Acrylic Customized X-Ray Positioning Stent for Prospective Bone Level Analysis in Long-Term Clinical Implant Studies

Ana Messias, Salomão Rocha, João Paulo Tondela, Rita Reis, Pedro Nicolau, Fernando Guerra Faculty of Medicine, University of Coimbra



Universidade de Coimbra

camlogfoundation 5TH INTERNATIONAL CAMLOG CONGRESS Background

Long-term evaluation of dental implants and their surrounding structures is crucial to provide more informa- tion concerning the success or failure of these therapies in clinical trials. The radiographic analysis, in conjunc-tion with the clinical evaluation of the implant sites, is the best non-invasive method for bone level determination¹⁻⁴. Among the diverse radiographic techniques, the periapical technique has proven to be the most accurate method for the linear measurement of alveolar bone height⁵⁻⁷. However, the diagnosis of progressive bone loss or the identification of bone gain from one radiographic examination

to the next may be very difficult to interpret due to errors in the alignment of successive images. To overcome this problem, Updegrave⁸ detailed the paralleling extension-cone technique and introduced the Rinn system, the first film holder to keep the film parallel to the tooth and in a flat position, but still not producing acceptable images for continuous reproduction. Ever since, numerous systems have been proposed to obtain superimposable dental radiographs but have not proven to prevent projection errors effectively as they fail to ensure the realignment of the initial imaging geometry⁹⁻¹².

Aim

This poster describes a technique to produce individualized X-ray positioning devices for obtaining optimally projected intraoral radiographs of dental implants with long term stability.

Materials & Methods Clinical & Laboratorial Procedures

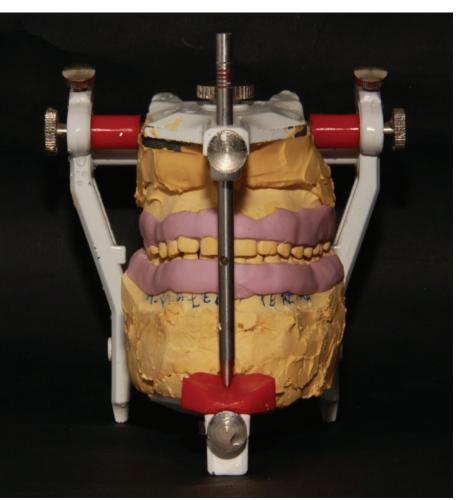


Fig I - Articulator mount and elimination of undercuts.



Fig 2 - Vertical and horizontal sensor basket plus sensor replica.



Fig 3 - Dentsply Rinn XCP-DS[®] system (bite block + sensor basket + positioning metallic tip).



Fig 4 - Tryout of the assembly to guarantee the best radiographic projection of the area of interest.



Fig 4 - Seating of a bilateral self-cure acrylic block over the arch containing the area of interest.

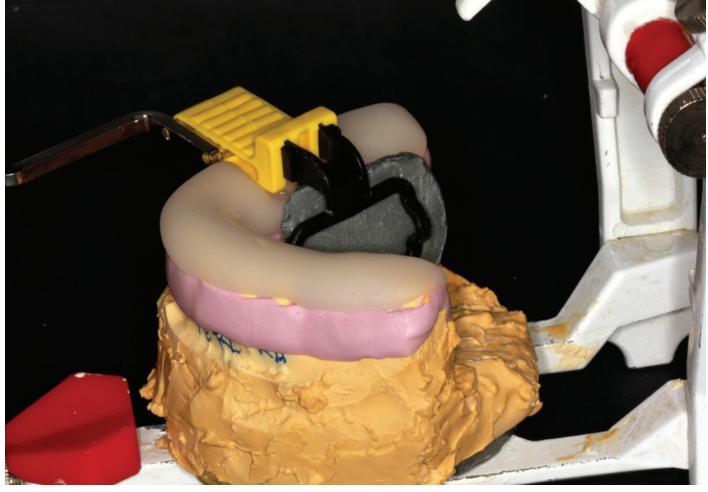


Fig 5 - Fitting of the assembly over the acrylic block.

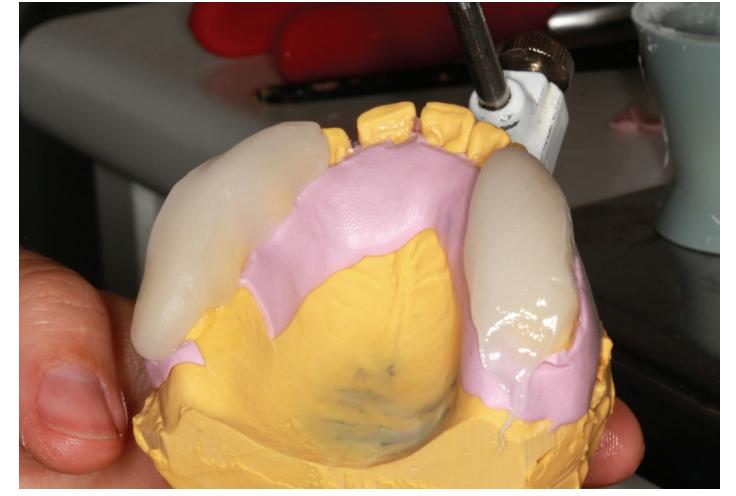


Fig 6 - Seating of bilateral self-cure acrylic block over a minimum of 4 teeth of the opposing arch.



Fig 7 - Stabilization of the bite block.

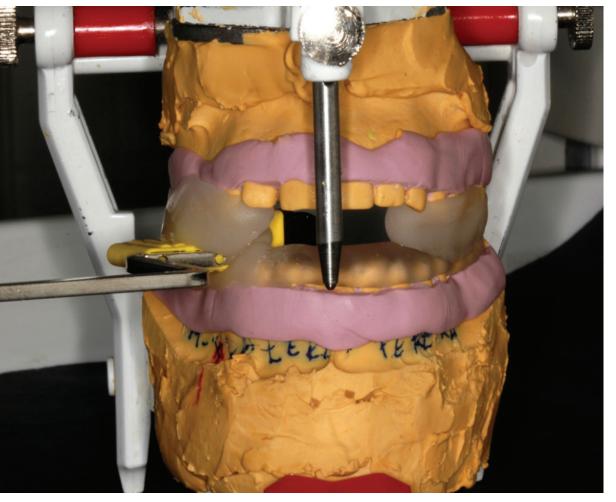


Fig 8 - Frontal view of the acrylic stent with the bite block, sensor basket and metallic tip.

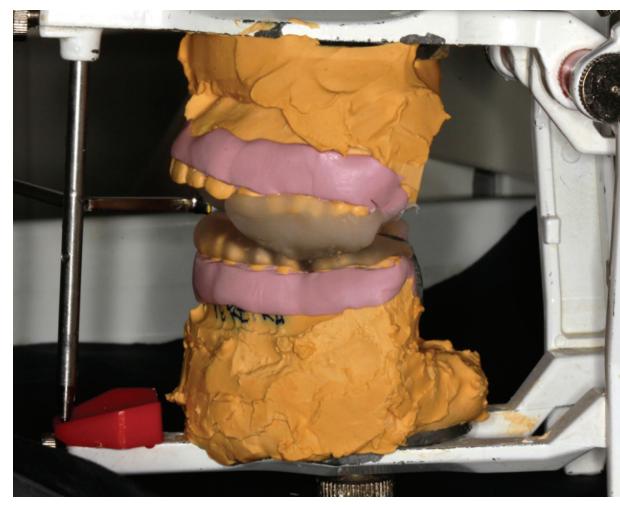


Fig 9 - Lateral view of the acrylic stent.



Fig 10 - Occlusal and posterior views of the position of the sensor, placed in the basket parallel to the area of interest.

Fig II - Frontal view of the intra-oral trial of the acrylic stent with the bite block and sensor.



Fig 12 -Fitting of the aiming ring in the metallic tip and orientation of the x-ray tube

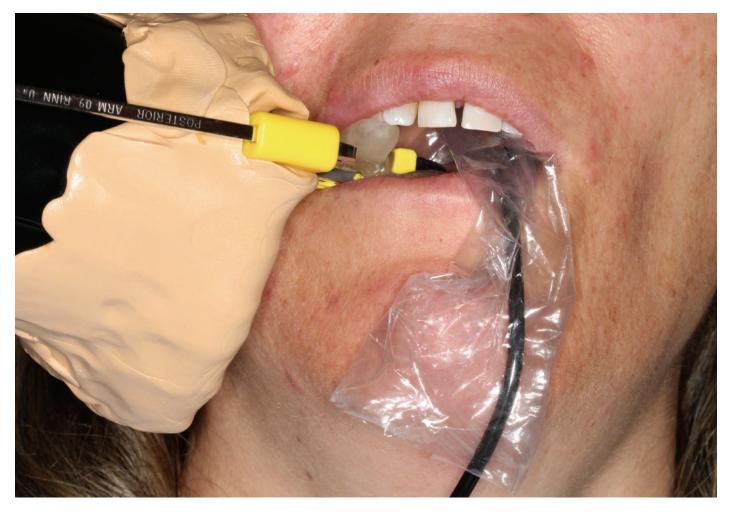


Fig I3 - Stabilization of the x-ray tube orientation with polivinylsiloxane

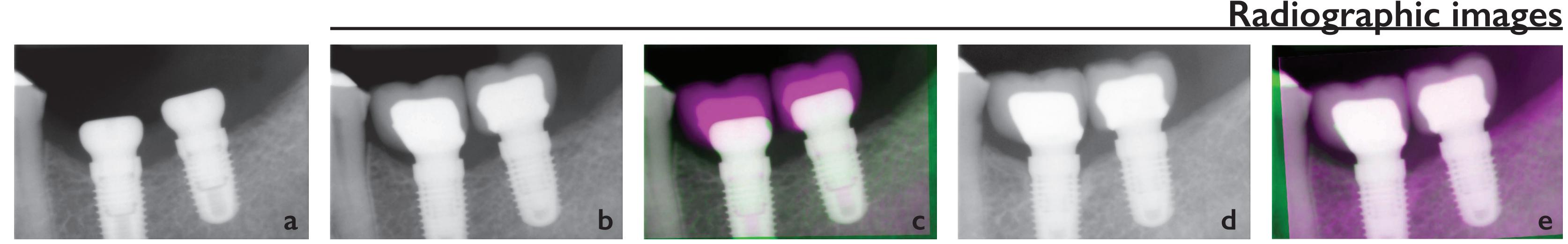


Fig 14 - Representative calibrated radiographs obtained at surgery (a), loading (b) and 1 year post-loading (c) represents the corregistration of the first pair of images (a and b), revealing the superimposition of the radiographs taken at surgery and loading. Image (e) represents the corregistration of the radiograph taken at loading (b) and 1 year post-loading (d). Unchanged structures remain in grey scale whereas structures present in only one of the radiographs are either represented by green or purple.

Reliability analysis for the measurements taken at the implants in each moment (surgery, loading, I [(0.920 - 0.986) 95% CI] (p < 0.01) and 0.990 [(0.976 - 0.996) 95% CI] (p < 0.01) for the thread pitch. year post loading) revealed an intra-class correlation coefficient for the mesio-distal width of 0.964

Conclusions

The template here described for X-ray standardization is adapted from a commercially available system meant for radiovisiography. This X-ray alignment device minimizes variations in X-ray imaging geometry and prevents angular distortion and alignment errors between two consecutive radiographs,

thus making matching images that are superimposable, which allows a quantitative analysis of longitudinal radiographic crestal bone changes.



^[1]L. Laurell, and D. Lundgren, "Marginal Bone Level Changes at Dental Implants after 5 Years in Function: A Meta-Analysis," Clinical Implants. A Meta-Analysis," Clinical Implants after 5 Years in Function: A Meta-Analysis," Clinical Implants, A Meta-Analysis," Clinical Implants after 5 Years in Function: Measurements," The International Journal of Oral & Maxillofacial Implants, A Meta-Analysis," Clinical Probing and Radiographic evaluation in Humans Comparing Two Non-. Submerged Implant Search, Vol. 13, No. 1, 2011, pp. 19-28. [2] M. Wakoh, et al., "Reliability of Linear Designs with Different Machined Collar Lengths," Journal of Periodontology, Vol. 76, No. 5, 2005, pp. 791-802. [3]], S. Hermann, J. D. Schoolfield, J. Meyer, D. L. Cochran and J. S. Hermann, "Crestal Bone Changes around Titanium Implants: A Methodologic Study Comparing Two Non-. Submerged Implant Search, Vol. 8, No. 4, 1997, pp. 255-264. [5] M. Wakoh, et al., "Reliability of Linear Distance Meas- urement for Dental Implants. A Methodologic Study Comparing Two Non-. Submerged Implants, No. 4, 2001, pp. 475-485. [4]F. Isidor, "Clinical Probing and Radiographic Vol. 8, No. 4, 1997, pp. 255-264. [5] M. Wakoh, et al., "Reliability of Linear Distance Meas- urement for Dental Implants, A Methodologic Study Comparing Two Research, Vol. 8, No. 4, 1997, pp. 255-264. [5] M. Vakoh, et al., "Reliability of Linear Distance Meas- urement for Dental Implants, Research, Vol. 8, No. 4, 1997, pp. 255-264. [5] M. Wakoh, et al., "Reliability of Linear Distance Meas- urement for Dental Implants, Part 1: A Retrospective Ra- diographic Evaluation in Humans Comparing Two No. 4, 2001, pp. 475-485. [4]F. Isidor, "Clinical Periodontology, Vol. 31, No. 4, 2001, pp. 475-485. [4]F. Isidor, "Clinical Periodontology, Vol. 31, No. 4, 2001, pp. 255-264. [5] M. Wakoh, et al., "Retrospective Ra- diographic Science Meas- urement for Dental Implants, Part 1: A Retrospective Ra- diographic Science Meas- Urement, "Dental Radiographic Vol. 8, No. 4, 1997, pp. 255-264. [5] M. Wakoh, et