Comparing accuracy of complete versus partial limiting design of computer guided surgical stent (in vitro study)

Thesis

Submitted to the Faculty of Dentistry, Ain Shams University, in partial fulfillment of the requirements for the Master Degree in Oral and Maxillofacial Prosthodontics

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B.D.S, 2008
Ain Shams University
2018

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سورة البقرة الآية: ٣٢

Acknowledgement

*I thank **god** for helping me to achieve this work and I hope to achieve my supervisors' acceptance.*

*I would like to express my great respect and thank **Dr. Marwa Ezzat Sabet,** Professor of Prosthodontics and Chairman of Prosthodontics Department, Faculty of Dentistry, Ain Shams University for her patience and support.*

*I would like to express my great respect and thank **Dr. Mahmoud El Moutassem Bellah El Homossany,** lecturer of Prosthodontics, Faculty of Dentistry, Ain Shams University and **Dr. Mohamed Shady Nabhan,** Lecturer of prosthodontics, Ain shams university for their great efforts to help me to achieve this work.*

Dedication

I want to dedicate this work to my father

Dr Mohamed Hebishi

My god blessed his soul

I give special thanks to my family for their great

support which helps me in achieving this work

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INTRODUCTION

Osseointegrated implants are a practical alternative to traditional prosthodontics. However, designing an implant-supported prosthesis with function and esthetics is a challenge. Malaligned implants often complicate the clinical laboratory procedures employed for fabrication of superstructures leading to improper load distribution and overall increase in stress concentration on supporting structures. This may compromise the maintenance of the bone-implant interface. Presurgical planning is essential to achieve excellent functional and esthetic outcomes with dental implants. Several factors such as the maxillary sinus, the mandibular canal, and adjacent teeth need to be considered before implant placement. (1)

Practitioners have generally used conventional dental radiographs (periapical and panoramic) and conventionally fabricated surgical guides. Surgical guides conventionally fabricated on diagnostic stone casts do not provide information about the varying thicknesses of the mucosa, topography of the underlying bone, or anatomical structures; furthermore, they do not remain stable during surgery. Cone beam CT (CBCT) has been introduced for presurgical implant planning. Practitioners can now simulate ideal implant placement and treatment planning, including assessment of the precise dimensions of the implant, ideal depth, and angulation, using CBCT scans. In addition, prosthetically directed implant placement using computer

software can ensure precise placement and predictable prosthetic outcomes, with the literature reporting the use of computer-aided design/computer-aided manufacturing (CAD/CAM) stereolithographic (SLA) surgical guides, which offer a significant advantage to the surgeon by improving precision and minimizing complications such as mandibular nerve damage, sinus perforation, fenestrations, and dehiscence . [2, 3]

The design of the surgical stent can be classified into a non-limiting design, partial limiting design, and complete limiting design. Complete limiting design restricts all of the instruments used for the osteotomy in a buccolingual and mesiodistal plane and provides better accuracy but its drawbacks are high cost and lack of visibility of osteotomy site during drilling, as the guide is in place during the whole sequential drilling.

Thus this study was prompted to evaluate the accuracy of complete limiting surgical stent over partial limiting surgical stent.

REVIEW OF LITERATURE

Dental Implant definition

A prosthetic device made of alloplastic material(s) implanted into the oral tissues beneath the mucosal or/and periosteal layer, and on/or within the bone to provide retention and support for a fixed or removable dental prosthesis; a substance that is placed into or/and upon the jaw bone to support a fixed or removable dental prosthesis .Although dental implants may be classified by their silhouette or geometrical form (i.e., fin, screw, cylinder, blade, basket, root form, etc.) generally dental implants are classified based on their anchorage component as it relates to the bone that provides support and stability. Thus, there are three basic types of dental implants: periosteal dental implants, endosteal dental implants, and transosteal dental implants. The decision as to what anchorage system provides the most support at initial placement determines which category is used to best describe the dental implant; the dental implant(s) provide bony support via the dental implant attachment while the dental implant abutment(s) connect the dental implant to the fixed or removable dental prosthesis. (4)

Rationale of dental implant

Now, there are increased needs for implant related treatments. the needs result from a combined effect of a number of factors such as: an aging population living longer, consequences of fixed prosthesis failure, anatomical consequences of edentulism, poor performance of removable

prostheses, consequence of removable partial dentures, psychological aspects of tooth loss, predictable long term results of implant supported prostheses and advantages of implant supported prostheses.[5]

Dental implants have become a widely treatment option used for the replacement of lost teeth. The development of dental implants has a major impact on the patients and the implant supported oral restoration has been become an increasingly used treatment option for partially edentulous and completely edentulous patients. also even in patients with severe bone loss and in locations which all previously considered unsuitable for implant placement has been made possible by means of bone augmentation, regeneration, and soft tissue regeneration procedures.[6]

Advantages of implant supported-prostheses

The use of the dental implant to provide support for prostheses offers a lot of advantages compared with the use of removable soft tissue borne restorations.

A primary reason to consider dental implants to replace missing teeth is the maintenance of alveolar bone. The dental implant placed into the bone serves not only as an anchor for the prosthetic device but also it help in decreasing bone resorption.[7]

Occlusion is difficult to establish and stabilize with a completely soft tissue-supported prosthesis. Because the mandibular prosthesis may move as much as 10 mm or more

during the function, proper occlusal contacts occur by chance, not by design. But an implant-supported restoration is stable.[5]

Chewing efficiency with an implant prosthesis is improved greatly compared with that of soft tissue borne prosthesis.[8]

The stability and retention of an implant-supported prosthesis have great improvements over soft tissue-borne dentures. Mechanical means of implant retention are far superior to the soft tissue retention provided by dentures or adhesives and cause fewer associated problems. The implant support of the final prosthesis varies, depending on the number and position of implants.[9]

Prosthodontically driven implant placement

Over the past decade, advances in implant dentistry have helped create a greater appreciation for the aesthetic demands of the clinician and the patient.[10]Because of these demands, implant dentistry has experienced a profound shift: from function, with a surgically driven approach, to esthetics, with a prosthetically and biologically driven approach.[11]

Drawbacks of surgically driven implant:

Earlier dentists placed implants where the greatest amount of bone was present, with less regard to placement of the final definitive restoration. In most of the times, the placement of an implant is not as accurate as intended. Even a

minor variation in comparison to ideal placement causes difficulties in fabrication of final prostheses.

Failures arise as a result of lack of consideration of the super structure during pre-surgical planning. Accurate placement is required to achieve best functional and esthetic result. Since the oral cavity is a relatively restricted space, a high degree of accuracy in placement of implant is very important for the success of the prostheses. [6, 12]

Advantage of prosthodontically driven implant

Accuracy in the placement of implant can be achieved by means of a surgical guide which provides adequate information regarding implant placement and at the time of surgery it fits on to the existing dentition or on to the edentulous span. Achieving a long-lasting esthetic outcome requires using the final restoration as the guide for implant placement and considering the form and position of the planned prosthesis for the final restoration. [(12-14)

Reverse planning, starting from the final tooth position, allows determination of the exact location of the implant and assures an esthetic outcome.

Careful planning and the use of a wax-up, a mock-up, and surgical guides will provide the surgeon with references for locating the implant properly in the 3 directions of the space: apicoocclusal, mesiodistal, and labiopalatal. In this manner, an esthetic result can be achieved. However,