STENTS FOR IMPLANTS
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Abstract:

The location of implant placement is often critical to the success and failure of particular restoration. One of the challenges of implant placement is planning the correct position of the implant in bone to achieve a prosthetic solution that fulfils biologic, esthetic, and biomechanical requirements. At the same time, it is important to prevent encroachment on vital structures, adjacent teeth, and body cavities. Accurate radiographic assessment and communication between the surgeon and the prosthodontist are vital for successful implant surgery and restoration. To facilitate this communication, a radiographic template with a guiding device, or surgical guide template is used. An attempt has been made to discuss role & different type of stents used for surgical planning of implant placement.

Key words: stents; surgical guide; guiding device; dental implant; radiographic guide; surgical template; CAD-CAM, stereo lithography; implant dentistry

INTRODUCTION

Appropriate placement of the implants has always been essential. Desirable position of implants is more challenging than restorative problems. A treatment that combines Oral surgeons, Periodontics, and Prosthodontics will most likely result in a stable, esthetic, and functional solution that fulfils the patient’s requirements and expectations. The correct implant position is so important that this factor alone may outweigh the advent of complex surface technology, advances in surgical techniques, or the intricacies of occlusal load factors in many clinical situations. Despite significant advances in devices and techniques, placing dental implants in a correct position still remains a challenge. Diagnostic casts, probing depths and panoramic radiography can lead to unpredictable results as they do not give three-dimensional (3-D) radiographic information required for correct positioning and orientation of implant. Moreover, predictable implant supported prosthesis also requires a determination of final prosthesis in treatment planning stage. Thus for a successful implant supported prosthesis the Prosthodontist should plan the implant position in accordance with accurate mesiodistal and buccolingual location, angulation with residual bone and correct implant orientation. To achieve these objectives surgical guide (stent) with radiopaque marker in conjunction with dental CT scan imaging should be used.

HISTORICAL BACKGROUND

The origin of word stent attribute to Jan F. Esser, a Dutch plastic surgeon who, in 1916 used the word to describe a dental impression compound invented in 1856 by the English dentist Charles R. Stent. The first medical-grade helical CT scanners were all single-slice, slower machines that were based in hospitals or private radiology facilities. With the development and introduction of the New Tom 9000

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(Quantitative Radiology, Verona, Italy) in 1998, cone beam volumetric tomography (CBVT/cone beam computed tomography [CBCT]) was introduced to the dental community. Columbia Scientific (CSI) introduced the 3D Dental software in 1988. This software converted CT axial slices into reformatted cross-sectional images of the alveolar ridges for diagnosis and evaluation. In 1991, combination software was introduced, (ImageMaster-101) which allowed the additional feature of placing graphic dental implants on the cross-sectional images. The first version of Sim/Plant was introduced by CSI in 1993, allowing the placement of virtual implants of exact dimensions, on CT images, in cross-sectional, axial, and panoramic views. In 1999, Simplant 6.0 was introduced, adding the creation of 3D reformatted image surface rendering to the software.

The Nobel Guide technology was introduced as a complete implant planning and placement system, for both straight-walled and tapered Nobel Biocare implants, planning (i.e., Facilitate, AstraTech Dental, Molndal, Sweden; Navigator, Biomet 3i, Palm Beach Gardens, FL, USA; ExpertEase, Dentsply Friadent, Mannheim, Germany).³

**METHODS OF FABRICATION**

Surgical guide template fabrication involves a diagnostic tooth arrangement through one of the following ways:

- A diagnostic waxing,
- A trial denture teeth arrangement, or
- Duplication of a preexisting dentition/restoration.⁴

The fabrication of the surgical guide templates is then based on one of the following design concepts:

1) Non Limiting Design
2) Partially Limiting Design
3) Completely Limiting Design

**Non Limiting Design:** This design indicates the ideal location of the implants without any emphasis on the angulation of the drill, thus allowing too much flexibility in the final positioning of the implant. Bluestein et al and Engelman et al described a technique in which a guide pin hole was drilled through a clear vacuum formed matrix. This hole indicated the optimal position of the implant. However, the angulation was determined by the use of adjacent and opposing teeth. (Fig.1)

**Partially Limiting Design:** In such designs, the first drill used for the osteotomy is directed using the surgical guide, and the remainder of the osteotomy and implant placement is then finished freehand by the surgeon. Techniques based on this design concept involve fabrication of a radiographic template, which is then converted into a surgical guide template following radiographic evaluation. (Fig.2, 3)
**Completely Limiting Design:** Restricts all of the instruments used for the osteotomy in a buccolingual and mesiodistal plane. Moreover, the addition of drill stops limits the depth of the preparation, and thus, the positioning of the prosthetic table of the implant. As the surgical guides become more restrictive, less of the decision-making and subsequent surgical execution is done intraoperatively. This includes 2 popular designs: cast-based guided surgical guide and computer-assisted design and manufacturing (CAD/CAM) based surgical guide.

**Cast Based Guided Surgical Guide:** The periapical radiograph is modified using digital software to help in transposition of root structure onto the cast. The cast is then sectioned at the proposed implant site, and bone-sounding measurements are transferred to help in orientation of the drill bit to perform a cast osteotomy. (Fig.4)

**CAD/CAM-Based Surgical Guide:**

CAD/CAM technology uses data from computerized tomography scan (CT) to plan implant rehabilitation. Stereolithography is a computer-guided, laser-dependent, rapid prototyping polymerization process that can duplicate the exact shape of the patient's skeletal anatomic landmarks in a sequential layer of a special polymer to produce a special 3D transparent resin model, which fits intimately with the hard and/or soft tissue surface. Once hardened, the polymeric prototype contains spaces for stainless steel or titanium drill-guiding tubes. These tubes precisely guide the osteotomy drills, precluding the need for the pilot drills.5, 6 (Fig. 5, 6)

**Predictable Implant Placement with a Diagnostic/Surgical Template and Advanced Radiographic Imaging:** This technique described facilitates precise dental implant placement. The use of tomography and computed tomography (CT) provided practitioners with the ability to assess the quantity and quality of bone and critical anatomic structures before surgery. These advanced radiographic techniques allowed better bone evaluation. However, orientation to a specific implant site was difficult, and determining the relationship between the final restoration and available bone was not always possible.7, 8, 9 (Fig. 7, 8)
CONCLUSION

Diagnostic and surgical guides are important tools of implant treatment, and, for this reason, they must be fabricated with precision and accuracy. Computer tomography (CT) scans and dental software have been used extensively in implant dentistry since 1987 and are generally considered valuable adjuncts in presurgical planning for endosseous implants.

REFERENCES