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MINIMIZING IMPLANT FAILURES

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Abstract:

Despite significant advances in devices and techniques, placement of dental implants at a correct position as per the esthetic, biological, and functional perspective still remains a challenge, because the trajectory of implants is seldom consistent with that of natural teeth due to the bone loss that follows extraction. Computerized-implant-dentistry being highly predictable and minimally invasive in nature has also allowed implant placement in patients with medical comorbidities (e.g. radiation therapy, blood dyscrasias), in patients with complex problems following a significant alteration of the bony anatomy as a result of benign or malignant pathology of the jaws or trauma and in patients with other physical and emotional problems. With significant achievements accomplished in the field of computerized implant-dentistry, attempts are now been made toward complete automation of implant-dentistry.

Keywords:

Implant failure, advances in imaging, stent, automated implant placement

INTRODUCTION:

Traditionally, determining implant position, size, number, direction, and placement depended on the presurgical diagnostic imaging, which often, was limited to two-dimensional radiographs, and on the guiding acrylic stents usually prepared over duplicated casts of diagnostic wax-up.

However, limitations of two-dimensional imaging and inaccuracies in the stent fabrication or guide channels often lead to erroneous implant placement, which results in complications and implant failure, especially in anatomically complicated situations. To overcome these limitations, many advancements have taken place, which have computerized the implant-dentistry. These include: • Three-dimensional computed tomography (CT) imaging • CT-based implant-planning software • Computer-aided-design/computer- aided-manufacturing (CAD/CAM) technology • Computer guided implant surgery (CGIS) • Computer navigated implant surgery (CNIS) • Robotic-implant-dentistry.[1]

Recently, Esmaeili et al. 2013 compared CBCT and a 64-slice CT scanner for the beam hardening artifacts produced by dental implants and suggested that given the higher resolution of the images produced by CBCT and its lower doses and costs compared with CT scanner, CBCT should be recommended in order to produce images of higher diagnostic values, especially in patients with extensive restorations, multiple prostheses or previous implant treatments.[2]

To aid the clinician during the surgical procedure,a broad range of surgical guides have been developed.[3-10] Design concepts vary, from the simplistic non-limiting, to the partially limiting, and, finally, to completely limiting surgical guides. The non-limiting design, in general, provides the surgeon an indication as to where the proposed prosthesis is in relation to the selected implant site.The partially limiting design offers the possibility to have a guide sleeve direct the first drill used for the osteotomy

The information acquired with CT or cone beam can be used in specialized software to plan the ideal position of dental implants in relation to the prosthetic reconstruction, the available bone, and the vital structures, which need to be avoided

Currently,there are two main technology directions that can be used to transfer the planning to the surgical field: navigated systems and surgical guide stents-based systems. In navigated surgery, the handpiece position in relation to the previously planned osteotomy site is followed live as the surgeon advances the surgical instrumentation.[11-16] With surgical guide stents-based systems, the surgeon follows the information as is encoded in the surgical guide, mostly by means of a guide ring that is embedded in the surgical guide stent

Computer-assisted surgical guide stents can be made via a rapid prototyping additive process called stereolithography[17] or through numeric-controlled milling, a subtractive process.[18,19] In stereolithography, a basin of light-polymerizing resin is illuminated with a laser, polymerizing small areas at a time, much like an ink-jet printer depositing ink on paper. The laser turns on and off based on the information it receives from the computer-aided design model in the computer. The basin is then moved down over a small distance, and the laser travels over the field again. This process is repeated over a period of time, slowly building the object.

LITERATURE REVIEW:

Despite significant advances in devices and techniques, placement of dental implants at a correct position as per the esthetic, biological, and functional perspective still remains a challenge, because the trajectory of implants is seldom consistent with that of natural teeth due to the bone loss that follows extraction. Pietrokovski [20] found that buccal bone resorption occurs at a rapid rate in the first 3 years of extraction of teeth, thus changing the amount and direction of alveolar bone. Thus it is of paramount importance to plan the position and angulation of implants in accordance with the underlying bone angulation

Incorrectly positioned, malaligned, and nonparallel implants lead to nonaxial loading of the prosthesis, in turn leading to improper load distribution, an overall increase in stress concentration, and eventual loss of osseointegration.[21]

Two-dimensional imaging techniques like orthopantomogram and intra oral periapical radiography are affordable, economical and easy means of implant site selection. Yet, they tend to produce errors as they have many shortcomings like image superimposition, limited reproducibility, and production of a projected image of three-dimensional object onto a two-dimensional plane as well as distortion and variable magnification of the image

Considering these limitations, cone-beam computed tomography (CBCT) imaging might be a viable, more practical and perhaps even better alternative to CT in the preoperative radiographic

Furthermore in 2012, Pires et al. in his study demonstrated that presence, location, and dimensions of the mandibular incisive canal are better determined by CBCT imaging than by panoramic radiography.[22]

Petersson et al [23] stated that panoramic evaluation alone is not sufficient, as it produces images that distort the jaws nonuniformly. Weinberg [24] documented that optimum implant orientation can be aided by a 3D radiographic database provided by a computed tomography (CT) scan when used in conjunction with a diagnostic stent. Lam et al [25] compared CT to panoramic imaging for dental implant treatment planning and found that CT is the most accurate method of implant site evaluation.

The SLA surgical guides derived from CT scan planning data were found to be highly accurate and easy to use in either bone-supported, toothsupported, or mucosa-supported configuration

One of them, rapid prototyping using stereolithographic modeling, was used in this study and is known in the engineering industry as a fast, economical CAM method to obtain prototypes.[26,27] Its application to the medical field has allowed for visualization of large osseous lesions and preoperative preparation of reparative strategies.[28,29] Santler and colleagues, reporting on more than 300 trauma and cancer cases, demonstrated the advantage of 3D models in preparing for large surgical reconstructions.[30] Use of an anatomic model has also been suggested for diagnosis of sinus elevations,[31] preparation of periosteal implants,[32,33] and design of soft tissue facial prostheses.[34] Choi and associates evaluated the accuracy of these models by making linear Measurements of multiple models and found that it was in the range of 0.5 mm.[35]

Erickson and coworkers[40] surveyed surgeons who used custom anatomic models for diagnosis of surgical reconstruction and fabrication of custom implants. They found that a majority of clinicians had changed their surgical approach and gained surgical time when using these models.[36]

CONCLUSION:

With significant achievements accomplished in the field of computerized implant-dentistry implant placement has become highly predictable, even in patients where implant surgery was contra-indicated formerly. As a result, attempts are now been made toward complete automation of implant-dentistry. Yet, keeping the limitation of high radiation dose, computerized implant-dentistry must be limited to anatomically complicated cases. Future tasks include advanced intraoperative imaging techniques for navigated surgeries along with sophisticated mechanized surgical tools and new robotic developments, which will revolutionize the field of implantology.

References

1. Gulati M, Anand V, Salaria SK,Jain N, Gupta S. Computerized implant-dentistry: Advances toward automation. J Indian Soc Periodontol 2015;19:5-10.
2. Esmaeili F, Johari M, Haddadi P. Beam hardening artifacts by dental implants: Comparison of cone-beam and 64-slice computed tomography scanners. Dent Res J (Isfahan) 2013;10:376-81.
3. Quinlan P, Richardson CR, Hall EE. A multipurpose template for implant Placement. Implant Dent 1998; 7:113–121.
4. Weinberg LA, Kruger B. Three-dimensional guidance system for implant insertion: part I. Implant Dent 1998; 7:81–93.
5. Atsu SS. A surgical guide for dental implant placement in edentulous posterior regions. J Prosthet Dent 2006; 96:129–133.

6. Shotwell JL, Billy EJ, Wang HL, Oh TJ. Implant surgical guide fabrication for partially edentulous patients. J Prosthet Dent 2005; 93:294–297.
7. Meitner SW, Tallents RH. Surgical templates for prosthetically guided implant placement. J Prosthet Dent 2004;92:569–574.
8. Windhorn RJ. Fabrication and use of a simple implant placement guide. J Prosthet Dent 2004; 92:196–199.
9. Tsuchida F, Hosoi T, Imanaka M, Kobayashi K. A technique for making a diagnostic and surgical template. J Prosthet Dent 2004; 91:395–397.
10. Stumpel L. Cast-based guided implant placement: a novel technique. J Prosthet Dent 2008; 100:61–69.
11. Wanschitz F, Birkfellner W,Watzinger F, et al. Evaluation ofaccuracy of computer-aided intraoperative positioning of endosseous oral implants in the edentulous mandible. Clin Oral Implants Res 2002; 13:59–64.
12. Wittwer G, Adeyemo WL, Schicho K, BirkfellnerW, Enislidis G. Prospective randomized clinical comparison of 2 dental implant navigation systems. Int J Oral Maxillofac Implants 2007; 22:785–790.
13. Wittwer G, Adeyemo WL, Schicho K, Gigovic N, Turhani D, Enislidis G. Computer-guided flapless transmucosal implant
14. placement in the mandible: a new combination of two innovative techniques. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2006; 101:718–723.

15. Casap N, Tarazi E, Wexler A, Sonnenfeld U, Lustmann J.Intraoperative computerized navigation for flapless implant surgery and immediate loading in the edentulous mandible.Int J Oral Maxillofac Implants 2005; 20:92–98.
16. Kramer FJ, Baethge C, Swennen G, Rosahl S. Navigated vs.conventional implant insertion for maxillary single tooth replacement. Clin Oral Implants Res 2005; 16:60–68.
17. Casap N, Wexler A, Lustmann J. Image-guided navigation system for placing dental implants. Compend Contin Educ Dent 2004; 25:783–784, 786, 788.
18. Sarment DP, Al-Shammari K, Kazor CE. Stereolithographic surgical templates for placement of dental implants in complex cases. Int J Periodontics Restorative Dent 2003; 23:287–295.
19. Fortin T, Champleboux G, Bianchi S, Buatois H, Coudert JL.Precision of transfer of preoperative planning for oral implants based on cone-beam CT-scan images through a robotic drilling machine. Clin Oral Implants Res 2002; 13:651–656.
20. Arvier JF, Barker TM, Yau YY, D'Urso PS, Atkinson RL,McDermant GR.Maxillofacial biomodelling. Br J OralMaxillofac Surg 1994; 32:276–283.
21. Pietrokovski J: The bony residual ridge in man. J Prosthet Dent 1975;34:456-462
22. Taylor TD, Agar JR, Vogiatzi T: Implant prosthodontics: current perspective and future directions. Int J Oral Maxillofac Implants 2000;15:66-75
23. Pires CA, Bissada NF, Becker JJ, Kanawati A, Landers MA.Mandibular incisive canal: Cone beam computed tomography. Clin Implant Dent Relat Res 2012;14:67-73

24. Petersson A, Lindh C, Carlsson LE: Estimation of the possibility to treat the edentulous maxilla with osseointegrated implants.Swed Dent J 1992;16:1-6
25. Weinberg LA: CT scan as a radiologic data base for optimum implant orientation. J Prosthet Dent 1993;69:381-385
26. Lam EW, Ruprecht A, Yang J: Comparison of two dimensional orthoradially reformatted computed tomography and panoramic radiography for dental implant treatment planning. J Prosthet Dent 1995;74:42-46
27. Hull C. Apparatus for production of three-dimensional objects by stereolithography. Patent 4,575,330 (11 March 1986) USA
28. Jacobs P. Rapid Prototyping and Manufacturing: Fundamentals of Stereolithography, vol 1. Dearborn, MI: Society of Manufacturing Engineers, 1992.
29. Stoler A. Helical CT scanning for CAD/CAM subperiosteal implant construction. J Oral Implantol 1996;22:247–257.
30. Heissler E, Fischer FS, Bolouri S, et al. Custom-made cast titanium implants produced with CAD/CAM for the reconstruction of cranium defects. Int J Oral Maxillofac Surg 1998;27:334–338.
31. Santler G, Karcher H, Ruda C. Indications and limitations of three-dimensional models in cranio- maxillofacial surgery.J Craniomaxillofac Surg 1998;26:11–16.
32. Bianchi SD, Lojacono A, Nevins M, et al. The use of replicate resin models in the treatment of maxillary sinus augmentation patients. Int J Periodontics Restorative Dent 1997;17:348–357.

33. McAllister ML. Application of stereolithography to subperiosteal implant manufacture. J Oral Implantol 1998;24:89–92.

34. Cranin AN, Klein M, Ley JP, Andrews J, DiGregorio R. An in vitro comparison of the computerized tomography/CADCAM and direct bone impression techniques for subperiosteal implant model generation. J Oral Implantol 1998;24:74–79.

35. Runte C, Dirksen D, Delere H, et al. Optical data acquisition for computer-assisted design of facial prostheses. Int JProsthodont 2002;15:129–132.

36. Choi JY, Choi JH, Kim NK, et al. Analysis of errors in medical rapid prototyping models. J Oral Maxillofac Surg 2002;31:23–32.