IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 22, Issue 2 Ser.15 (February. 2023), PP 11-17
www.iosrjournals.org

Guided Stents in Dental Implantology – A Review

A. Aneez, *PG student, Department of Prosthodontics and crown and Bridge, KarpagaVinayaga Institute of Dental Sciences, Madhuranthagam, Chengalpattu district, Tamil nadu, India.*
R. Kamala kannan, *Professor and Head, Department of Prosthodontics and crown and Bridge, KarpagaVinayaga Institute of Dental Sciences, Madhuranthagam, and Chengalpattu district, Tamil nadu, India.*
C. Nagappan, *Professor, Department of Prosthodontics and crown and Bridge, KarpagaVinayaga Institute of Dental Sciences, Madhuranthagam, Chengalpattu district, Tamil nadu, India.*
J. Raghunathan, *associate professor, Department of Prosthodontics and crown and Bridge, KarpagaVinayaga Institute of Dental Sciences, Madhuranthagam, Chengalpattu district, Tamil nadu, India.*
N. C. Arun Prasad, *Senior Lecturer, Department of Prosthodontics and crown and Bridge, KarpagaVinayaga Institute of Dental Sciences, Madhuranthagam, Chengalpattu district, Tamil nadu, India.*
S. Vinoth Kumar, *Senior Lecturer, Department of Prosthodontics and crown and Bridge, KarpagaVinayaga Institute of Dental Sciences, Madhuranthagam, Chengalpattu district, Tamil nadu, India.*
Corresponding author: Name: A. Aneez

ABSTRACT:
BACKGROUND:
Dental implantology has developed as a viable replacement for conventional prosthodontics. In order to deliver a prosthetic device that meets biologic, aesthetic, and biomechanical requirements, it has been challenging to precisely locate an implant in the bone. The guided stents act as a conduit for the transmission of treatment planning information. In recent days.as the importance of the treatment increased, the researches among this procedure had also increased. In this way so many new methods hadalso been invented to improve the treatment success. Placement of dental implants with the help of the guided stent is a successful criteria in the present days. The main aim of this review article is to describe the various implant surgical stents and to describe the considerations to use the implant guided stents.

Keywords: *Surgical guide, Surgical template, Implant, Implant placement, Surgical stent.*

Date of Submission: 13-02-2023 Date of Acceptance: 26-02-2023

I. INTRODUCTION:

To replace missing teeth, implants have now become an important option. Dental implants are difficult to place correctly despite major advancements in tools and methods.

The success of an implant relies on osseointegration and the placement of the implant in the best possible way to provide a functional and aesthetically pleasing repair. Implant placement in the best possible location aids in creating beneficial pressures on the implants. Previously failures were common in dental implants, it might be due to failure in implementation of the treatment plan during the procedure. To avoid such errors during placement and to implement proper treatment plan surgical stents were introduced.[1,2]

Prior to implant implantation, guided stents are the templates that provide the dental surgeon with information about the location of the patient's teeth. Previously dental implant position and placement depends mainly on the residual bone availability. Because of this after placement of implant, planning of prosthesis is very difficult. To avoid these difficulty prosthetic driven implantology was introduced, this includes guided stents or surgical templates.[3]

IDEAL REQUISITES OF GUIDED STENTS:

1. The guided stent has to be firm and shouldn't flex over time or after coming into contact with physical or chemical irritants. No "rocking" or insufficient seating of the guided stent should occur. When placed throughout radiographic inspection and surgical phases, it shouldn't go through any alterations or breakage.
2. The guided stent should allow the dental surgeon to place the implant in the ideal position according to the x, y, and z axes (i.e., buccolingual, mesiodistal, and apico-coronal dimensions).[4]

3. Size should be kept to a minimum while yet meeting stiffness and stability standards in order to ease surgical operations. To enable reflection of access mucous flaps, the guided stent's resin structure should be lower in height when teeth are missing.
4. The template should cover as many natural teeth as possible if the arch being treated still has any residual teeth in order to keep the guided stent in place. In the absence of any residual teeth, tissue-borne stents should extend over non-reflected soft tissue areas (include the mandibular retromolar ridges and pads, maxillary palate and tuberosities, and maxillary sinuses).[5]
5. The occlusal surface should be smoothed so that the guided stent may be suitably positioned when mild finger pressure is applied to assure immobility during implant site drilling. The template should be able to be inserted by the patient during a radiological examination and/or the physician during surgery. The size of the guided stent will determine how easy this treatment may be completed. In certain cases, it's required to eliminate all internal undercuts and lessen the height of the resin on the supporting teeth for the guided stent.
6. Although it could be helpful during surgery since it gives a sharper perspective of the operating field, transparency is not absolutely necessary. Additionally, the sleeve's inclination, which is visible from the outside, may be used as a guide to enhance drill direction.[6]
7. A guided stent is adjustable if the location and inclination of the sleeves may be altered. A radiographic evaluation conducted at the time of surgery planning makes this feasible.
8. There must be access to irrigation since drilling an osteotomy without irrigation would cause the bone to become too hot (necrosis), which will prevent the implant from integrating. Due to the surgical guide tube's diameter being around 0.2 mm bigger, sufficient irrigation is challenging to accomplish.[7]
9. The guided stent used in surgery also has to be sterilizable. Due to the need for chemical disinfection, this is challenging to do with the resinous materials now in use. Guided stents should be able to be cleaned with 3.2% glutaraldehyde and submerged in 0.12% chlorhexidine throughout the procedure.[8,9]

CLASSIFICATION:

There are three different surgical template designs are based on surgical restriction:

- ❖ Non limiting design
- ❖ Partial-limiting design
- ❖ Complete-limiting design

Non-Limiting Design

Due to the nonlimiting template's indication of the optimum space (position) for the last rebuilding instead of the genuine mesiodistal angulation, the implant surgeon is given more freedom in terms of dimension variability in the implant placement. Due to its simplicity in manufacture and cheap cost, the nonlimiting template has advantages. These stents only allow for the initial positioning of the planned prosthesis; they do not allow for the precise angle (buccolingual) or position (mesiodistal). 10 With this kind of stent, there is an incredible parcel of opportunity and scope about a definitive area of the embed.(Fig 1a)

Partial Limiting Design

One drill size may be angled using the directed sleeve or opening that is important for the incomplete restricting plan (typically the pilot drill). The other osteotomy locales are done by hand once the first drill is utilised. A partial limiting template may be made using a variety of methods, such as manually created templates in a laboratory or templates made from radiographic templates that are then transformed into surgical guided stents.[11,12](Fig 1b)

Complication: The nonlimiting design is less accurate than the partly limiting design, yet these templates still do not allow for the implant's ultimate location. Clinical tests have shown that these templates contain a significant amount of buccolingual orientation inaccuracy.

Complete Limiting Design

The location, angulation, and depth of the osteotomy are determined by the guided tubes or sleeves in the entire limiting template design, which limits the implant surgeon's ability to vary these parameters. If you have an osteotomy planned in the buccolingual or mesiodistal planes, this sort of instruction will help you avoid making any mistakes. Drill stops might also be used to prevent excessive depth preparation of the site. In essence, the ultimate location of the implant is known with the whole limiting design (Fig. 1c) prior to the actual operation. This method is widely used because it allows for rapid provisionalization after implant placement, allowing the final abutment or restoration to be made out of prosthetic materials.[12,13]

CBCT GUIDED SURGERY

CBCT Templates by Support:

When using a CBCT-generated treatment plan, the complete-limited design is the most common.

Tooth-Supported Guides

The most precise and user-friendly guides are those that are supported by teeth. These instructions rely heavily on the correctness of the impression and study cast since they are mostly employed by individuals with partial dentures (Fig 2a). These guides are usually transparent, making it possible to see the guide's whole seating arrangement. On the study cast or in the mouth, there should be no gaps between the guide and the teeth. The guide must also be sturdy and move not even slightly when softly handled.[14]

Indications

1. patients with partial tooth loss
2. Enough teeth to provide support for the guide

Bone-Supported Guides

Patients with partial or complete edentulousness may employ bone-supported guides. To reveal the bone ridges and enable for optimal guide seating, these guides need significant full-thickness reflection (Fig 2b). Correct seating of the guide may be challenging if bone alteration is recommended, which might lead to mistakes while implanting the patient. Prior to placing the bone-supported guide, a bone reduction guide may be employed in certain circumstances. It should be noted that there may be little bone protrusions below the scan's resolution. The preparation of the osteotomy site should thus begin with a careful inspection of the bone shapes.

Indications

1. Patient edentulous
2. Patients with partial dentition (at least three missing teeth)

Soft Tissue–Supported

Patients who have lost all of their teeth often need soft tissue-supported guides, and these procedures are typically referred to as flapless (Fig 2c). In certain situations, it might be difficult to position the guides appropriately, particularly if there is overextension beyond the vestibule or mouth floor. Sometimes bite registrations are used to make sure everything is set up correctly. It is common practise to use stabilising pins or screws after an osteotomy or while inserting an implant to ensure the bone heals properly. The most challenging cases for the use of soft tissue guides are those involving the flat palatal vaults of the maxilla and the high floor of the mouth with limited vestibule of the mandible. The "dual scan" method is used to create the majority of full arch soft tissue-supported guides.[15]

Indications

1. only patients without teeth
2. Must have enough backing

a. the maxilla (palate)

b. Mandible: adequate lingual or vestibular support for the prosthesis

CBCT by Drill Guidance

Pilot Guide

- ideal for a first job (buccal-lingual, mesial-distal)
- Only one drill was utilised.
- Final drilling and implant placement must be done freehand.
- Depth control may be present (guided drills with stops)[16]

Uses: position and angulation of the implant. (Fig 3a)

Universal Guide

- Compatible with all implant systems
- Drill guidance
- Depth control
- Finalize osteotomy with surgical system
- Must place implant freehand (Fig 3b)

Uses: depth, position and angulation

Fully Guided

- branded surgical supplies
- Depth control with drill guide (full sequence)
- Implant direction and depth control (Fig 3c)
- Possibility of immediate grin

Uses: depth, position, angulation, and implant placement

Types of Guided Stents

Three types of Guided stent can be used for dental implant placement they are as follows,

1. Radiographic diagnostic stent
2. Lab. constructed surgical guide stent (Positioning stent)
3. CAD/CAM constructed surgical guide template (stereolithographic or cone-beam stent).

1. Radiographic diagnostic stent:

A clear acrylic template constructed on a stone model of the patient (or a clear duplicate of denture) with radiopaque marks in different locations of the fitting surface to be used as a guide for radiographic determination of the best prospective sites for dental implants. (Fig 4a)

2. LAB. CONSTRUCTED SURGICAL GUIDE TEMPLATE (POSITIONING STENT):

A clear acrylic surgical template constructed on a stone model of the patient (or a clear duplicate of denture) with tubing in the predetermined sites for guiding the surgical drills during osteotomy and insertion of dental implants. (Fig 4b)

3.CAD/CAM CONSTRUCTED SURGICAL GUIDED STENT (STERIOLETHOGRAPHIC OR CONE-BEAM STENT)

A stent constructed according to the cone-beam computed tomography (CBCT) using CAD/CAM technique and milling machine (Fig 4c). It is used for guiding the surgical drills (during osteotomy) and dental implant (with a definite length, width and inclination) during insertion into the predetermined site. With the use of this kind of stent, the dentist is able to pinpoint precise locations for potential implant surgery and, as a result, choose the best position and angulation for the implant in relation to occlusal load. The prosthesis will be better designed, there will be less surgical trauma, less need for surgery, and patients will be more comfortable as a consequence of the dental surgeon's ability to eliminate needless osteotomy and prevent unsatisfactory implant site preparation.[17]

ADVANTAGES OF GUIDED STENTS:

less manual mistakes are made when implant placements are done by hand.

• Through minimally invasive techniques that provide psychological support to both the patient and the practitioner, postoperative surgical issues are reduced.

• Accuracy - Because implants are prosthetically driven parts, any inaccuracy might cause unexpected changes in how they work. Implant placement accuracy has improved because to guided stents.

• Safety: One of the key considerations when putting implants in the mouth's most vital locations is safety. Any mistake, no matter how slight, may have serious consequences. With the help of guided stents, such errors can be prevented.[18]

• Predictability; Predictability is more with guided stents.

Aesthetics - because of computer aided treatment planning and exact and easy implementation of treatment planning leads to good aesthetics results.

• Hygiene - Because implants are placed correctly, maintenance of good dental health is maintained.

• Implant supported prostheses need to be positioned in predetermined locations for the highest chance of survival. Such excellent implant locations may benefit from guides.

• A shorter implant surgical procedure.

• Simplicity of manufacturing: thanks to computer-aided designs, fabrication is simple.

• Graft harvesting is possible with the use of specialised surgical guide types, such as bone reduction guides.[19]

• In circumstances when all teeth are missing, the guide itself might serve as a temporary prosthetic.

• Accessibility: Improved surgical site visibility and simple access for flap exposure.

• Because of less failures and exacts implementation of treatment planning patient visits can be reduced.

DISADVANTAGES OF GUIDED STENTS:

- Guided stents do not allow the predetermined position of the dental implant if any modifications required at the time of surgery.
- Any tissue changes like soft tissue changes like swellings and hard tissue changes like loss of abutment teeth may alter the fit of the stent which leads to the failure of the dental implant placement.[20]
- Guide dislocation at the time surgical procedure.
- Drill stent lodgement
- Guide dislocation may also occur if the drill is meant to break through hard bone, which creates torsional stresses on the sleeves and causes them to lift off the guide.
- The start-up costs for acquiring software are quite high.

II. Conclusion:

We may draw the conclusion that, in today's prosthetic-driven implantology, surgical guided stents will remain a useful tool for obtaining accuracy. The use of surgical guided stents may be essential to creating the best implant treatment plan and achieving a positive treatment result.The guided stents serve diagnostic and surgical purposes.

Refrences:

[1]. Ramasamy M, Giri RR, Subramonian K, Narendrakumar R. Implant surgical guides: From the past to the present. Journal of pharmacy & bio-allied sciences. 2013 Jun;5(Suppl 1):S98.
[2]. Talwar N, Singh BP, Chand P, Pal US. Use of diagnostic and surgical stent: a simplified approach for implant placement. The Journal of Indian Prosthodontic Society. 2010 Dec;10(4):234-9.
[3]. Salem D, Mansour MH. Surgical guides for dental implants; a suggested new classification. J Dent Oral Health. 2019;6(104):1-8.
[4]. Misch CE. Contemporary Implant Dentistry. 3rd ed. St Louis: Mosby; 2008
[5]. Huh, Y. J., Choi, B. R., Huh, K. H., Yi, W. J., Heo, M. S., Lee, S. S., & Choi, S. C. (2012). In-vitro study on the accuracy of a simple-design CT-guided stent for dental implants. Imaging science in dentistry, 42(3), 139-146.
[6]. Sajjan MS, Yekula PS, Kovvuri SS, Alluri RR. A simple technique for fabrication of a surgical guide for predictable placement of dental implants. Journal of Dental Implants. 2017 Jan 1;7(1):11.
[7]. Stumpel 3rd LJ. Cast-based guided implant placement: a novel technique. J Prosthet Dent. 2008;100:61–69
[8]. Hebel MKS, Gajjar R. Anatomic basis for implant selection and positioning. In: Babbush C, ed. Dental Implants: the Art and Science. Philadelphia: WB Saunders; 2001:85–103.
[9]. Almog DM, Torrado E, Meitner SW. Fabrication of imaging and surgical guides for dental implants. J Prosthet Dent. 2001;85:504–5
[10]. Ozan O, Turkyilmaz I, Ersoy AE, et al. Clinical accuracy of 3 different types of computed tomography-derived stereolithographic surgical guides in implant placement. J Oral Maxillofac Surg. 2009;67(2):394–401.
[11]. Turbush SK, Turkyilmaz I. Accuracy of three different types of stereolithographic surgical guide in implant placement: an in vitro study. J Prosthet Dent. 2012;108(3):181–188.
[12]. Simon H. Use of transitional implants to support a surgical guide: enhancing the accuracy of implant placement. The Journal of prosthetic dentistry. 2002 Feb 1;87(2):229-32.
[13]. D'Souza KM, Aras MA. Types of implant surgical guides in dentistry: a review. Journal of Oral Implantology. 2012 Oct 20;38(5):643-52.
[14]. Khanna SS, Balaji SM, Priyadarshani MB, Syed S, Syeda TT, Mohammed S. Surgical Guides in Implants: A Review. Saudi Journal of Oral and Dental Research. 2020.
[15]. Pesun IJ, Gardner FM. Fabrication of a guide for radiographic evaluation and surgical placement of implants. The Journal of prosthetic dentistry. 1995 Jun 1;73(6):548-52.
[16]. Edge MJ. Surgical placement guide for use with osseointegrated implants. The Journal of prosthetic dentistry. 1987 Jun 1;57(6):719-22.
[17]. Ma B, Park T, Chun I, Yun K. The accuracy of a 3D printing surgical guide determined by CBCT and model analysis. The Journal of Advanced Prosthodontics. 2018 Aug 1;10(4):279-85.
[18]. Tarlow JL. Fabrication of an implant surgical stent for the edentulous mandible. The Journal of prosthetic dentistry. 1992 Feb 1;67(2):217-8.
[19]. Ku YC, Shen YF. Fabrication of a radiographic and surgical stent for implants with a vacuum former. The Journal of Prosthetic Dentistry. 2000;2(83):252-3.
[20]. Tsuzuki T, Matsuura T, Kido H, Ishikawa M, Ukon S, Sato H. New Fabrication System for Dental Implant Surgical Stents: Time- Saving Laboratory Technique Using a Light- Curing Resin and Transparent Artificial Teeth. Clinical Implant Dentistry and Related Research. 2001 Apr;3(2):107-10.
[21]. Render PJ, Fondak JT. A surgical guide for implant placement. The Journal of Prosthetic Dentistry. 1992 Jun 1;67(6):831-2.
[22]. O'Neilly PJ, McGlumphy EA. New implant surgical guide. The Journal of Prosthetic Dentistry. 1993 Dec 1;70(6):506-10.
[23]. Poitras Y: The complete edentulous maxilla surgical template, Monte Carlo, Monaco, 1996, International Congress of Oral Implantologists
[24]. Meitner SW, Tallents RH. Surgical templates for prosthetically guided implant placement. The Journal of prosthetic dentistry. 2004 Dec 1;92(6):569-74.
[25]. Becker CM, Kaiser DA, University of Colorado Health Science Center D. Surgical guide for dental implant placement. The Journal of prosthetic dentistry. 2000 Feb 1;83(2):248-51.

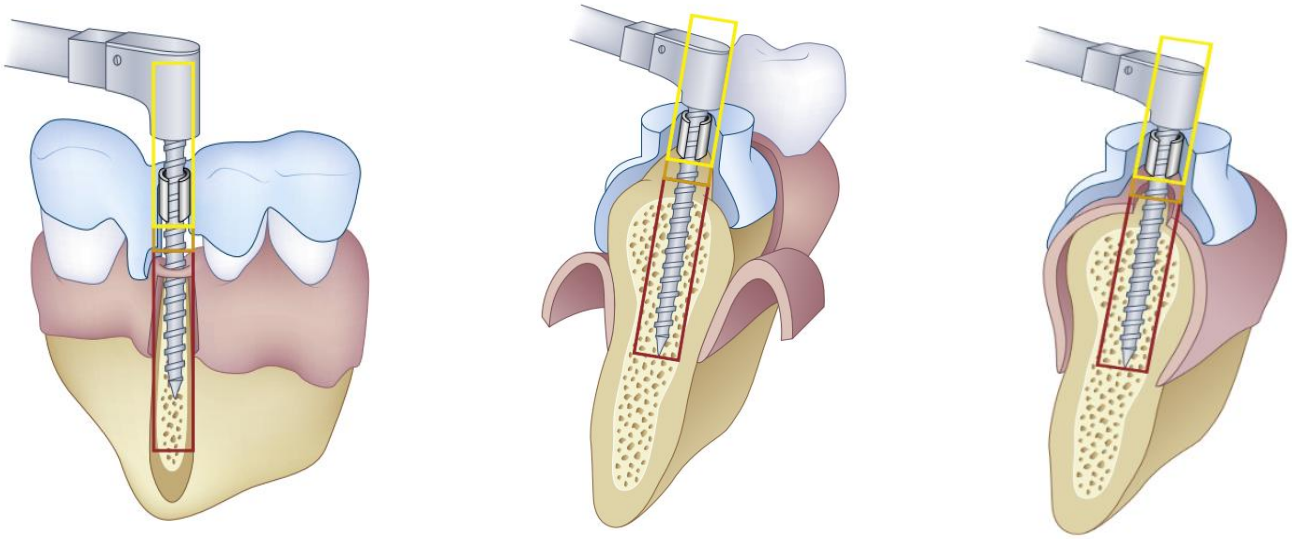
FIGURE LEGENDS:

FIGURE1:

a) Non Limiting Design b)Partial limiting Design

c)Complete limiting Design

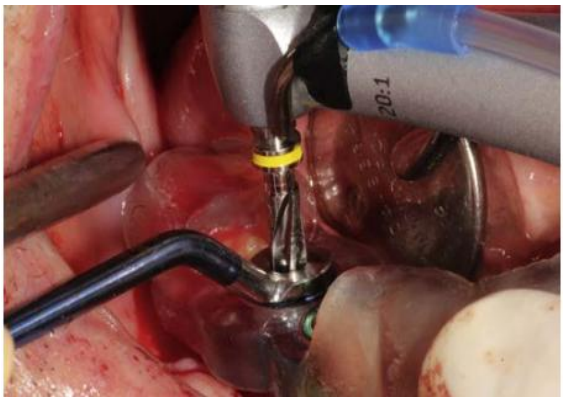
FIGURE 2:



a)Tooth Supported b)Bone Supported c) Soft Tissue Supported

FIGURE 3:

a)Pilot Guide



b) Universal Guide

c) Fully Guided

FIGURE 4:

a)Radiographic Stent

b) Lab Constructed Template

c) CAD/CAM Constructed Guided Stents