

Success of Implant-Supported Restoration After Alveolar Osteotomy in Posterior Mandible Using Autogenous Bone or Synthetic Material: 10 years follow-up of randomized clinical trial

Britto, A.D ; Kalil, E.C ; Bordin, D. ; Siqueira, R.A ; Shibli, J.A

Department of Periodontology and Oral Implantology, Dental Research Division, University of Guarulhos (UnG),
Guarulhos, São Paulo, Brazil 🇧🇷

BACKGROUND

Although dental implants are considered an excellent and safe modality treatment, the posterior jaw rehabilitation has proved to be a challenge since the bone atrophy occurs associated with tooth loss. This atrophy limits the bone height available for implant placement due to the proximity of the inferior alveolar nerve (Bormann et al., 2010)

Alveolar osteotomy with interpositional is one of the alternatives for the rehabilitation of these cases (Jensen et al., 2006; Scarano et al., 2011; Laviv et al., 2014). The osteotomy could apparently guarantee a better vascular supply of the bone graft as well as the transport segment and could reduce the bone reabsorption observed in onlay block grafts (Felice et al., 2009) in addition to allowing the installation of part of the implant in native bone (Roccuzzo et al., 2020).

However, there are few reports of long-term follow-up of this technique to date (Kamperos et al., 2017; Roccuzzo et al., 2020).

This study aimed to assess the clinical and radiographic durability after 10 years of dental implants placed in the posterior areas of mandibles previously treated with this technique, in a split-mouth design with one side autologous bone (Fig. 1 control group) and in the other side non-ceramic hydroxylapatite - nCHA (Kawakami et al., 2012) (Fig. 2 test group).

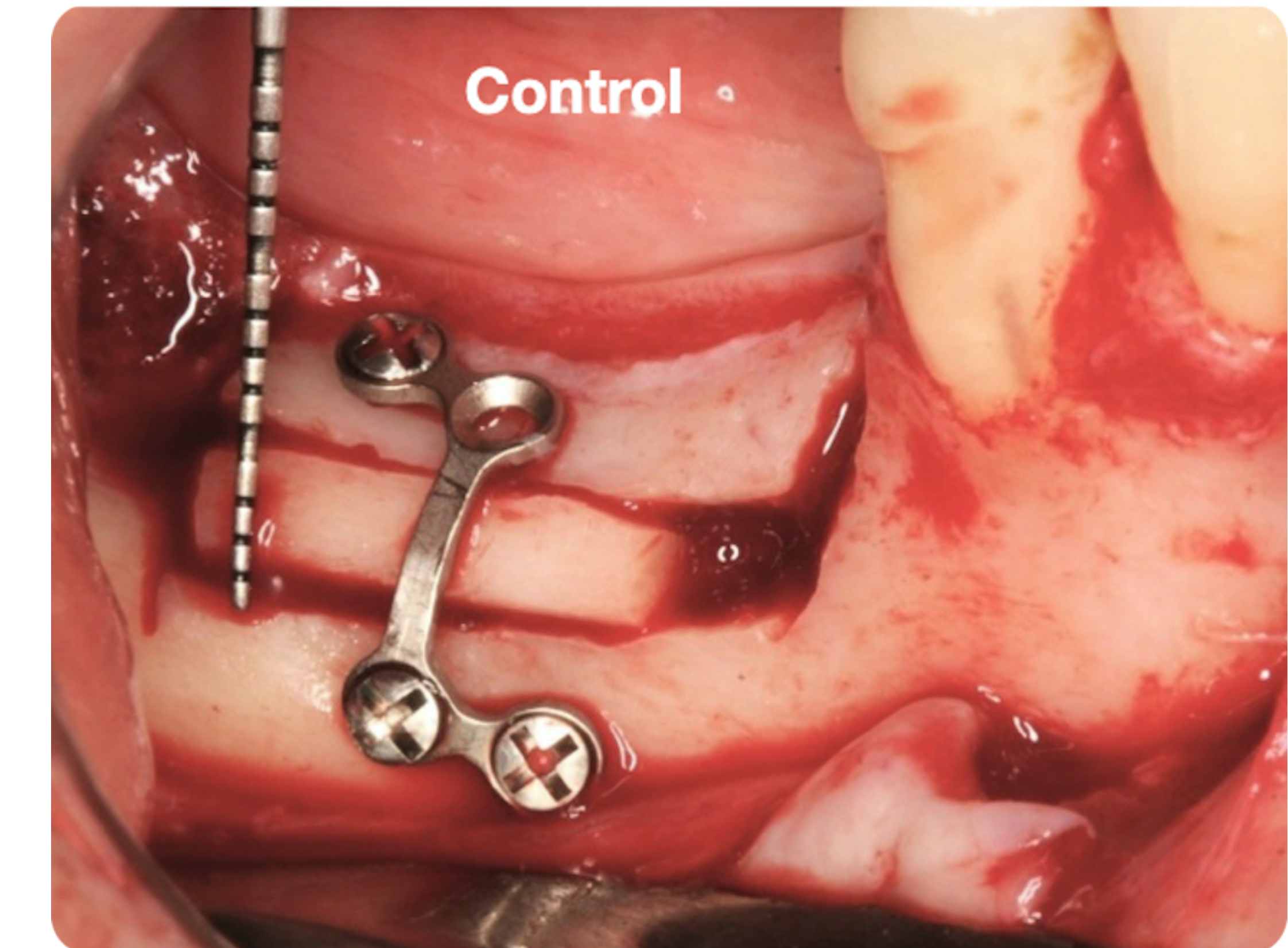


Fig. 1 - bone graft - control group

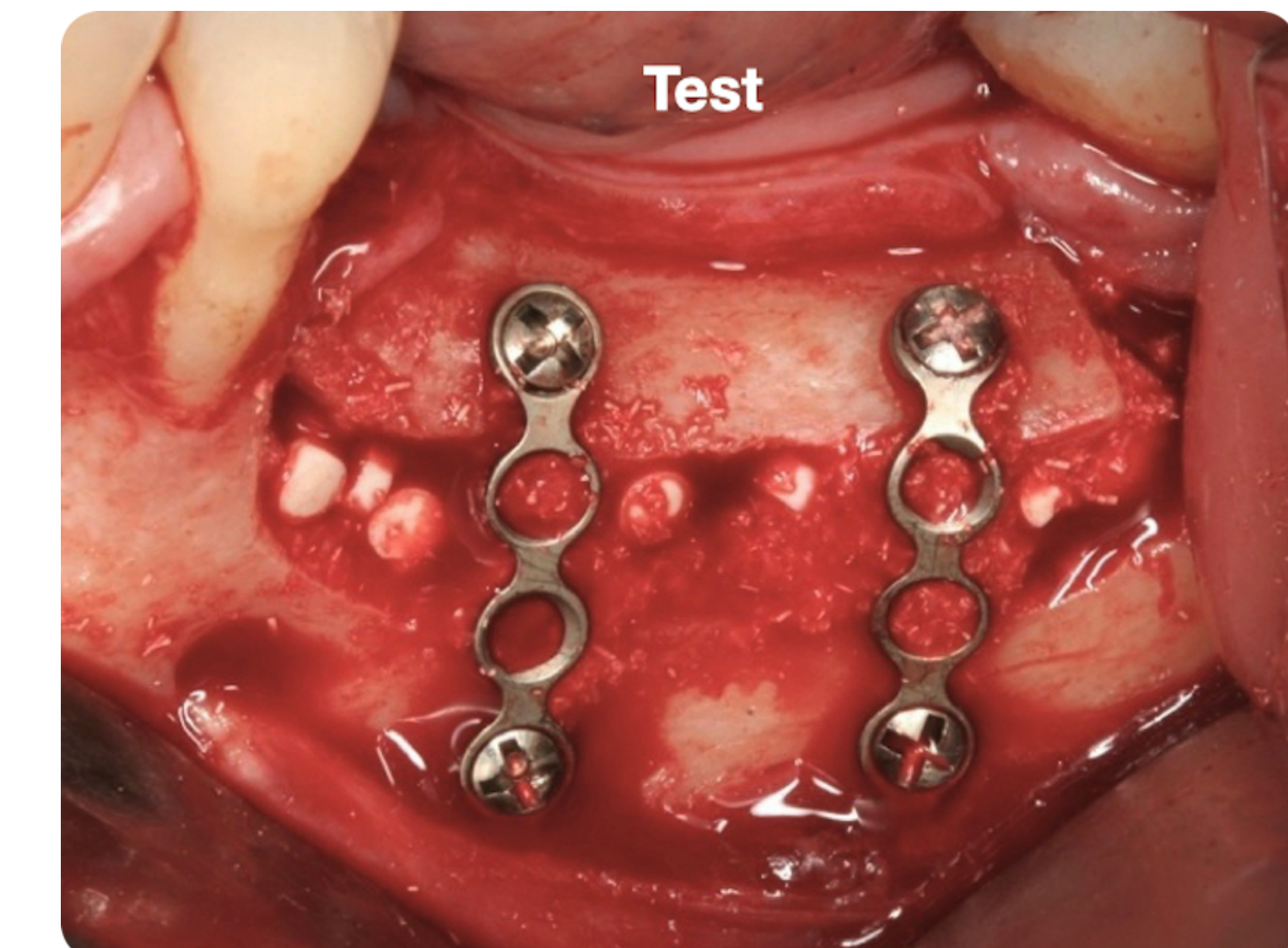


Fig. 2 - bone graft - test group

METHOD

Twelve patients were included in a split-mouth design between 2010 and 2012. The control group underwent alveolar osteotomy with an interpositional autogenous bone graft and the test group underwent alveolar osteotomy with an interpositional inlay on resorbable non-ceramic hydroxylapatite (ncHA) (Fig. 3: a, b and c). After 6 months of healing, a cone beam tomography and 3D reconstruction were performed (Fig. 4 - 5) and 2 implants were placed on each side of the patients (Fig. 3: d, e and f) and loaded after an additional 6 months period.

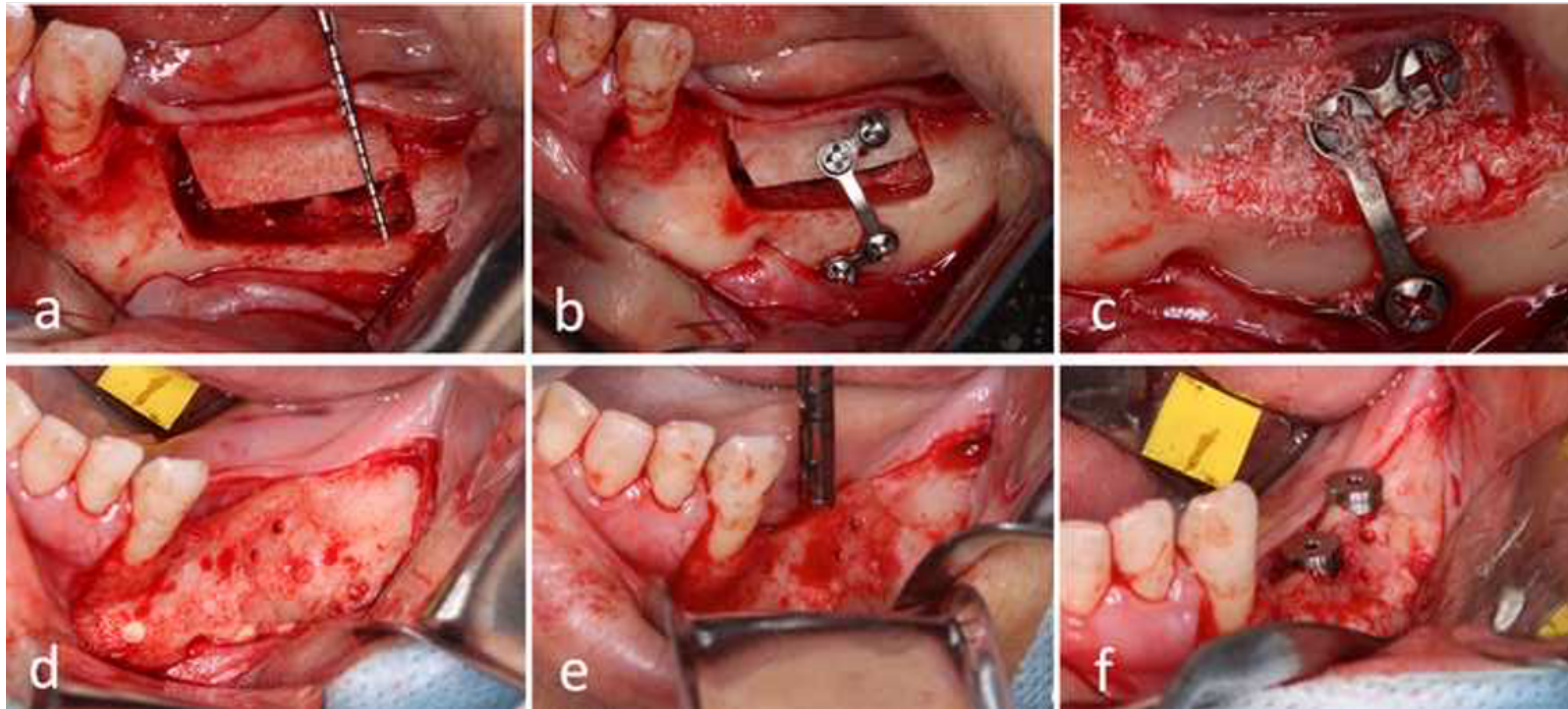


Fig. 3 Images of the test group (a) after osteotomy (b) fixed with miniplates (c) grafted with HA (d) after 6 months of healing (e) retrieval of the bone biopsy (f) implant placement (Bechara et al., 2015)

Dottore et al., 2014 evaluated these implants after a 1-year loading period, resulting in an overall implant survival rate of 95.45% and a similar implant stability index between both groups.

Bechara et al., 2015 performed the histological evaluation of autogenous and non-ceramic calcium hydroxylapatite grafts collected at the time of implant installation and analyze the resonance frequency (RFA) through the implant stability quotient (ISQ). Good graft incorporation was observed in both groups; although, in the test group, residual grafted material was observed. Bone density and marrow spaces were similar between groups. No differences were observed between ISQ values and histometric variables between groups ($p < 0.05$) (Fig. 6)

METHOD

Ten years following the prosthetic loading, clinical and radiographic related to discomfort, sensibility, suppuration/exudation, implant stability coefficient and peri-implant bone loss were evaluated (approval from the Human Research Ethics Committee (CAAE: 40081520.2.0000.5506 version 2)).

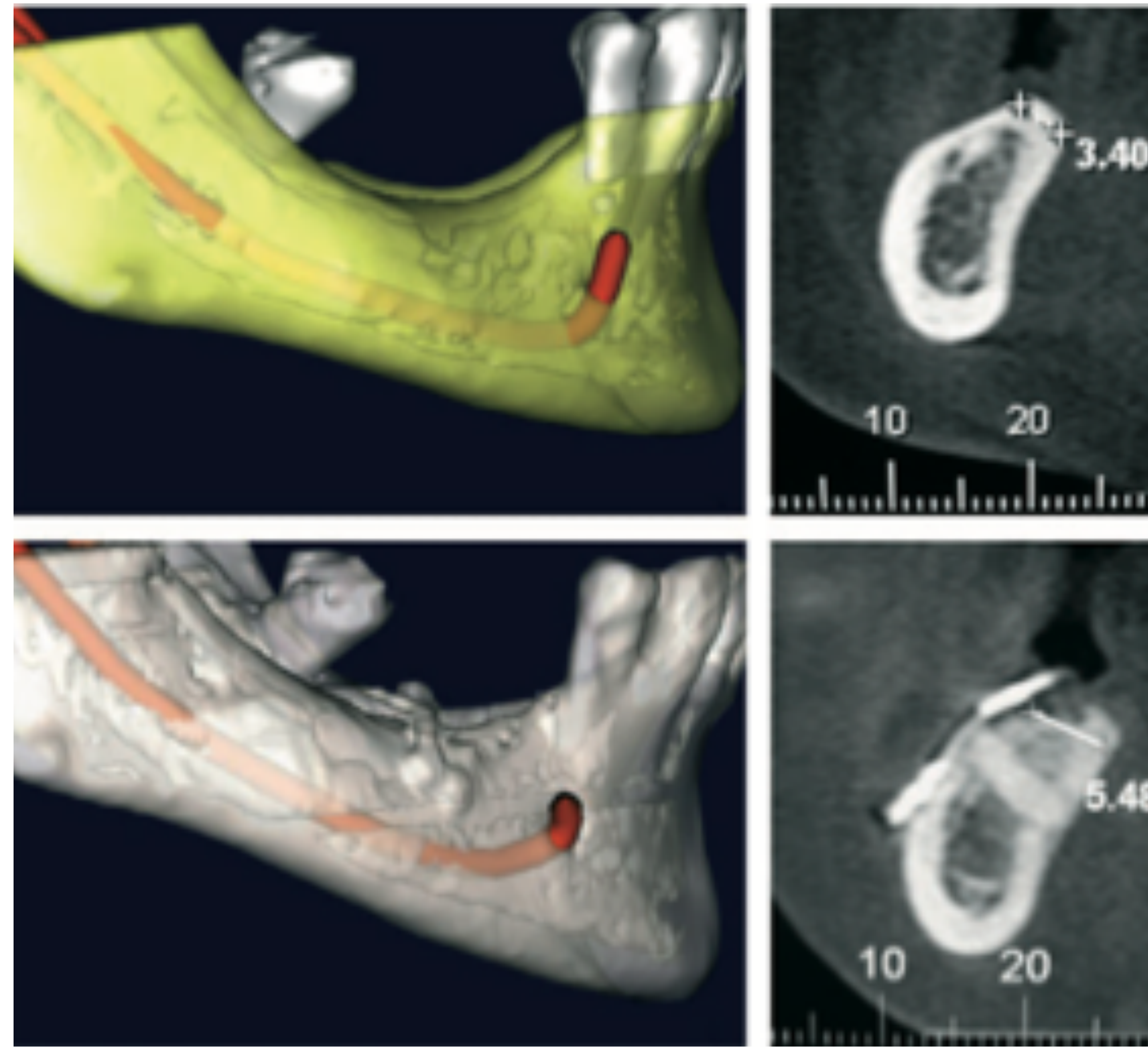


Fig. 4 Radiographic view of reconstructed 3D image of control group (autogenous bone) before (upper) and (6 months after surgery (lower); sagittal view of control group before (upper) and 6 months after surgery (lower). (Kawakami et al., 2012)

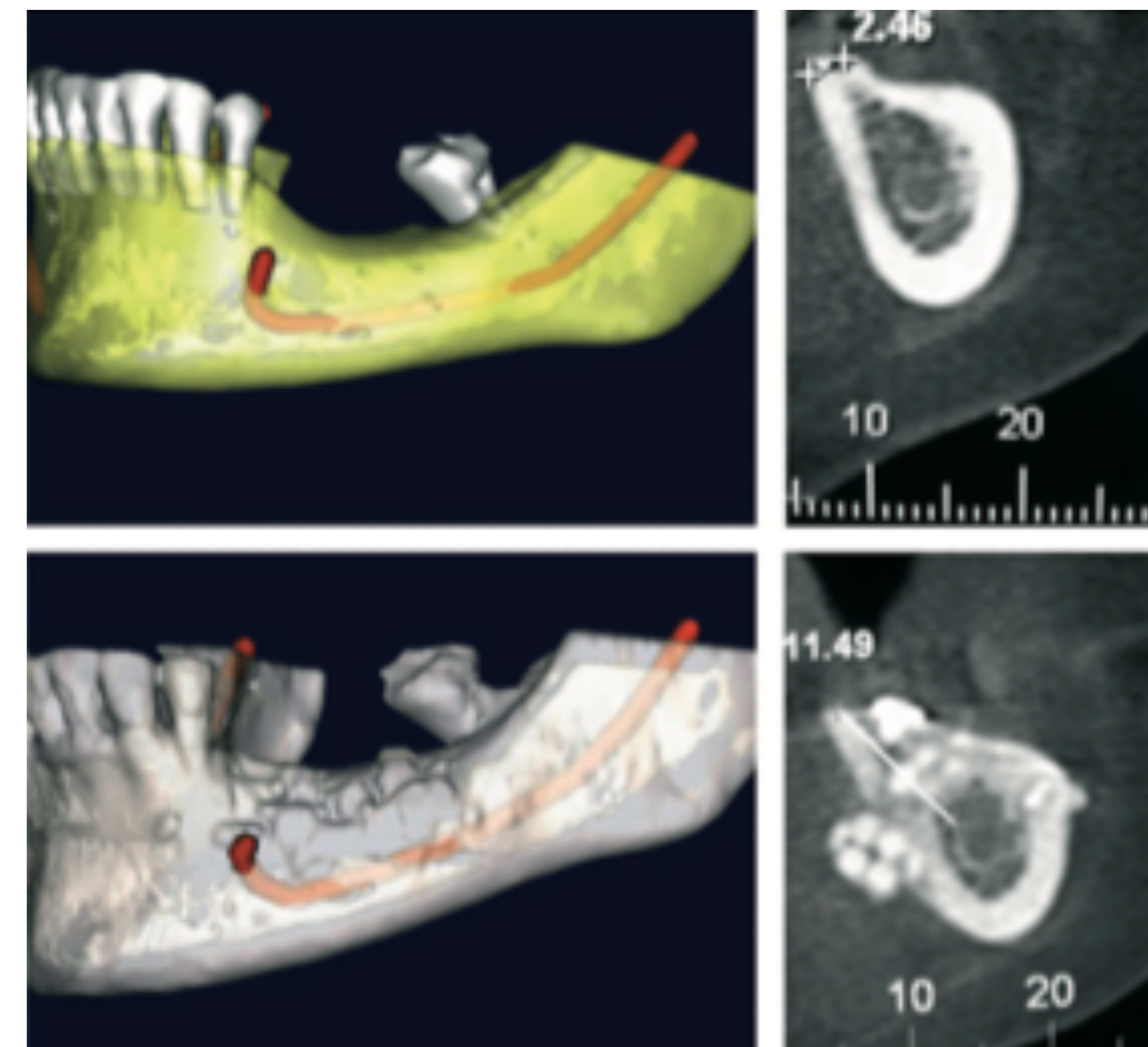


Fig. 5 Radiographic view of reconstructed 3D image of test group (ncHA bone graft) before (upper) and 6 months after surgery (lower); sagittal view before (upper) and 6 months after surgery (lower). (Kawakami et al., 2012)

The success criteria were absence of pain or sensitivity over function, suppuration/exudation, clinically detectable mobility, continuous peri-implant radiolucency and visible bone contact < 2 mm. The implant was classified as “survival” when it was still functional at the time of evaluation (10 years after functional loading). The peri-implant bone level was measured as the distance between the implant neck and the closest cervical bone level using ImageJ software (NIH ImageJ). To evaluate implant stability (ISQ), resonance frequency analysis (RFA) was used. The clinical data obtained were statistically evaluated using the Chi-square test and Fisher's exact test ($p < 0.05$), while the ISQ data were evaluated using the t test ($p < 0.05$).

RESULTS

None of the implants exhibited pain, suppuration, movement or continuous peri-implant radiolucency. The survival rate was 100%. Concerning the peri-implant bone level, the control group had a success rate of 88% and the test group had a success rate of 90%. The average values (mm) for the marginal bone loss were 1.91 ± 1.01 and 1.63 ± 1.14 for the control and test groups, respectively, without statistically significant difference between the groups ($p= 0.577$). ISQ mean values for the control and the test groups were 54.33 ± 10.29 and 57.61 ± 5.34 , respectively, without statistically significant difference between the groups ($p= 0.525$) Table 1.

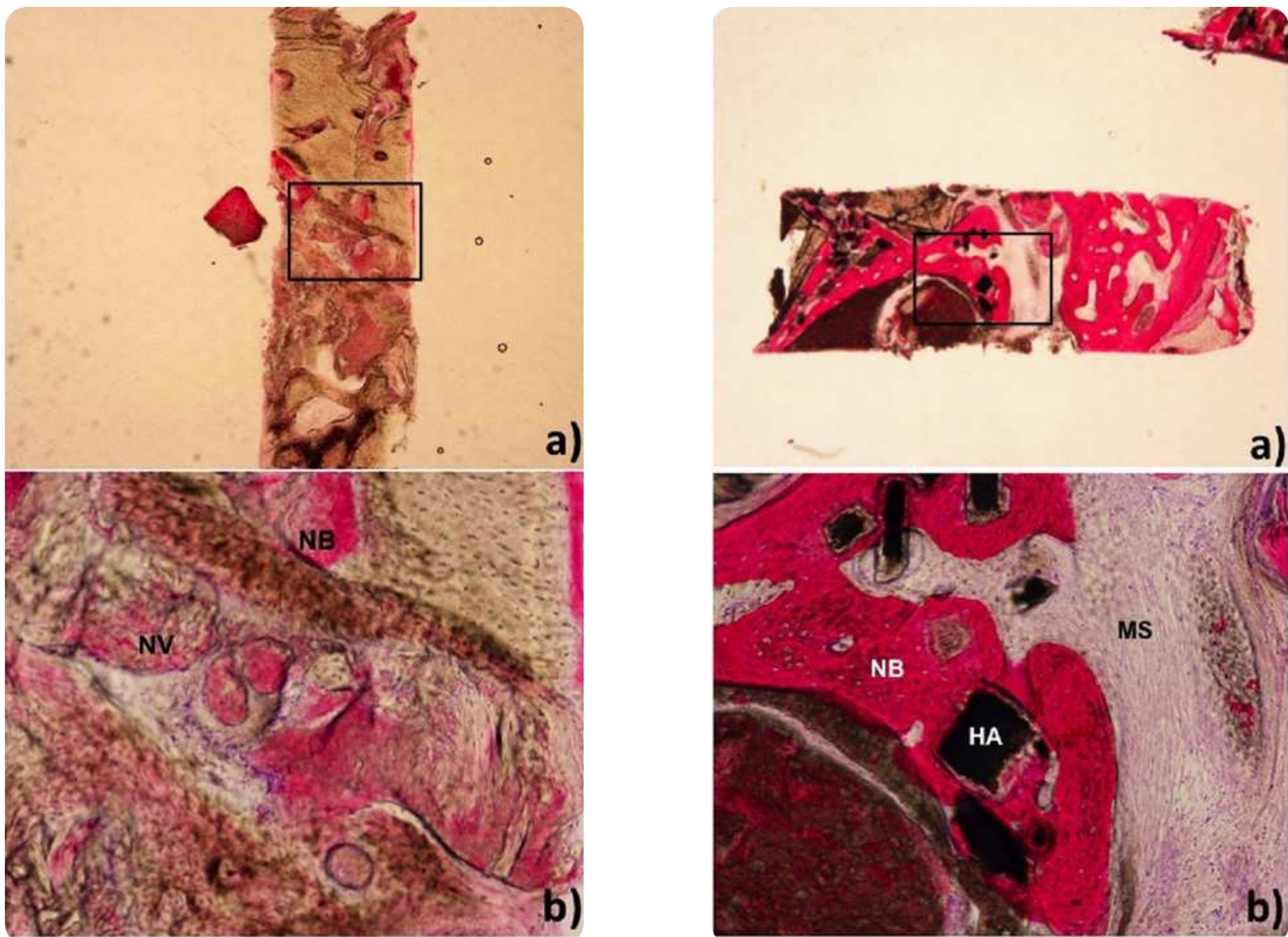


Fig. 6 the lower view of the histologic ground section; the left control group and the right test group (Bechara et al. 2015). (B) delimited area presented in (a) - (toluidine blue and fuchsia). NB: newly formed bone, NV: non vital bone, HA: hydroxilapatite.

All metal-ceramic crowns were considered clinically satisfactory with no ceramic or prosthetic screw fractures. Regarding the prosthetic components, two prosthetic screws presented loss of torque at the time of evaluation. Two implants, one from the test group and the other from the control group showed marginal bone loss > 2 mm. The success rate was 88.8% for the control group and 90% for the test group. Some signs of the presence of hydroxylapatite could be observed through radiographic images (Fig. 8).

	Control Group	Test Group	P value
	Mean $\pm$ SD	Mean $\pm$ SD	
Bone level (mm)	1.91 ± 1.01	1.64 ± 1.14	0. 577
Implant stability (ISQ)	54.33 ± 10.29	57.61 ± 5.34	0. 525

Table 1 Implant stabiity values and bone level of the test group and control group

CONCLUSION

The alveolar osteotomy with either ncHA or autogenous bone for vertical bone augmentation appears to be a realible method for successful implant placement over 10 years period and can be considered an option for treating mandibles with severe vertical bone loss. No statistic difference was observed between the groups.

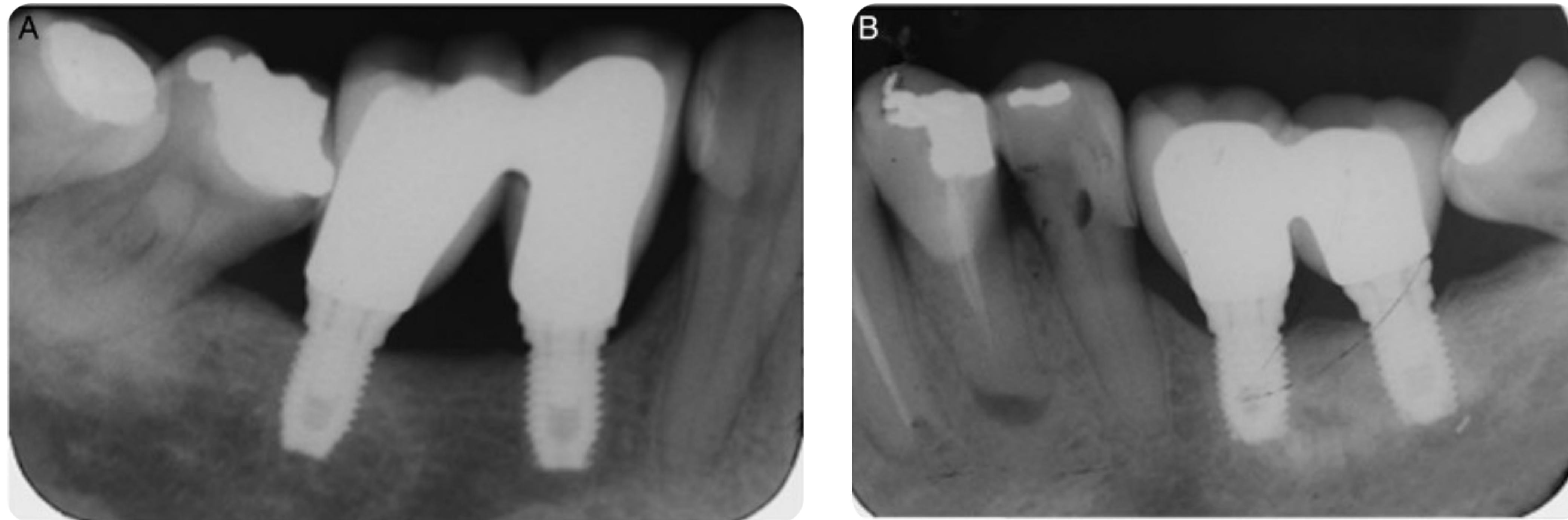


Fig. 7 Radiographic image after prosthetic rehabilitation (Dottore et al., 2014).



Fig. 8 Radiographic image of the same patient after 10 years.



Fig. 9 Clinical condition of metal-ceramic crowns after 10 years in function.

REFERENCES

