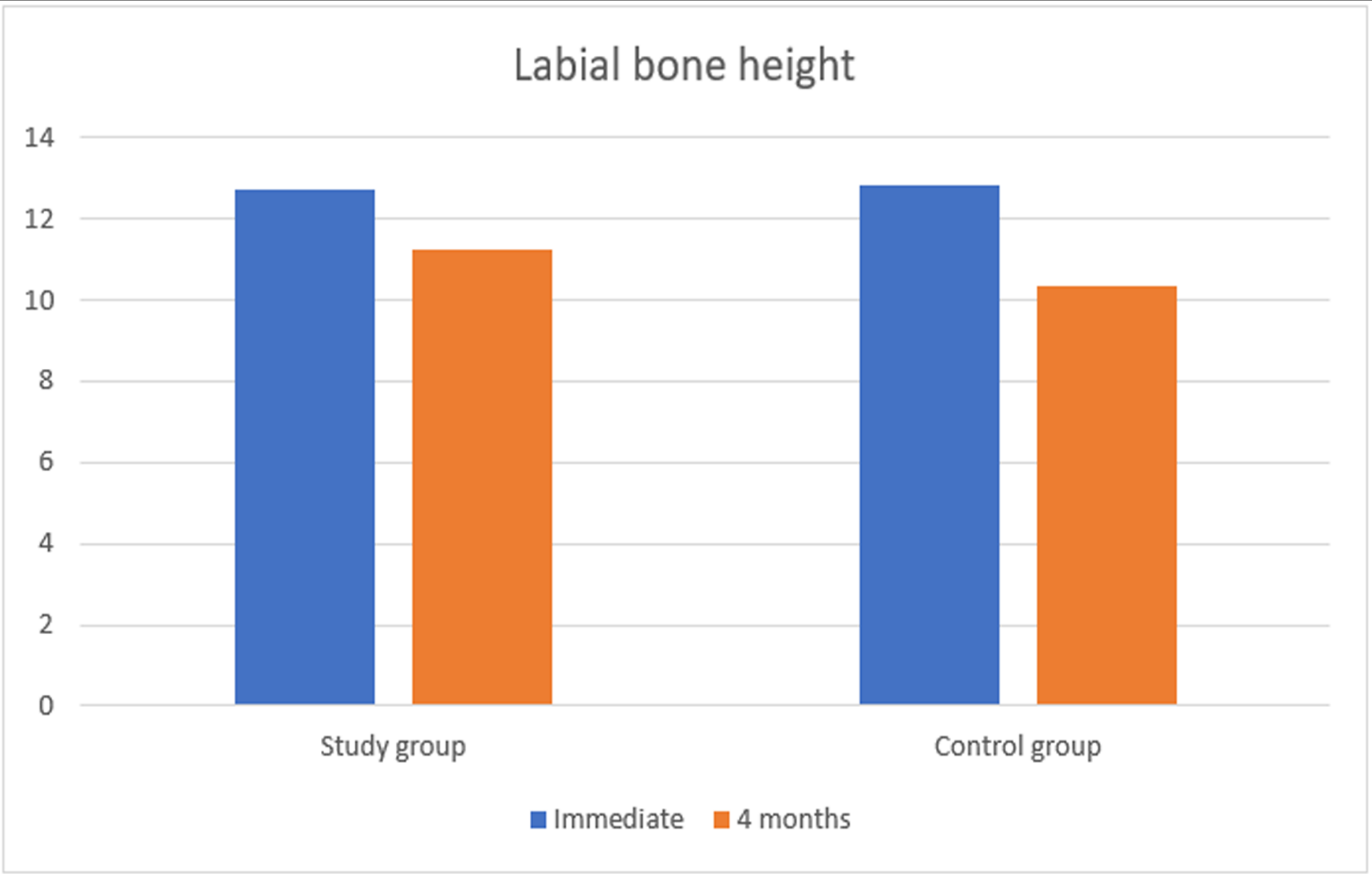


Fig 16: Bar chart showing the difference in labial bone height immediate and 6 months postoperatively in both groups

	Immediate	4 months	Bone loss	Bone loss percentage (%)
Study group	12.57 ± 0.95	11.17 ± 1.12	1.38 ± 0.61	10.99 ± 4.76
Control group	12.63 ± 0.98	10.21 ± 0.95	2.42 ± 0.63	19.12 ± 4.53
P value	0.893	0.055	0.001 *	0.001 *

Table showing the in labial bone height immediate and 6 months postoperatively in both groups