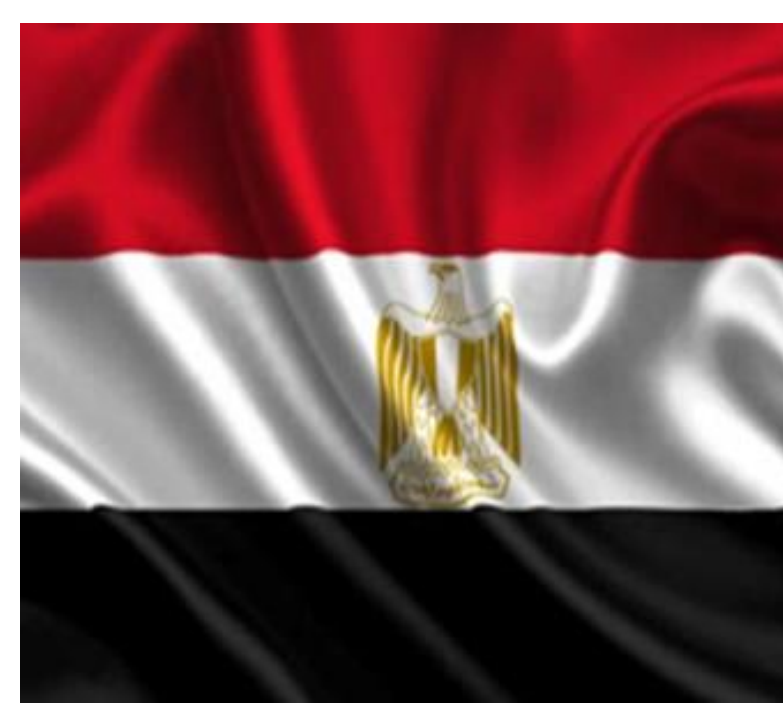
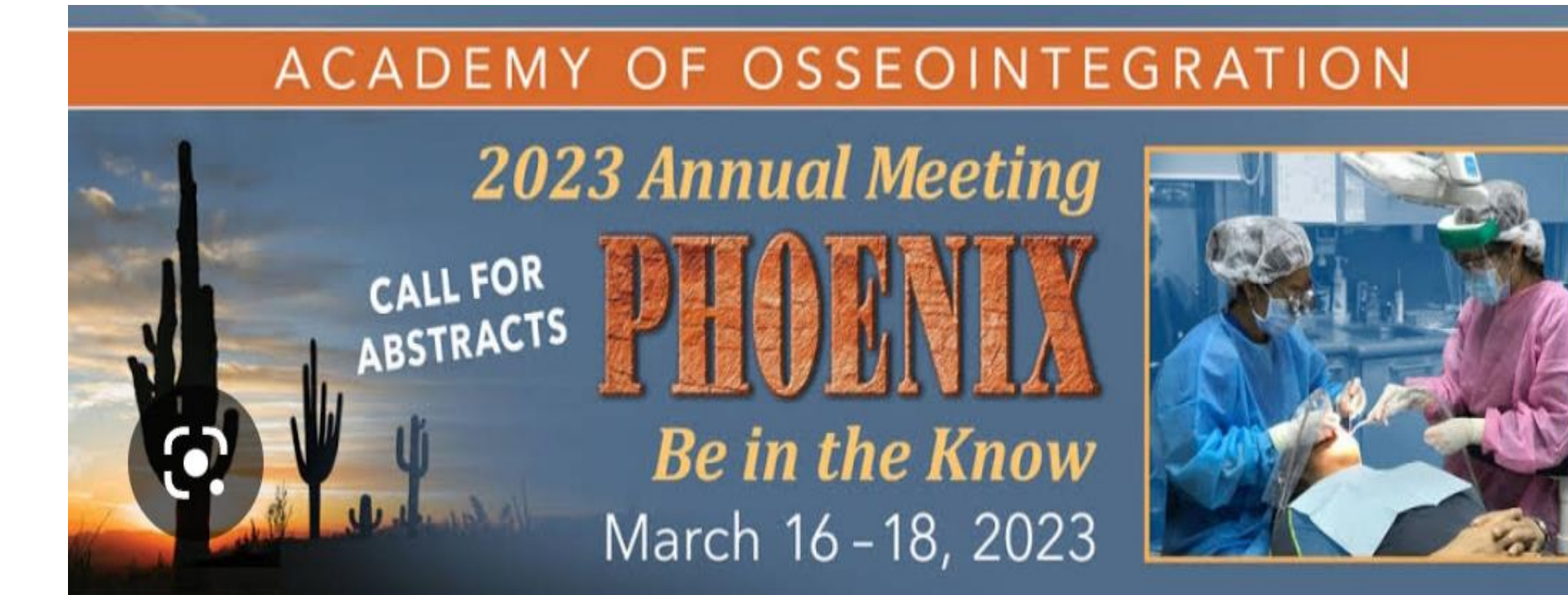




Computer Guided Autogenous Cortical Shell (Khoury Plates) Harvesting And Positioning Using patient Specific Guides (PSGs) Versus Free Hand Protocol for Horizontal Bone Augmentation At The Anterior Maxillary Alveolar Ridges



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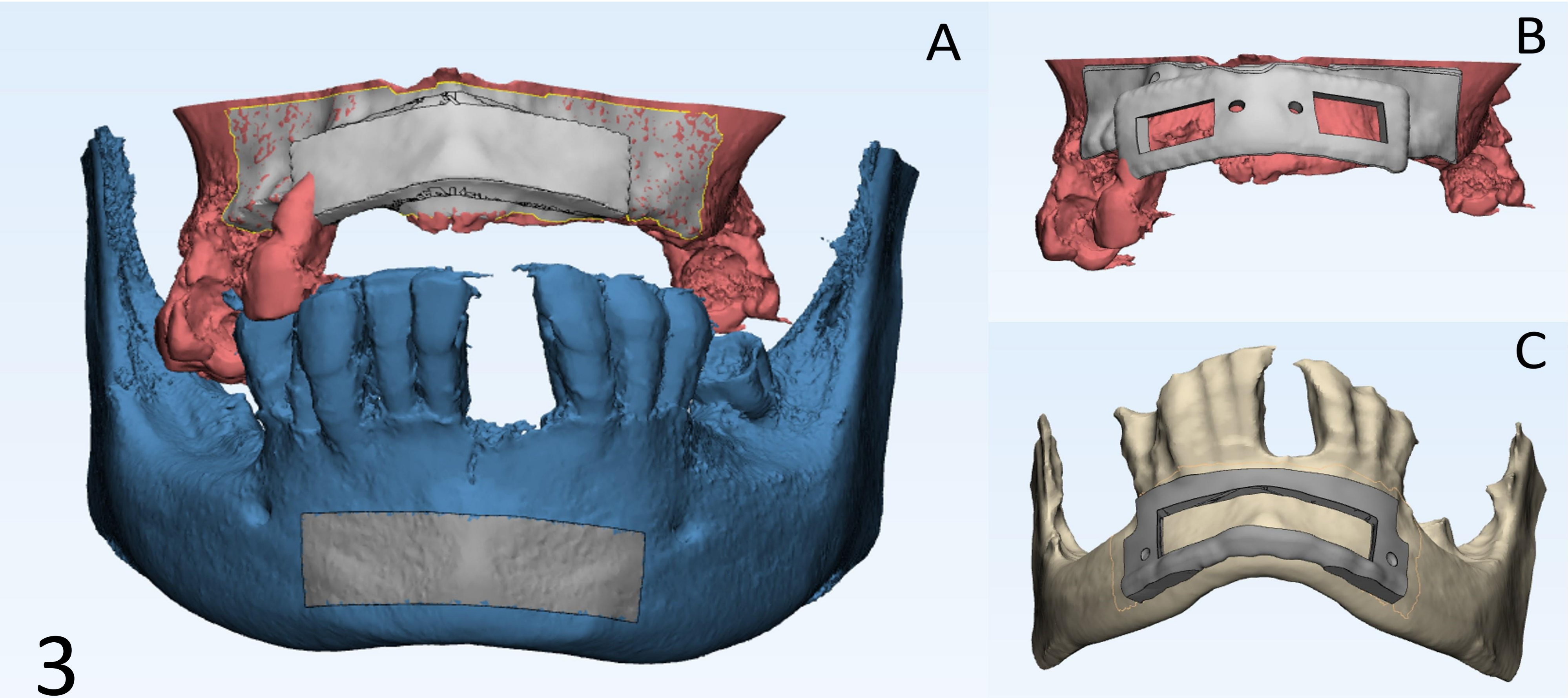
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Introduction: the cortical shell technique (Khoury plates) is one of the most trustworthy techniques for horizontal augmentation. This study suggests a full digital protocol using 2 bone-supported patient-specific surgical guides (harvesting and positioning guides) for safe graft harvesting and precise positioning to maximize the benefits of this technique for inexperienced operators.



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

Methods: This was a randomized clinical trial including 14 patients with horizontally deficient anterior maxilla were divided randomly into two groups 7 patients received free hand harvesting and fixation of cortical shells from the symphysis (control group) while the other 7 patients received the same protocol using 2 patient-specific guides, the first guide (harvesting guide) used for safe and accurate graft harvesting with the proposed dimensions while the second guide used for shell fixation leaving the desired gap with the recipient site that was filled with a particulate 1:1 mix of Xenogeneic and autogenous grafts. A CBCT scan was requested preoperative, immediately post-operative, and 4 months postoperative to measure the bone width gain and to determine the accuracy of shell fixation.



Case 1: Fig 3 :(A) preoperative proposed Graft Dimensions, (B) virtual 3D design of the positioning guide frontal view, (C) virtual 3D of harvesting guide frontal view

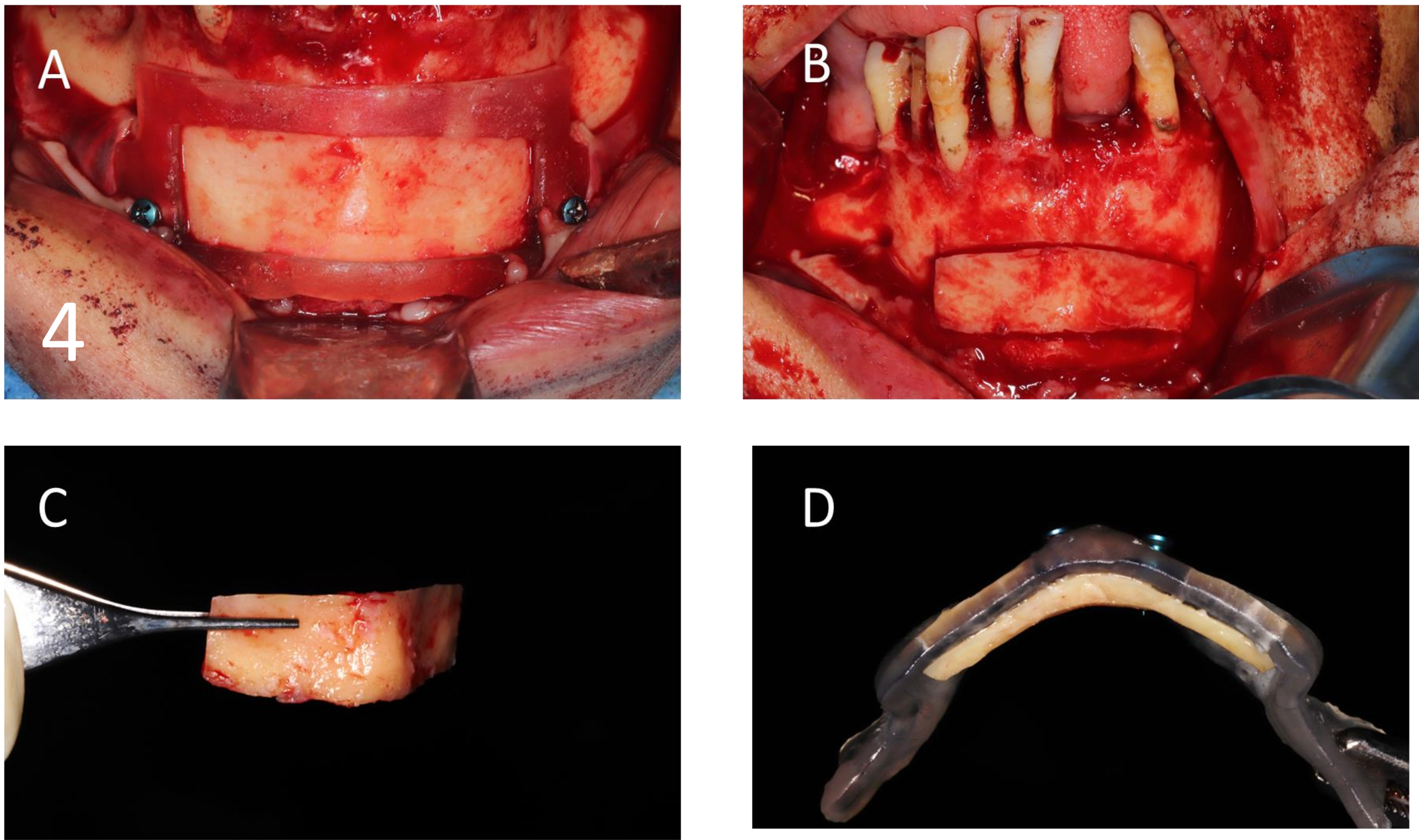


Fig 4 (A), Harvesting guide in place fixed by monocortical screws (B), bone block outline after removal of the guide (C),harvested Thin cortical shell (D),Cortical shell fixed in the positioning guide

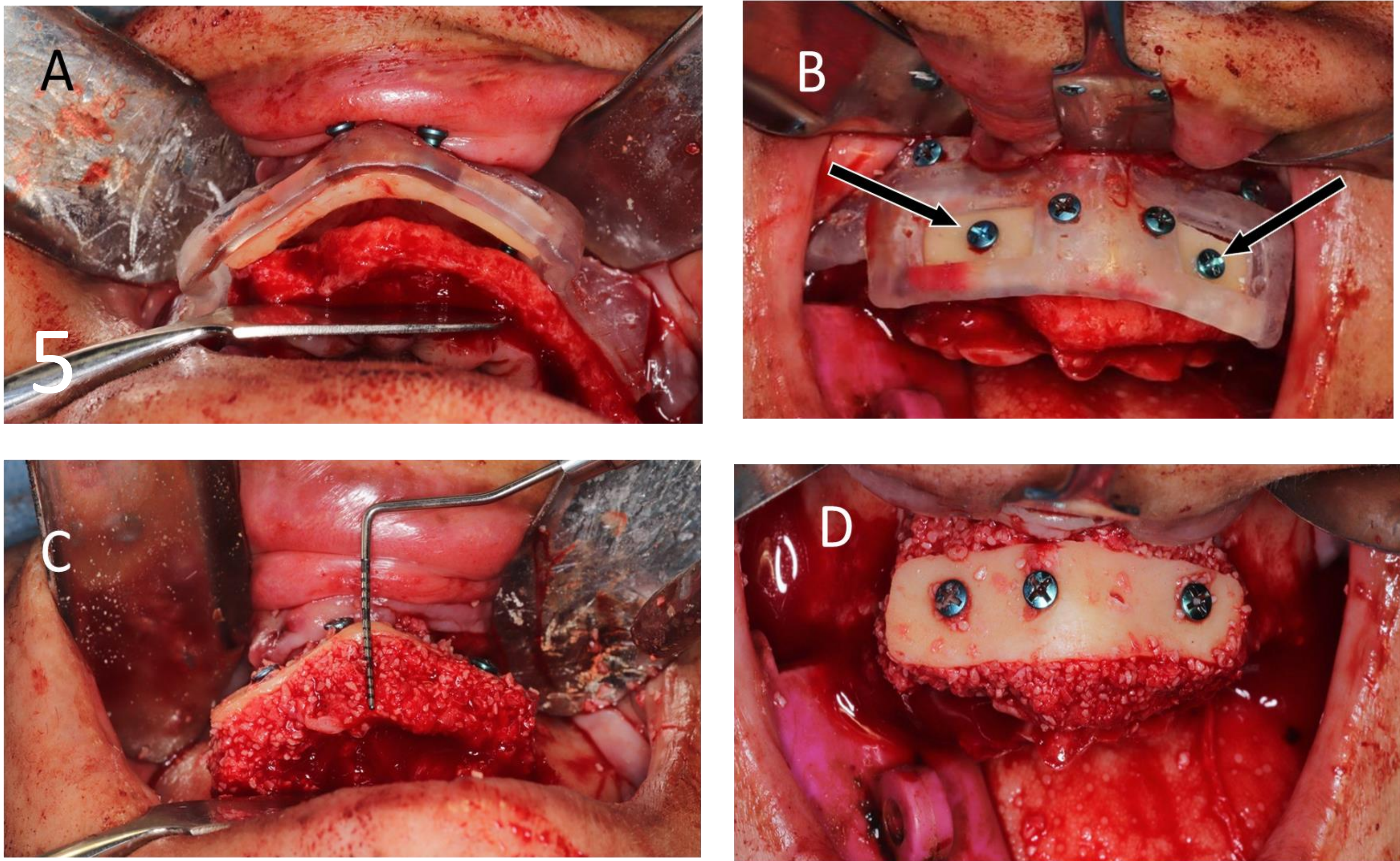


Fig 5(:A) occlusal view of the whole assembly fixed to the native bone by 2 screws ,(B) another 2 monocortical screws fixing the shell in a through and through manner via an open window in the positioning guide , (C) final occlusal view D)frontal final view after guide removal

Fig 6: superimposition on between the planning (blue color) and immediate postoperative CBCT

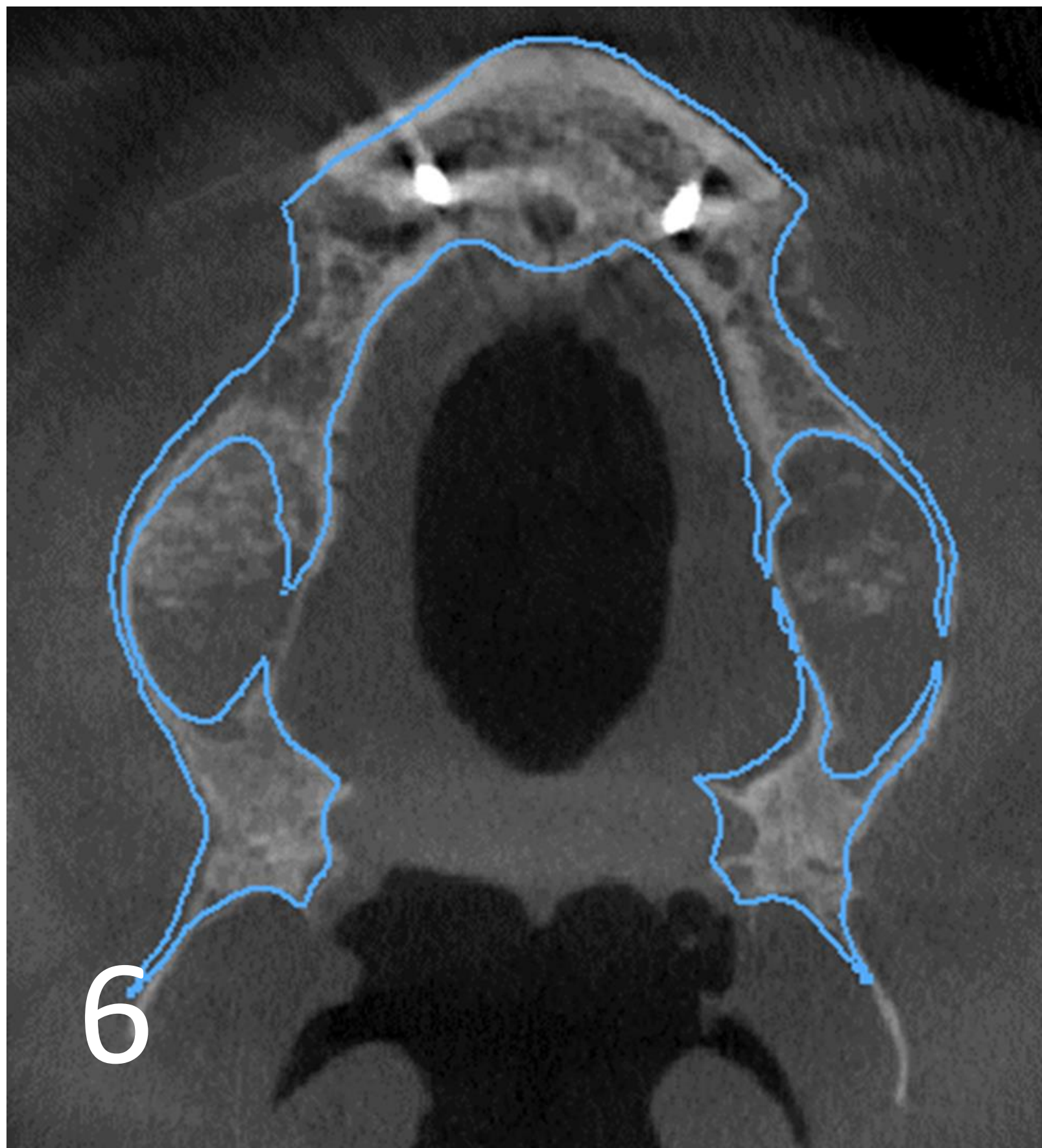
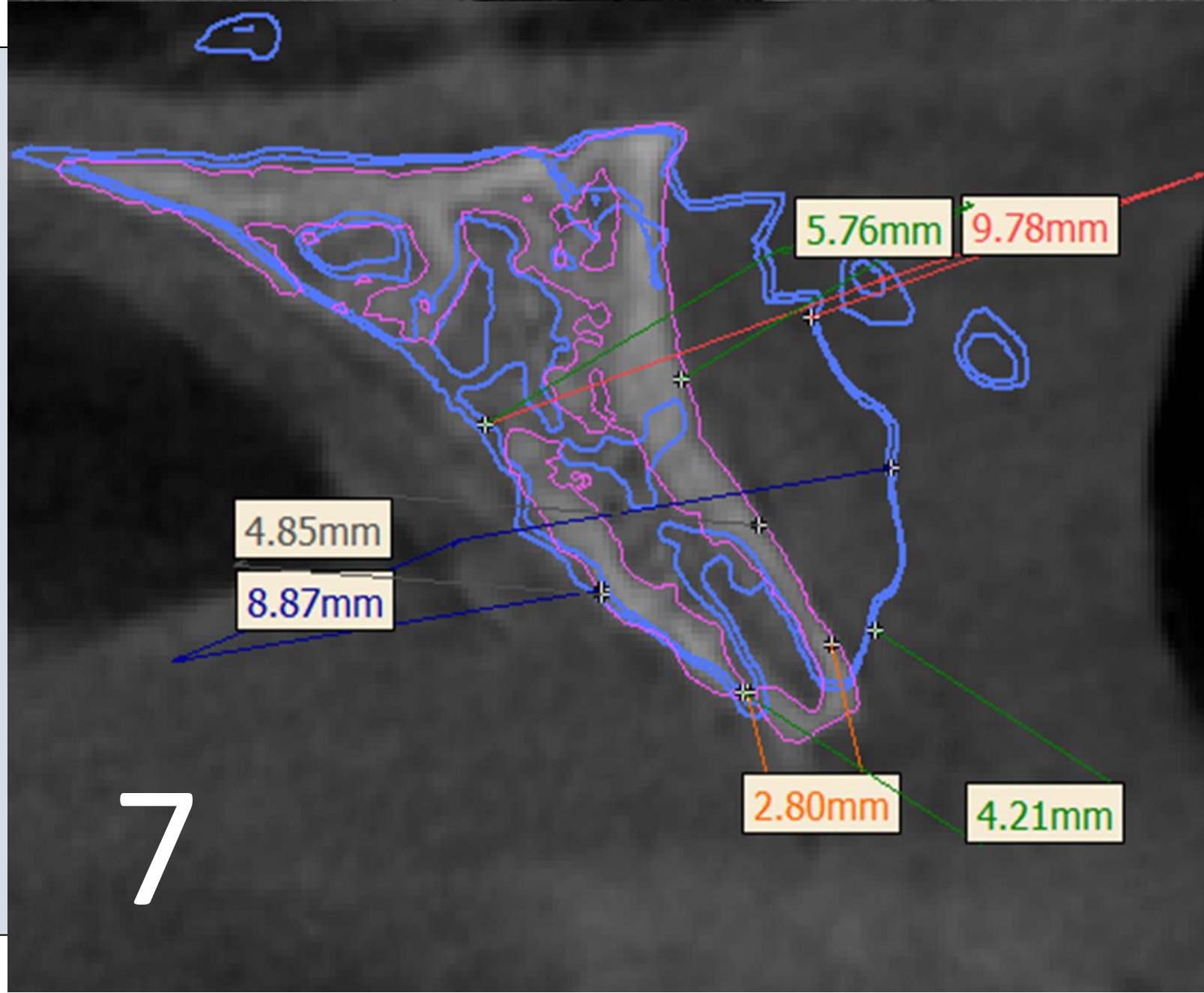


Fig 7: susperimposition of the ridge preoperatively (pink Color)and the postoperative showing the bone Gain



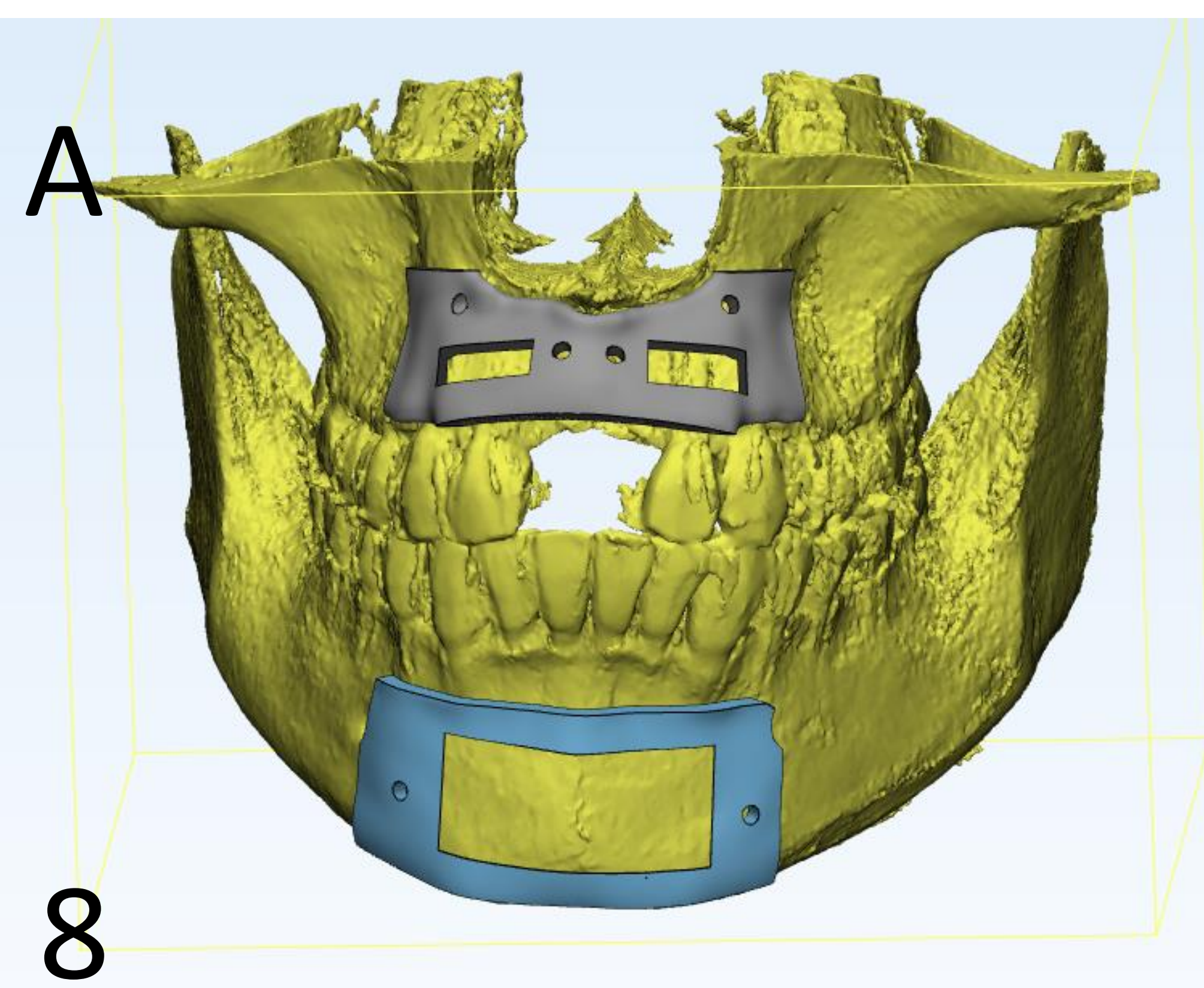


Fig 8 **CASE 2** (a)) virtual3D design of the patient specific harvesting and positioning guides

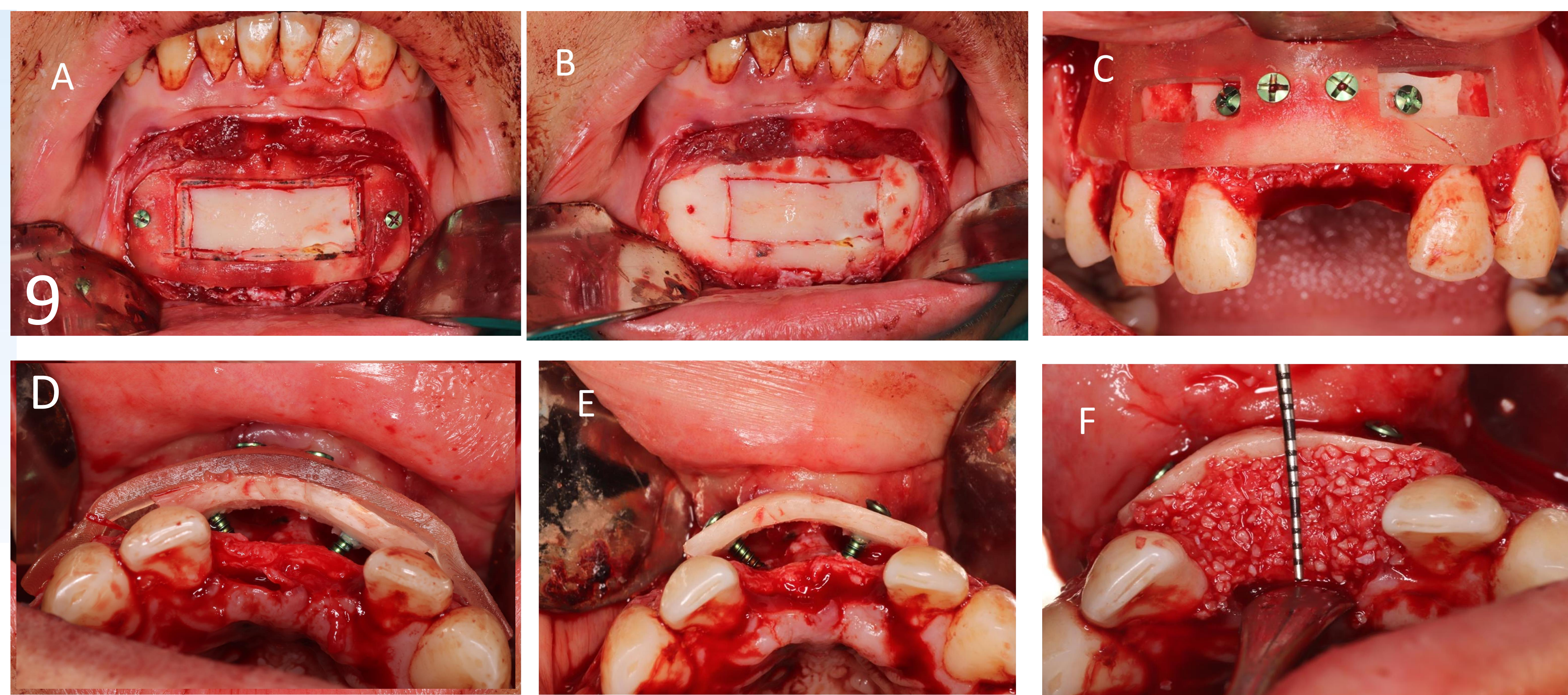


Fig 9 **CASE 2**: (A)monocortical screws fixing the harvesting guide , (b) bone block dimensions after guide removal(C) positioning guide fixed in place (D,E)cortical shell fixed to the recipient site bone in an accurate 3D position ,(f)the interpositional gap filled with bone paricles

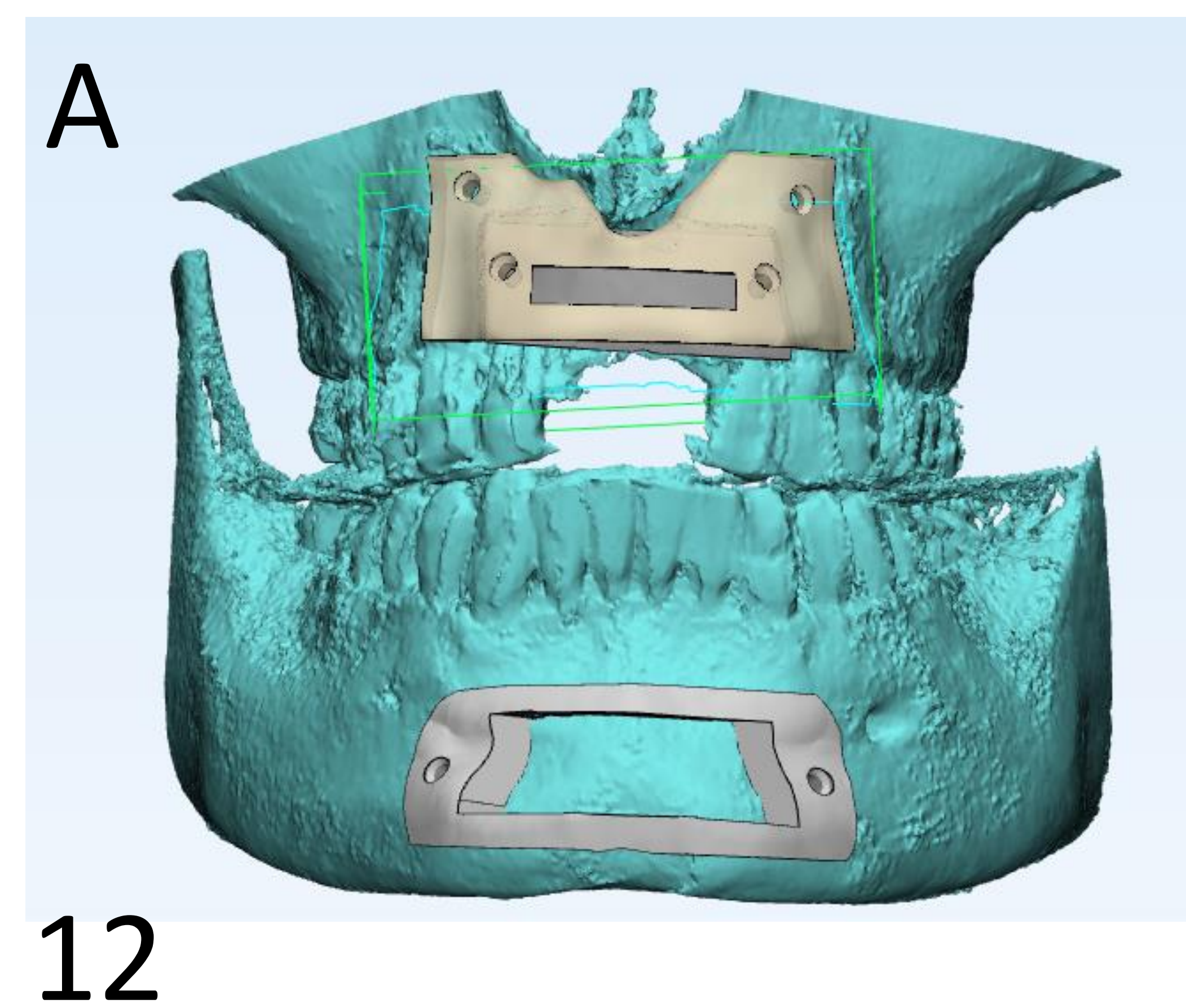


Fig 12: **CASE 3** preoperative virtual design of the patient specific guides

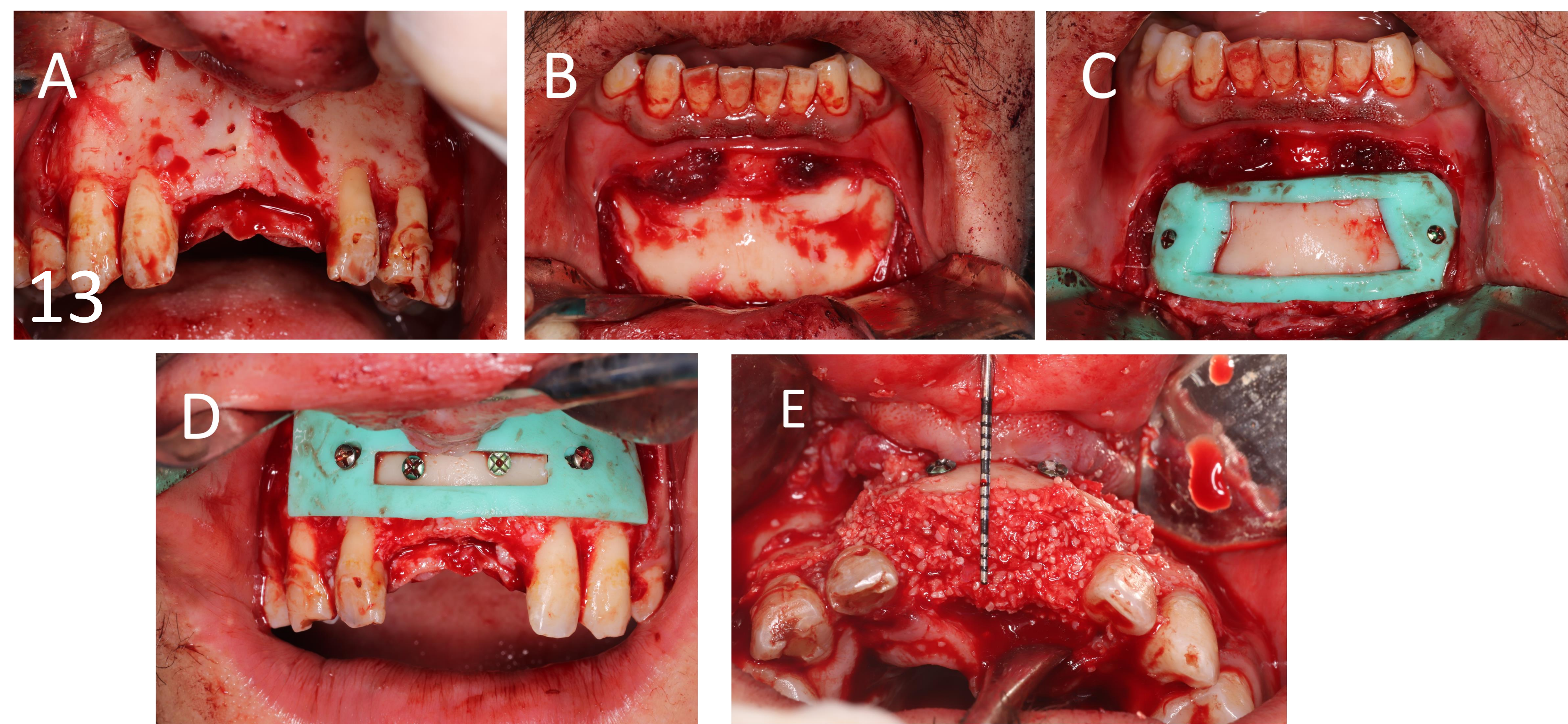


Fig 13 **CASE 3** (A,B) full thickness flap exposurein donor and recipient sites,(C)harvesting guide in place fixed by monocortical screws,(D,E) cortical shell fixation at the desired 3d position via the opened window and final graft with interpositional particulates occlusal view

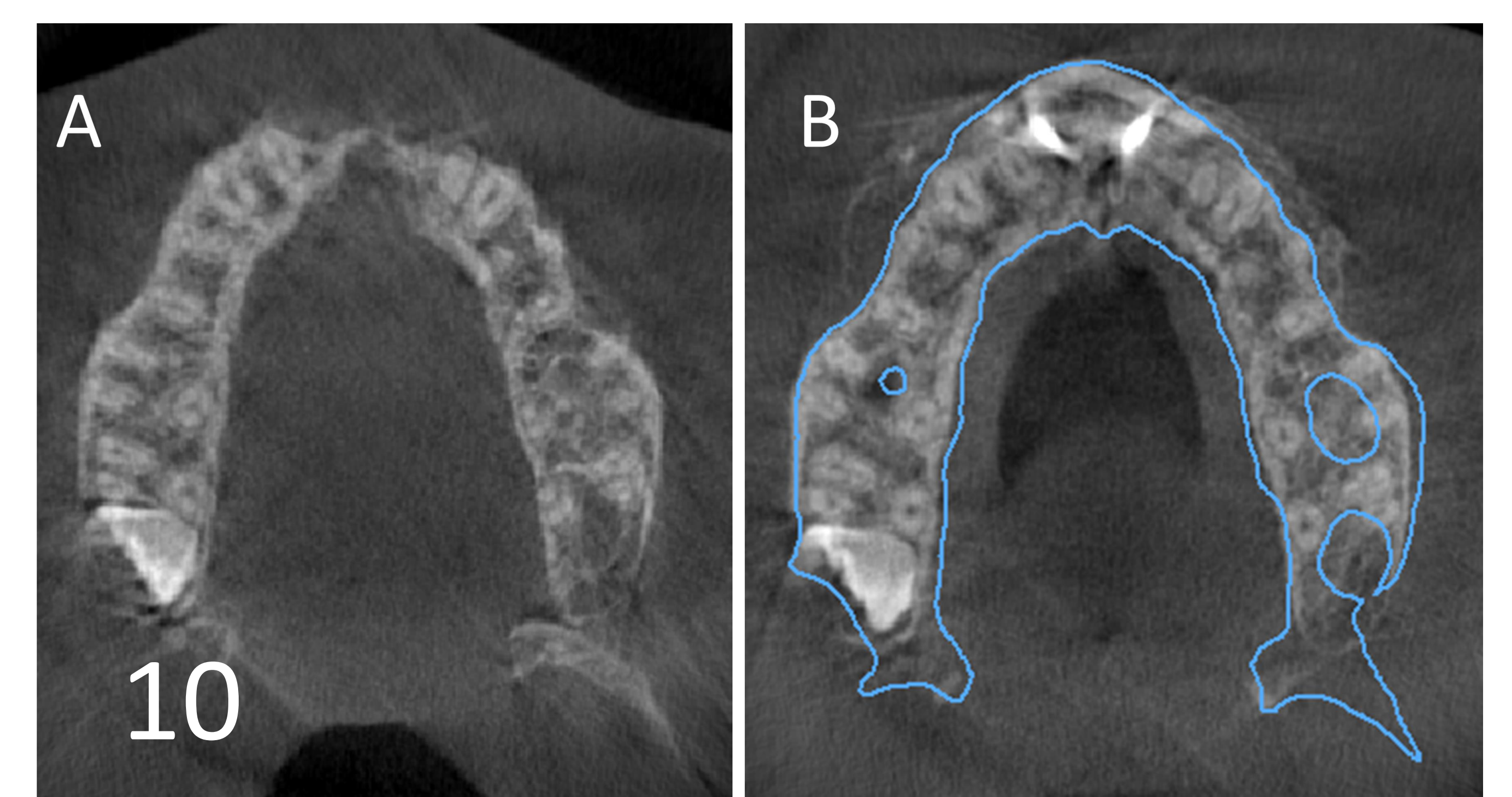


Fig 10 (A) **CASE 2**: (A) pre-operative axial cut,(B)showing the superimposition of planning ridge contour (blue line) over the post-operative contour

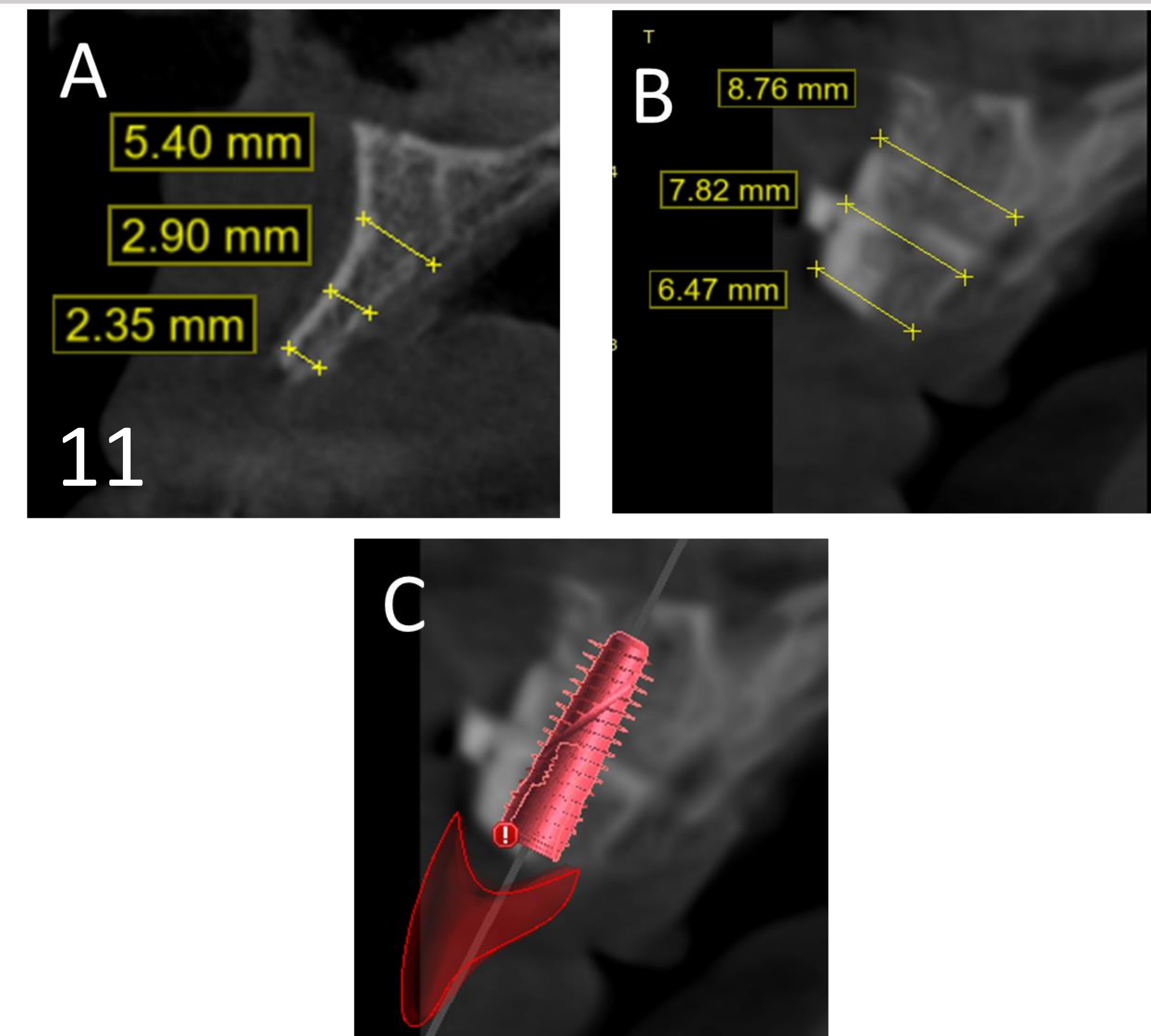


Fig 11: **CASE 2**: (A) preoperative CBCT,(B) 4 months post-operative CBCT,(C) implant planning.

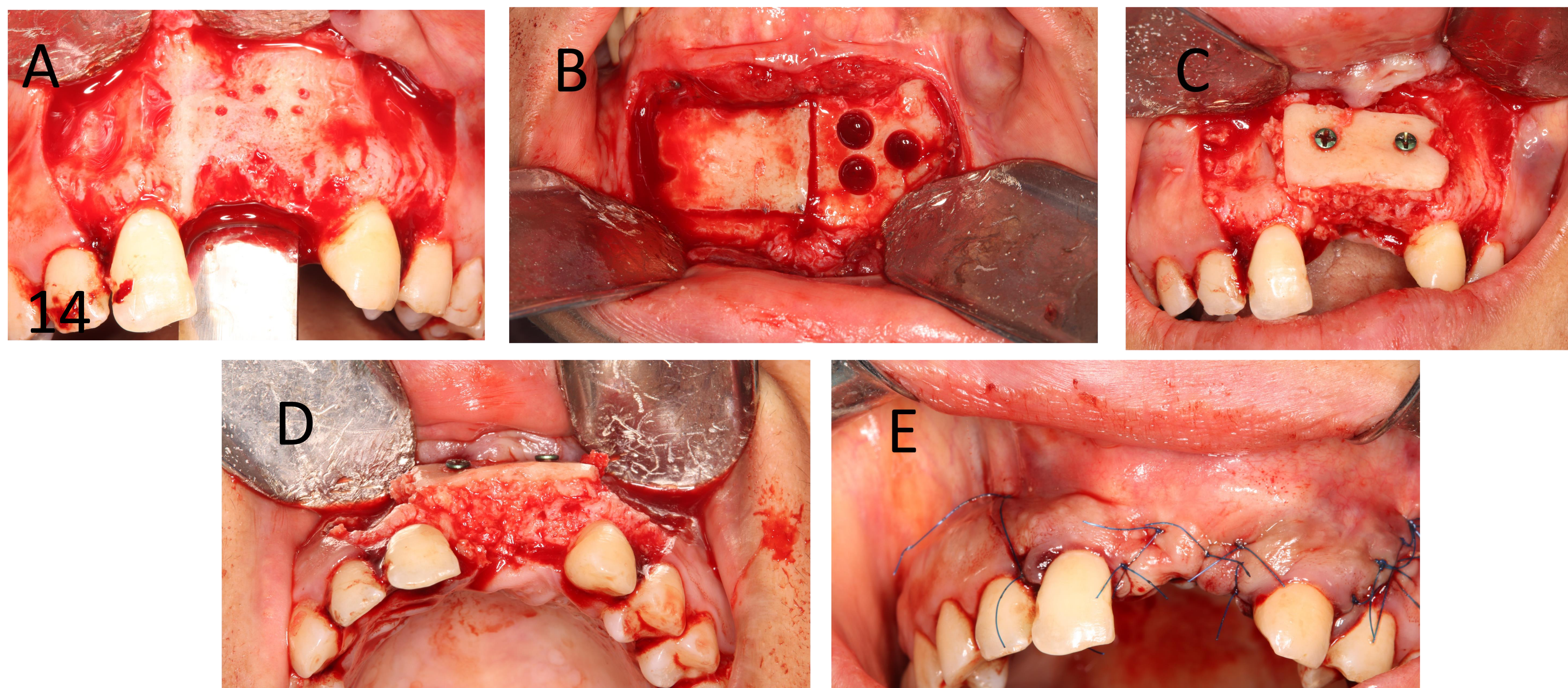


Fig 14 CASE 1 Free Hand Group: (A) recipient site preparation (B): free hand osteotomy site preparation graft harvesting (C) frontal view for fixed graft,(D) occlusal view after fixation and particulate bone placement, (E) recipient site closure

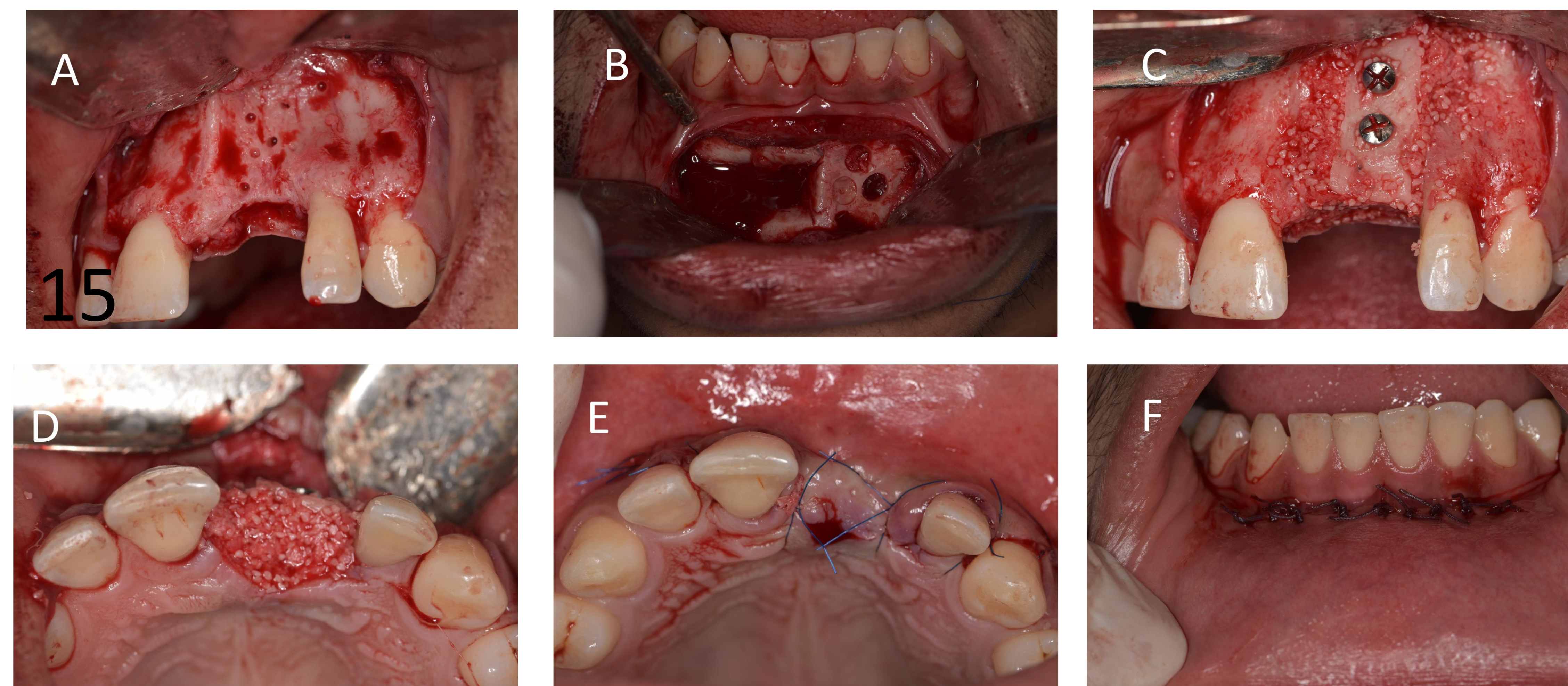


Fig 15 CASE 2 Free Hand Group: (A) recipient site preparation, (B) bone harvested from chin area ,(C) frontal view after fixation, (D) final occlusal view, (E) closure of recipient site, (F) finally closure of donor site.

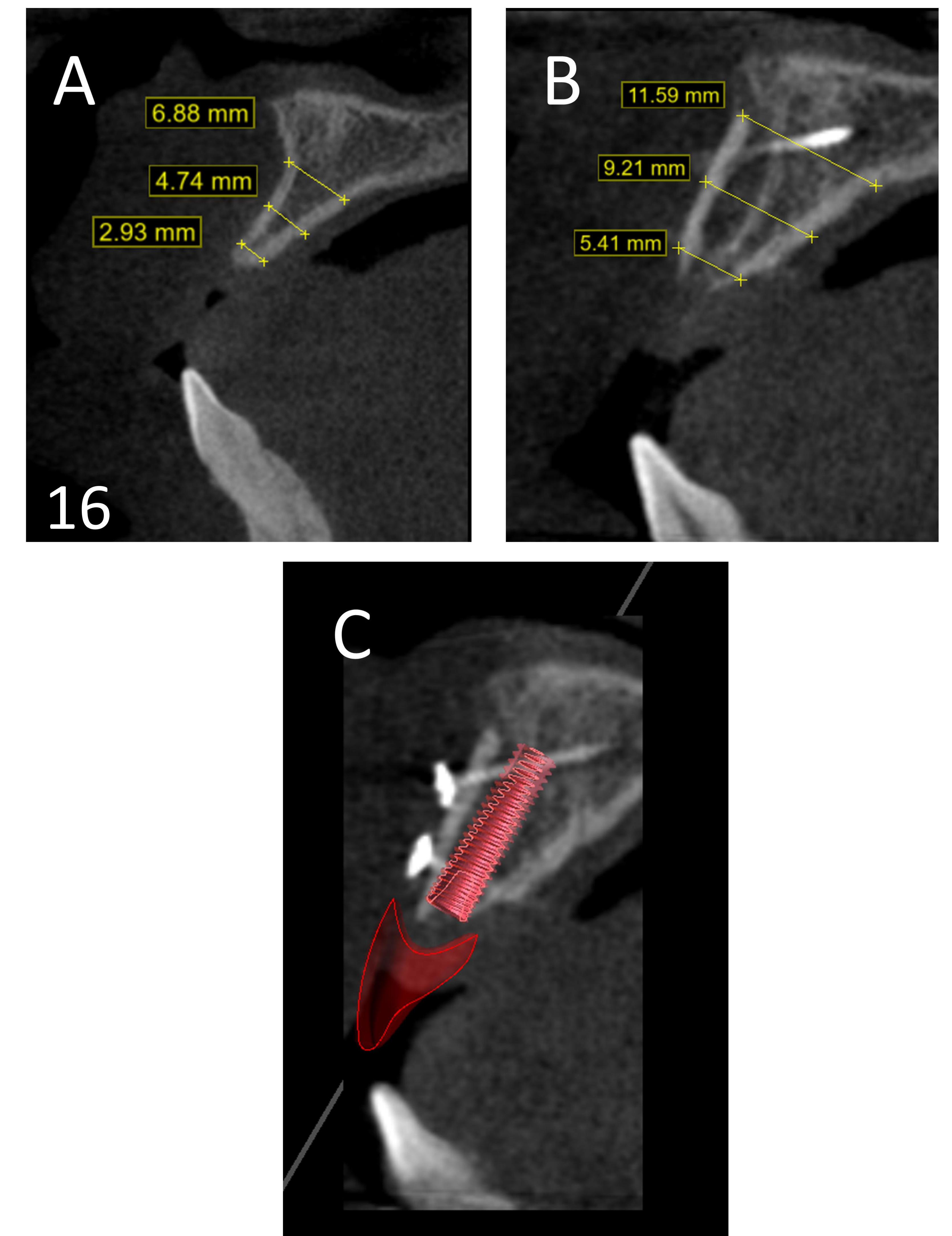


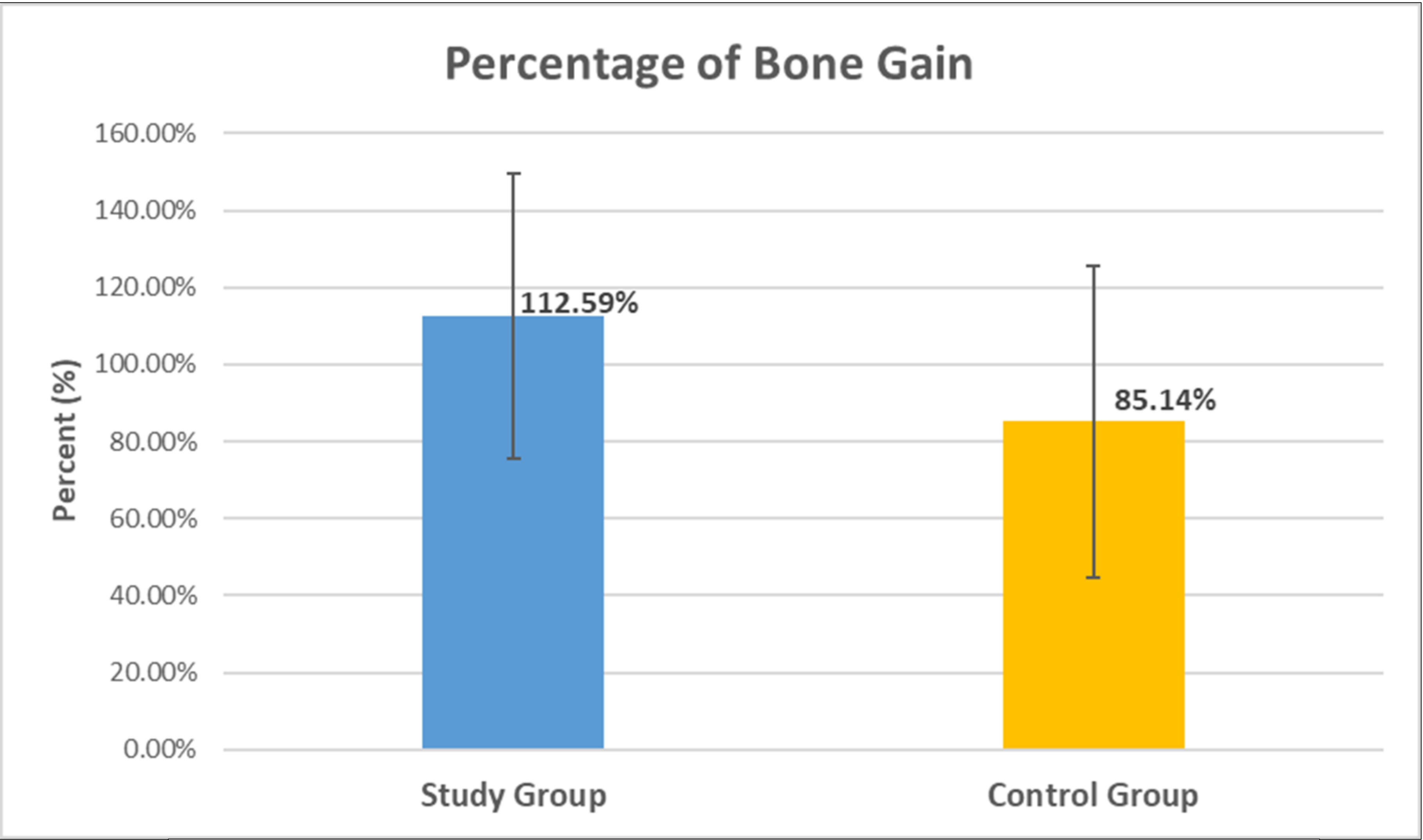
Fig 16 CASE 2 Free Hand Group : (A) Preoperative and (b) 4 months postoperative,(C) implant planning

Results: Wound healing was uneventful for all the patients except one patient in the control group and one case in the study group that shows failure.

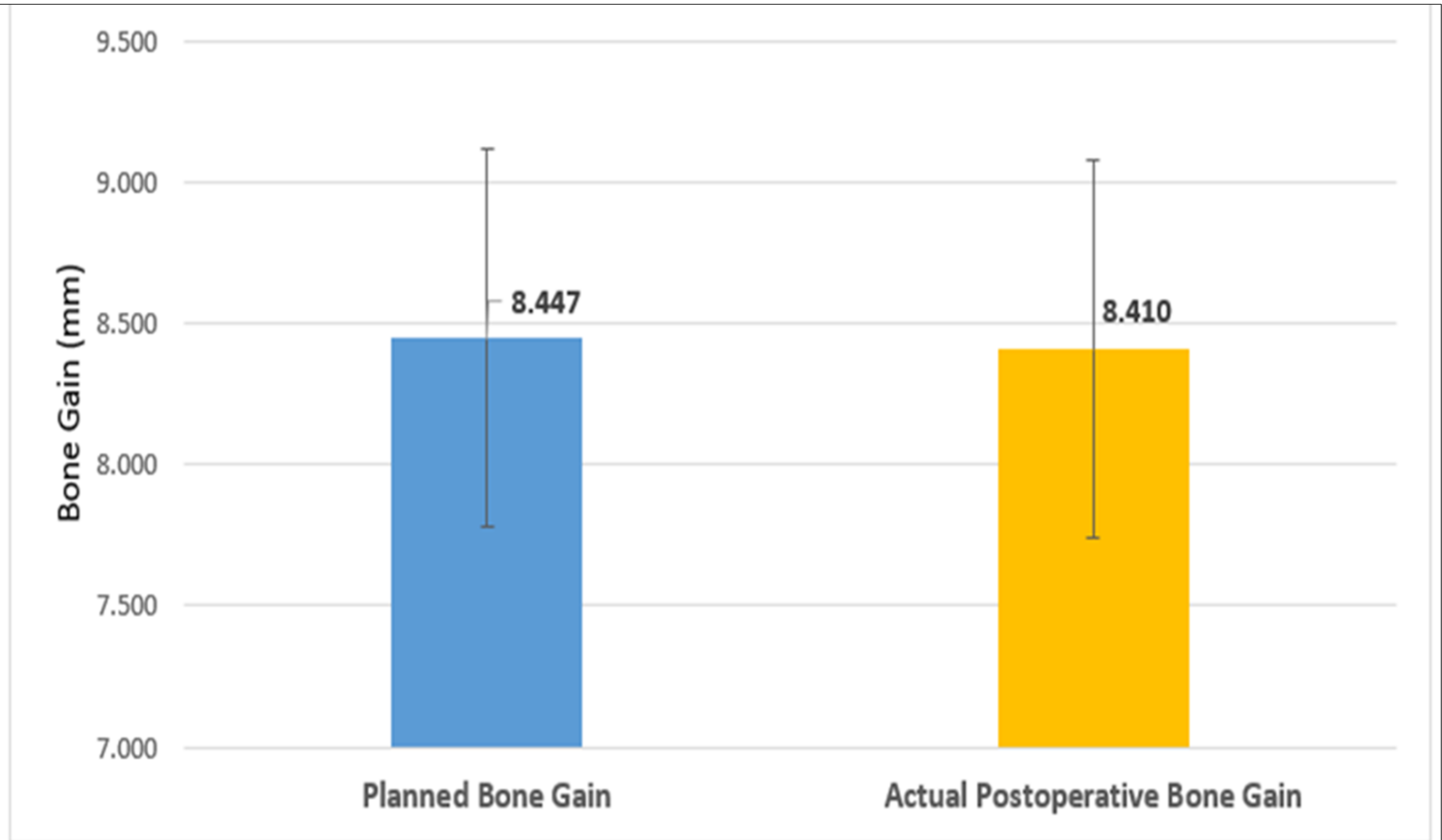
Mean value of bone gain percentage of Study group ($112.59\% \pm 37.04\%$) while the control group ($85.14\% \pm 40.38\%$) yet the difference was not statistically significant.

Result of accuracy measurement showed that the mean value of planned horizontal bone gain of the Study group (8.447 ± 0.67) mm was comparable to the mean value of the actual immediate postoperative bone gain (8.41 ± 0.668)mm, and the difference was not statistically significant.

conclusion computer guided autogenous cortical shell harvesting and fixation protocol could be a precise and accurate alternative to the conventional technique, especially for those beginners and inexperienced oral surgeons



Bar chart showing percentage of bone gain between both groups



Bar chart showing of bone gain in mm between both groups