



“ Measurements of volume and density in bone grafts placed in maxillary sinus floor elevation surgeries with the lateral window technique with computerized tomography reading and image editing programs. Report of two cases. ”

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INTRODUCTION

The sinus floor elevation technique and implant placement in the regenerated area have been successfully used when atrophic posterior maxilla are found.¹ Several studies highlight the correlation between bone quality, primary stability and successful osseointegration.² With the use of the segmentation technique applied to cone beam computerized tomographies (CBCT), it is possible to obtain volume and density data that can be useful for treatment planning of implant placement (Fig 1).

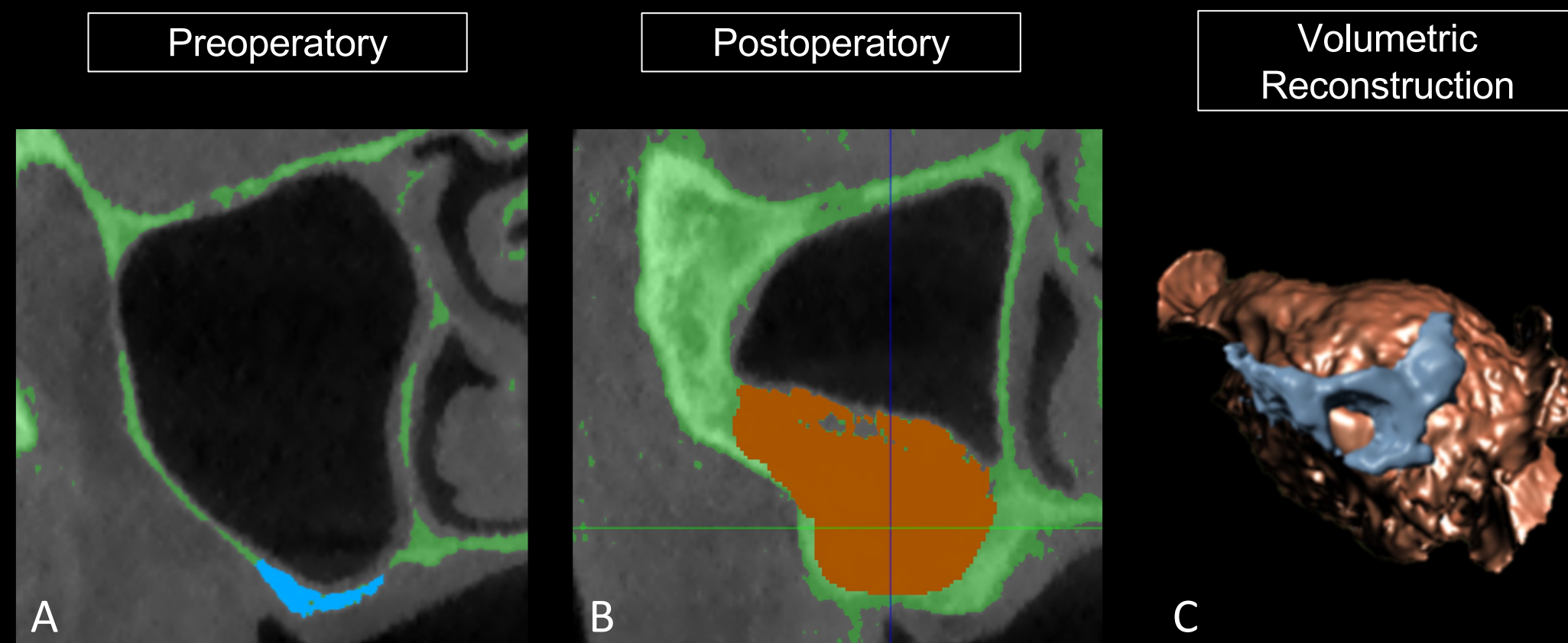


Figure 1. A. Segmentation of the preoperative volume. B. Segmentation of the postoperative volume. C. Splice of the volumetric pre and postoperative reconstructions.

METHODS

3D measurement of bone volume

By means of a tomographic density highlighter, pre and post bone structures were separated and formatted in a standard triangular language (STL) and introduced into the Meshmixer®(USA) software.

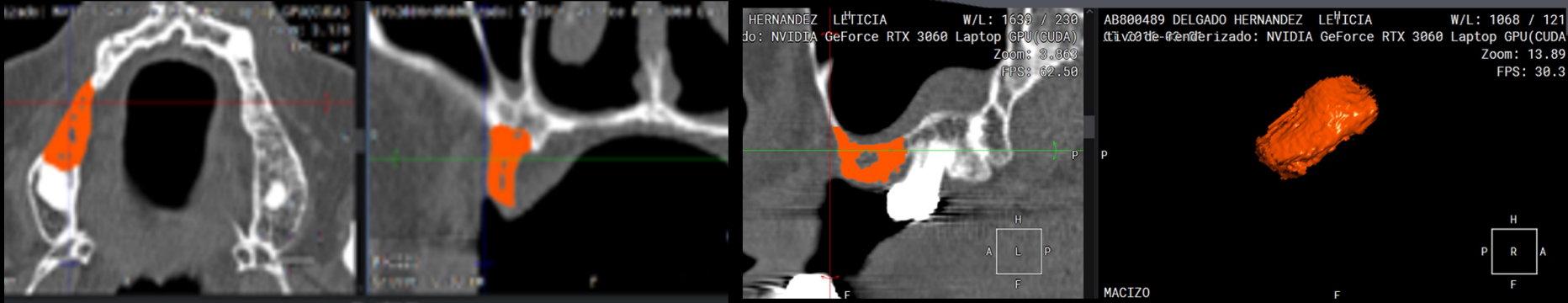
A
Segmentation of
pre and post
operative volume

B
Splicing in
Meshmixer®

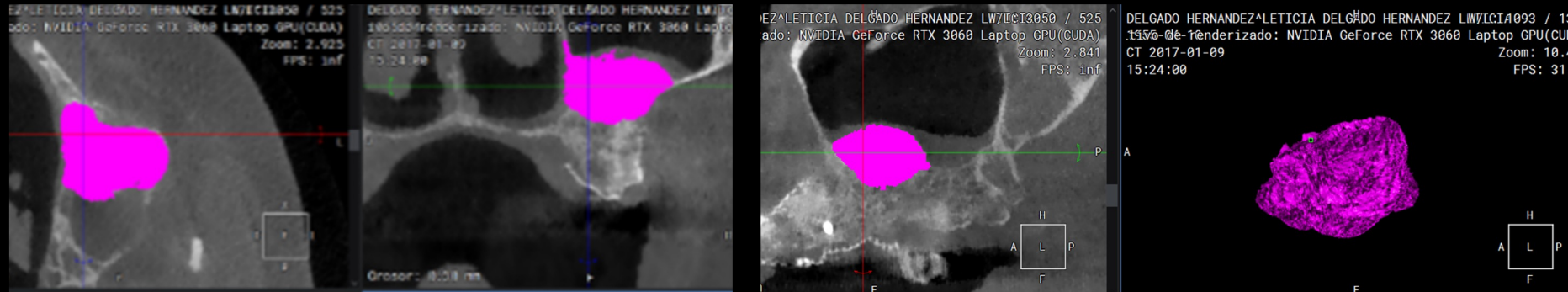
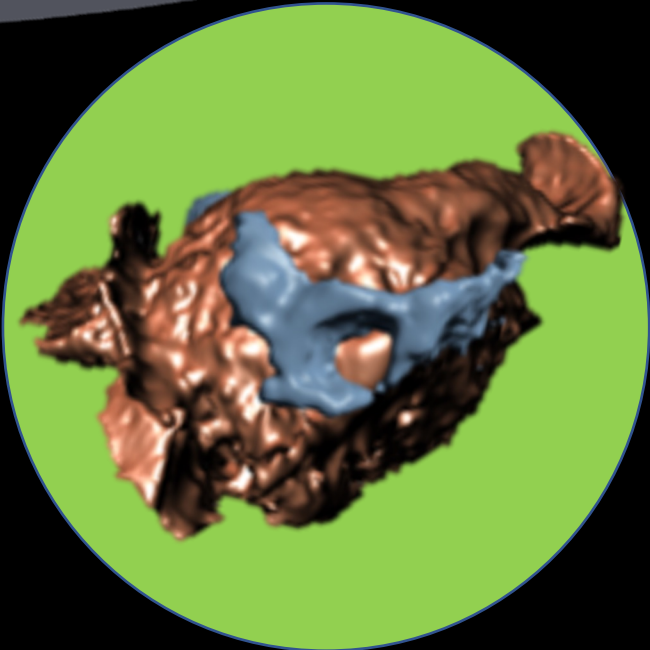
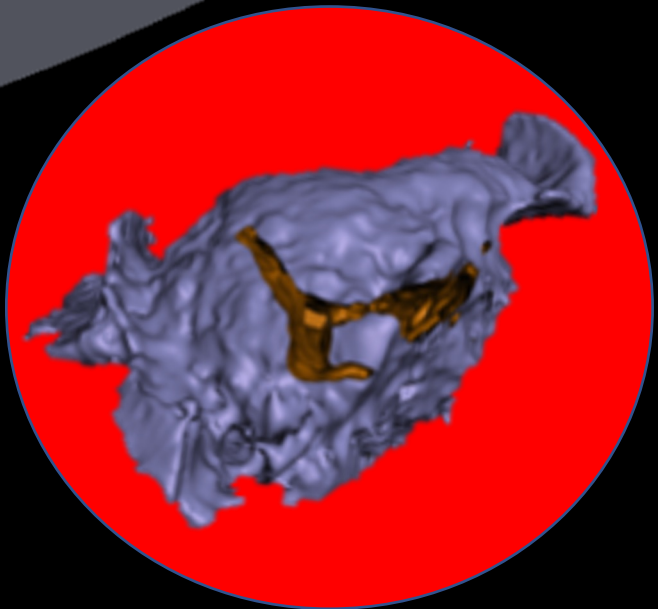
C
Substraction of
gained volume by
boolean
operations.

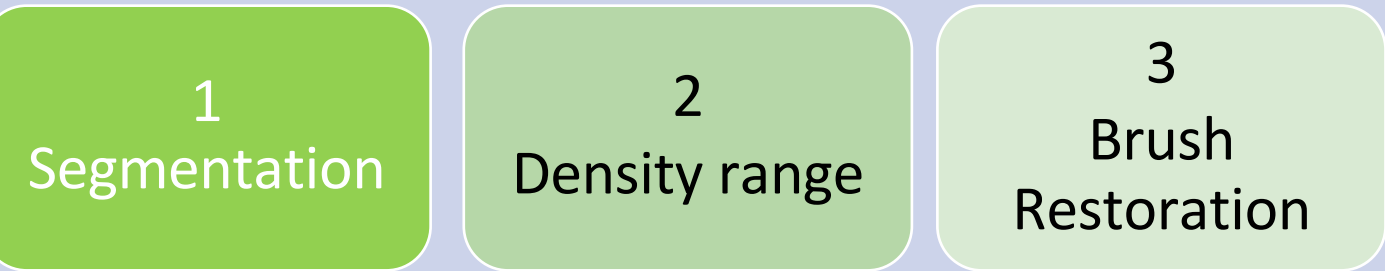
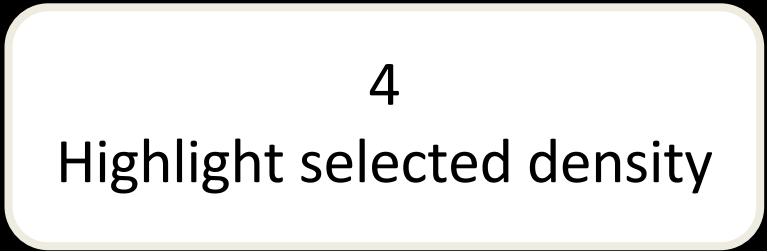
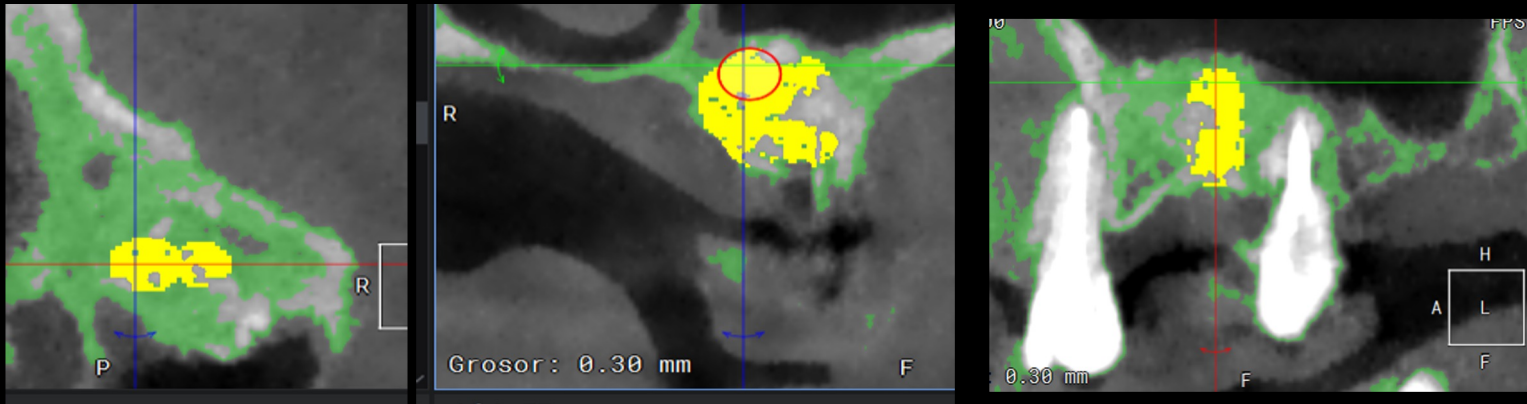
D
The STL result that
measures the final
gain.

Preoperative



Postoperative

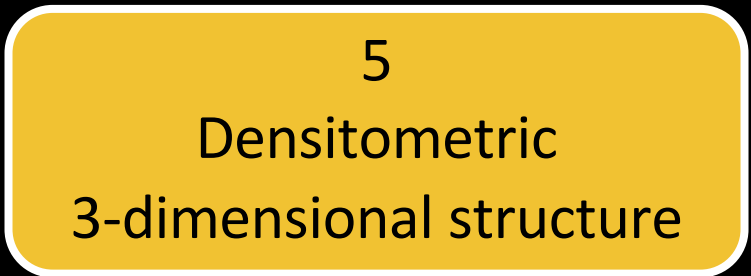
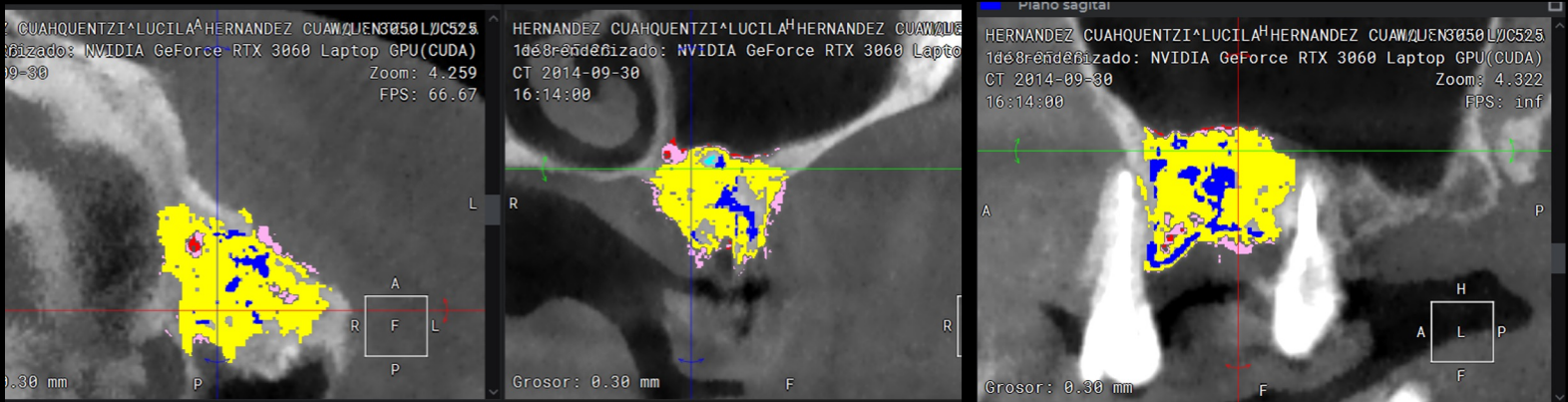
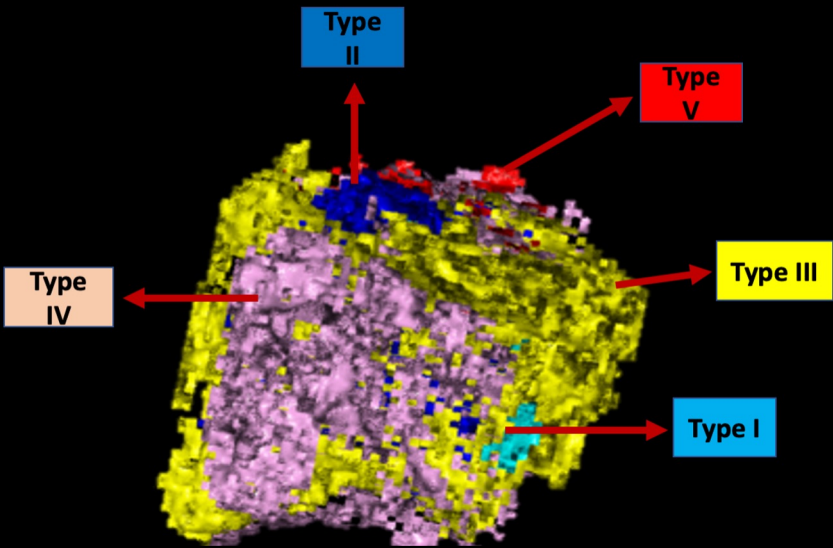




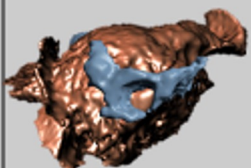
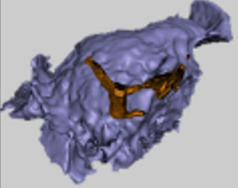
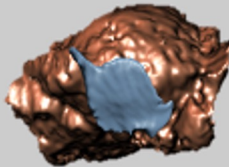
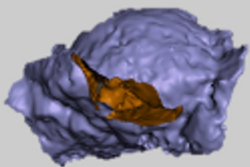
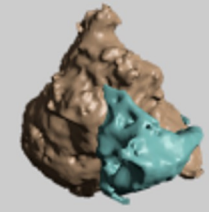
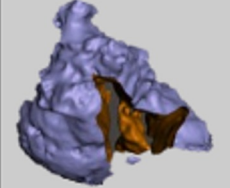
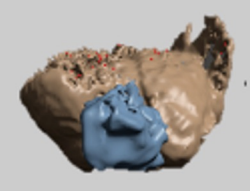
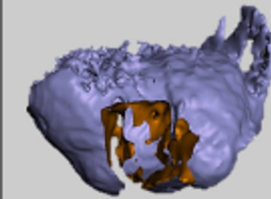
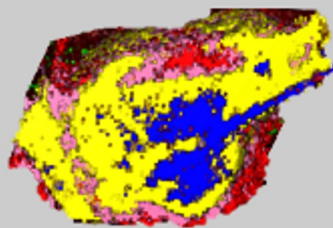
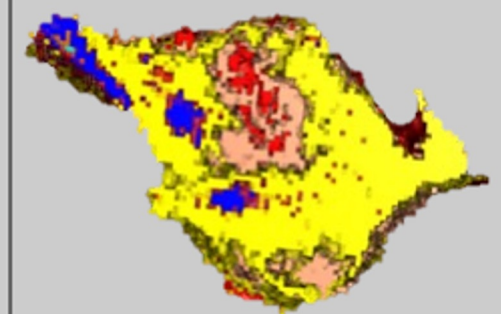
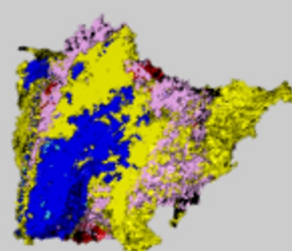
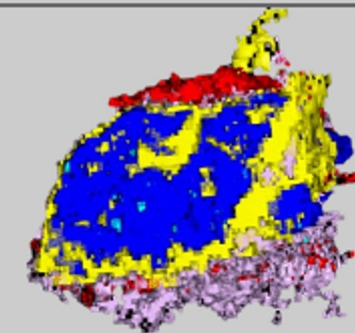
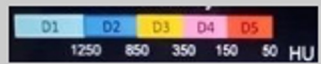
METHODS

3D measurement of bone density.

The Inobitec® software enables the segmentation of the images in the osseous regeneration area and it is possible to assign different colors to different densities according to HU scales, obtaining a three-dimensional densitometric structure.



☒	0-150 UH	☒	0.023 cm ³
☒	150-300 UH	☒	0.210 cm ³
☒	350-850 UH	☒	0.866 cm ³
☒	850-1250 UH	☒	0.268 cm ³
☒	1250 - UH	☒	0.011 cm ³

Bone Graft 3D Segmentation Chart								
	Patient # 1				Patient # 2			
Side	Right		Left		Right		Left	
Volume gains	1.27 cm ³		2.62 cm ³		1.10 cm ³		1.64 cm ³	
Segmented 3D volume gains (Boolean difference) (Blue: pre Brown: post)	Pre-Post	Cut	Pre-Post	Cut	Pre-Post	Cut	Pre-Post	Cut
								
Bone Type Classification (Misch, 1989)	% of bone Type							
Type I (M: > 1250 HU)	0 %		0.26 %		2.7 %		1.61 %	
Type II (M: 850 - 1250 HU)	11.29 %		6.06 %		38.2 %		32.3%	
Type III (M: 350 – 850 HU)	65 %		71.46 %		35.4 %		31 %	
Type IV (M: 150 – 300 HU)	16.26 %		21.03 %		19.9 %		24.2 %	
Type V (M: < 150 HU)	7.04 %		1.2 %		3.71 %		10.42 %	
Segmented 3D densitometric structure								
								

RESULTS

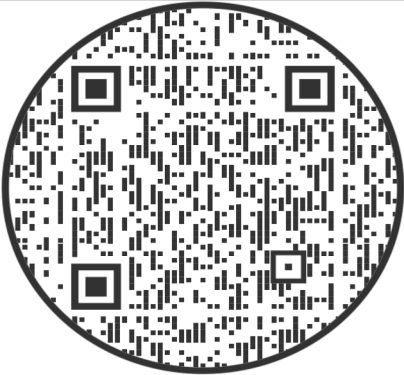
In patient 1, a volume of bone gain of 1.27 cm³ was obtained on the right side, and 2.62 cm³ on the left side. The most common type of bone on the right side was type III, with 65%. The most common type of bone on the left side was type III, with 71.46%.

In patient 2, a volume of bone gain of 1.10 cm³ was obtained on the right side, and 1.64 cm³ on the left side. The most common type of bone on the right side was type II, with 35.4%. The most common bone type on the left side was type II, with 31%.

CONCLUSION

The image segmentation and editing techniques used provided volume and density data that can be used for treatment planning of implant placement.

REFERENCES



ACKNOWLEDGMENTS

I would like to express my sincere gratitude to my teachers, to MsC. Lourdes Bravo Troncoso as the clinical advisor and Dr. Valentina García Lee as the methodological advisor of this work. For the invaluable work of Dr. Lorena Contreras Álvarez, Clinical Responsible of the High Specialization of Oral Implantology for facilitating the tomographic records used in this report.