

Virtual Reality Applied to Dental Implant Surgery

A Computer Guided Protocol

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Abstract—Virtual reality is already an important complement in treatment planning. Dental implants can be placed in a virtual model optimizing its position, avoiding important structures and maximizing mechanical properties. With CAD/CAM technology a surgical guide can be made to transfer implant planned position to a real person, in a blind process, and tooth prostheses can be made to be positioned on dental implants after surgery.

Index Terms—Virtual reality; Computer guided surgery; Dental implant.

I. INTRODUCTION

New three-dimensional diagnostic and treatment planning technologies in implant dentistry have expanded on concepts of a team approach to the planning and placement of dental implants. The accurate and predictable placement of implants according to a computer-generated virtual treatment plan is now a reality, taking the virtual plan from the computer to the patient clinically [1]. The use of computer guides allows the implant to be inserted in a far more precise way. It is obvious that careful planning is the key factor to avoid implant misplacement [2]. Template-guided implantation will ensure reliable transfer of preoperative computer-assisted planning into surgical practice [3]. This paper shows how virtual reality can help in dental practice, making procedures more precise, safer and with a great reduction of uncomfortable effects.

II. SYSTEM CHARACTERISTICS

The patient's dental prosthesis is duplicated in acrylic resin and used as a radiological guide, adding some radio-sensitive marks on it (Fig.1). Tomographies of the individual wearing the radiographic guide and the radiographic guide itself are made.

Data is converted by the guided surgery software (NobelGuide[®]) into 3D images (Fig.2) and the virtual plan is made (Fig.3), concerning mechanical properties, emerging of implants, bone volume and avoiding important structures such as nerves and vessels.

Data is then sent to a production centre (Procera[®]-Sweden) where a surgical template is produced. Based on this template, a virtual-based model simulating the surgical outcome is created, and a provisional prosthesis is confectioned.

The surgical procedure is performed without incisions or sutures and the dental prostheses are immediately fixed on the dental implants.



Figure 1. Marked radiological guide

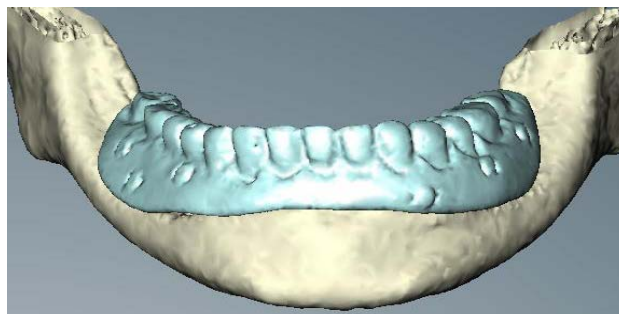


Figure 2. 3D image of a mandible and radiological guide

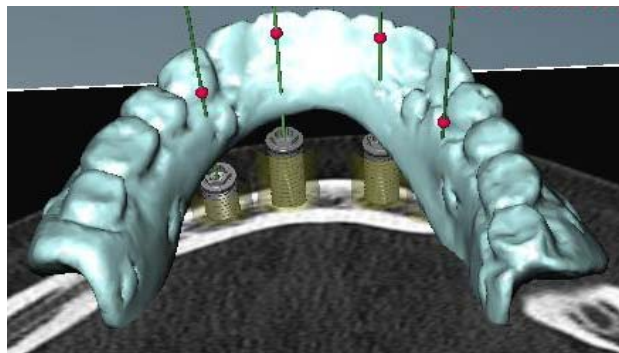


Figure 3. Planning implant positioning

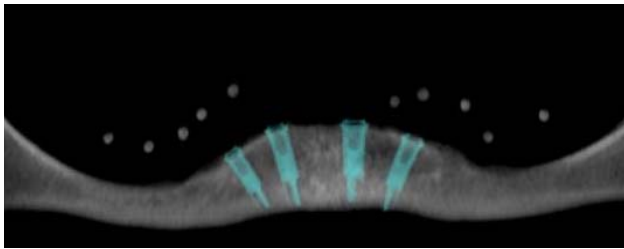


Figure 4. Virtual planning

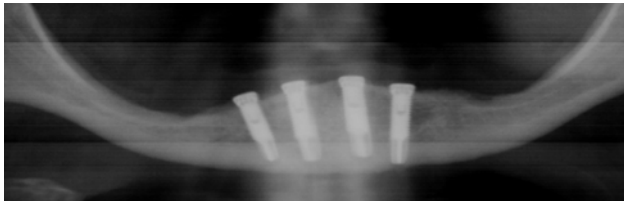


Figure 5. Real treatment

III. CONCLUSION

Virtual reality is a significant tool by its precision and predictability (Fig.4 and Fig.5). Complex and risky surgeries can be made safely with this process, optimizing the existing restraining environment. Implants can be successfully placed using a minimally invasive surgery and therefore reducing post-operative symptoms and treatment time.

This procedure will be demonstrated to increase the general public awareness of its significant advantages in terms of safety, comfort and success.

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