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Review Article

Minimally invasive flapless approach in dental implant – A review

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ABSTRACT

Dental implants are surgically placed into or on top of the jawbone of the patients. They are considered to be an important contribution to dentistry as they have revolutionized the way by which missing teeth are replaced with a high success rate. Before dental implants, dentures and bridges were used, but dental implants have become a very popular solution due to the high success rate and predictability of the procedure, as well as its relatively few complications. A full thickness mucoperiosteal flap is used in a typical dental implant placement procedure to expose the alveolar ridge. Dental implants are then inserted in the bone, and the flaps are adapted using sutures. Over the past three decades there have been several alterations to this flap design, now integrating esthetic considerations in the critical esthetic zones of the dentition. Flapless implant surgery is one of these alterations that is quickly rising in popularity. This review will highlight about the techniques, advantages and disadvantages of flapless implant surgery over the traditional implant surgery.

1. Introduction

Dental implants (also known as oral or endosseous implants) have been used to replace missing teeth for more than half a century. They are considered to be an important contribution to dentistry as they have revolutionized the way by which missing teeth are replaced with a high success rate. The most common cause of teeth loss is periodontitis, and other causes include dental caries, trauma, developmental defects, and genetic disorders. The use of dental implants to rehabilitate the loss of teeth has increased in the last 30 years.[1] Intimate contact between the implant surface and the peri-implant bone must be established and maintained for dental implants to be successful. Therefore, for any implant system to be successful, there must be integration between the implant surface and the bone. As a direct structural and functional connection between organised live bone and the surface of a load-bearing implant, this integration is referred to as osseointegration.[2]

Modern implantology has been built on the idea of surgery with flap elevation since the 1970s. The painful tooth extraction can be done either before or after the flap procedure.[3] A full thickness mucoperiosteal flap is used in a typical dental implant placement procedure to expose the alveolar ridge. Dental implants are then inserted in the bone, and the flaps are adapted using sutures. Flap elevation improves vision and access at the surgical site, but it also increases the risk of interproximal crestal bone loss and long-term aesthetic concerns (Fahim Vohra et al, 2014).[4] The flap is used in the conventional method of

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implant insertion. In the original guidelines, implants were to be covered with mucosal flaps for 4 to 6 months.[5,6] De Sanctis & Zucchelli (2007) modified the flap's design, which needed two phases.[7] Modifying is initially done to get rid of infection and lessen micromotion.

This flap design has undergone a number of changes over the past three decades, currently including aesthetic considerations in the dentition's crucial aesthetic zones. Early 1970s studies revealed a connection between flap elevation and gingival recession as well as bone resorption surrounding natural teeth.[8] The flapless surgical approach was introduced in the late 1970s by Ledermann to overcome the bone resorption process. Flapless implant surgery is one of these alterations that is quickly rising in popularity. According to the findings of numerous studies conducted on both people and animals, flapless implant surgery is regarded as a stable procedure that should provide positive outcomes.[3] The alveolar mucosa and bone are perforated using a tissue punch or a crystal incision, as opposed to the flap approach, which requires the elevation of a mucoperiosteal flap. Therefore, flapless surgery ensures reduced invasiveness, preservation of vascularity of tissue, absence of vertical incisions, reduced patient discomfort, and a shorter perioperative period. Patient recovery results in minimal or no swelling.[3] The inter-dental papilla is preserved as much as feasible by the limited flap design. The inter-proximal bone around the neighbouring tooth is kept from losing its periosteum by maintaining the inter-dental papilla. As a result, bone nourishment is unaffected and there is less bone resorption following dental implant installation.[9] Experimental studies have proven that by flapless implant surgery we can prevent alteration of vascularization of involved area.[10] In atraumatic techniques, less crestal bone resorption is seen which has an influence on final aesthetics. In this review we will see about the flapless implant procedure, their advantages and disadvantages over conventional procedure.

There are two types of flapless implant surgery:

1. Direct drill method
2. Soft tissue punch technique.

2. Flapless Implant Procedure

Innovative site preservation procedures created for immediate or delayed implant insertion following tooth extraction in regions of high aesthetic concern were some of the first uses of the "flapless" approach in dental implant surgery. In order to fully prepare the vascular supply and surrounding soft tissue, the flapless technique is often performed with a tiny incision, drilling into the soft tissues, or removal soft tissue with a tissue puncher or rotational burs without flap elevation. A modified implant treatment known as the "flapless technique" did not use horizontal or vertical incisors for immediate or delayed implant placement.[11]

Before the treatment began, a mouthrinse containing 0.2% chlorohexidine was given. A 4mm soft tissue punch was utilised to remove the soft tissue at the operative site after local anaesthetic (2% lidocaine) infiltration. An initial round bur and a 2mm twist drill were used to prepare the osteotomy site, and plenty of saline irrigation and parallelism checking were done. To get the appropriate height and width, further drills of varying heights and diameters were made after that. Implant placement is completed.[12]

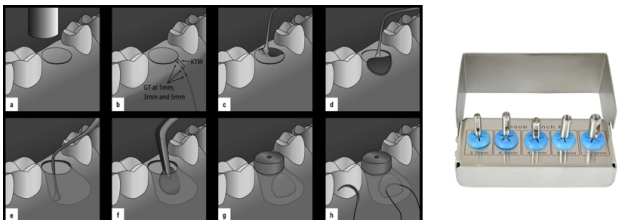

Fig. 1:

Flapless implant surgery can be accomplished by guided surgery utilising 3D navigation, assisted surgery using classic retrograde planning without 3D navigation, or traditional implant placement without the aid of a surgical guide (free-hand).[13]

Awareness of the indications and the surgical approach (soft tissue surgical manoeuvres) widely utilised for effective treatment of peri-implant tissues is another requirement for implant surgeons wishing to do flapless implant surgery.[14] In order to get the best flap design when inserting a implant which is submerged or connecting the submerged implant to the abutment, the peri-crestal incision must be placed so that around 3 mm of high-quality keratinized tissue is left on the oral side of the growing implant structures. When there is 5 to 6 mm of residual keratinized gingival on the buccal flap next to the implant site, resective contouring (gingivectomy) is advised.

Table 1: Guidelines for selecting tissue surgical maneuvers

Width of keratinized gingiva present on buccal flap margin	Indicated surgical meneuver
5 to 6 mm	Resective contouring
4 to 5 mm	Papilla regeneration (Palacci)
3 to 4 mm	Lateral flap advancement

Anthony G. Sclar. Guidelines for flapless surgery. *J Oral Macillofac Surg*

3. Various Implant Placement in Flapless Procedure

A well-accepted surgical procedure and standard practise for primary implantation in the aesthetic zone is immediate implant insertion using a flapless method since it requires less time during surgery, has a better prognosis, and is more

affordable than delay loading.[15] There were no significant differences between the immediate and delayed therapy in terms of clinical parameters such implant survival, bone resorption, and keratinized gingiva.[16] It was also discovered that patients with initially partial facial bone wall missing responded favourably to one-stage flapless surgery with delayed implant insertion.[17] On the other hand, immediate implantation might improve face aesthetic by preserving surrounding soft tissue after an initial recession of 1 to 3 mm.[18] Additionally, initial loading did not manifest osseointegration faults, demonstrating the peri-implant bone's reaction to these circumstances.[19] To increase implant longevity and obtain favourable results in regards to precise implant locations, preoperative preparation is essential. In some circumstances, the traditional method is still advised as the best practise.[20] Tomography and modern computer software are used in instantaneous flapless surgery to achieve great clinical dependability.[21]

3.1. Advantages of Flapless implant procedure

1. Faster perioperative healing: Less invasive techniques, such as flapless ones, might produce superior clinical outcomes by preventing the reflection of soft tissue while requiring less time for surgery and a quicker recovery for the patients. In contrast to traditional surgery, when the flap is likely to dehisce, the wounds in the surrounding mucosa are smaller, cleaner, and less exposed after flapless treatments. Cleaner wounds may enhance the healing of the peri-implant mucosa.[22]
2. Post-operative area will be good as there is absence of suture.
3. Following surgery, mucoperiosteum reflection and suturing are not necessary since flap elevation is not necessary and operations on neighbouring tissues are minimised. Consequently, surgery time is often cut down.
4. The vascular supply and surrounding soft tissue are properly protected with the flapless procedure since it doesn't elevate the flap and instead employs rotating burs or a tissue punch to obtain access to the bone. Hence flap necrosis is prevented in case of flap elevation technique.[23]
5. A clean surgical site, less bleeding, and fewer complications are all benefits of an intact vasculature. Using this minimally invasive surgical technique, the interdental papilla's integrity and the alveolar blood flow of the surrounding osseous are adequately protected.[12]
6. Traditional techniques may involve more complicated surgical procedures and specialised equipment, increasing procedural challenges and morbidity. Studies even imply that patients' postoperative discomfort, such as pain and edema, is essentially non-existent after flapless implant surgery. Thus, patients who have high hopes embrace the flapless implant approach.[12]
7. Dr. Sami Khalaf Jabar College of Dentistry- Maysan University, in his study regarding the advantages and disadvantages of flapless implant technique suggested that radiographic findings showed, mean bone loss in flap technique was more when compared to flapless implant technique in 3 months, 6 months and 12 months follow up.[24]
8. Patient's perception of minimally invasive therapy

3.2. Disadvantages of Flapless implant

1. Limited vision is one of the negatives since it makes it difficult for surgeons to see important anatomical markers. Due to the inability to position the implant as effectively as with the flap procedure, there was a greater chance that it would be put at the incorrect depth or angle, which raised the risk of bone loss. Utilising computer-aided techniques, the implant recipient location and nearby anatomical components may be visualised in three dimensions.[25]
2. The capacity of flapless implant surgery to shape osseous topography is diminished when tissues are required to support restorative treatments and to enhance the shapes of soft tissues.
3. The possibility of thermal injury as a result of restricted access for irrigation during osteotomy preparation, because bone cell survival is sensitive to heat. Local bone necrosis may result from the heating of nearby bone, which will be after which fibrous tissue will be positioned at the implant-bone contact.[26]
4. Even though flapless implant surgery ensures little discomfort for the majority of patients, bone resorption cannot be totally avoided. Bone resorption may occur when the vestibular bony wall is not thick.[27]
5. Flapless implant surgery is a blind technique, according to Malteo and Francesco (2010). As a result of the challenging evaluation of alveolar bone shape and angulation, one should be aware of the danger of deviation implant.
6. The overall width of the keratinized tissue surrounding the implant is also very likely to be greatly reduced. as a result of this operation, which is unavoidably required to remove the tissue punch at the implant site.
7. Since the mucogingival tissues are not elevated during the masked approach used in this procedure, certain surgical risks and consequences, such as unnoticed bone dehiscence/fenestration and the possibility for infection, might arise.

Table 2: Flap procedure

Advantages	Disadvantages
• Surgical visibility is enhanced	• Greater surgical exposure required
• Allows for bone and soft tissue contouring	• Increased postoperative sequelae
• Increased surgical control for osteotomy site	• Delayed recovery time
	• Reduced blood supply after flap
	• Increased surgical time

4. Complications in Flapless Implant Surgery and Safety in Placement

There have been reports of surgical, postoperative, and prosthetic problems in diverse situations. Primary implant instability, misfitting, and surgical guide fracture were the major surgical problems.[28] Following post-extractive implant implantation in the front jaw using a flapless approach, Luisa Limongelli et al. found the first incidence of a significant lingual and sublingual haemorrhage. The patient's immunity was linked to other common surgical problems such mucositis and peri-implantitis that were accompanied by persistent discomfort. Three-dimensional (3D) imaging by CT scans is required to visualise the mandible shape, provide definite drilling parameters such length and angulation, and safeguard the soft tissues in sublingual region and vascular structures to prevent this problem.

5. Digital imaging in Flapless Implant Surgery

For accurate placement of implant in case of flapless implant surgery certain pre operative imaging should be carried out. Cone beam computed tomography (CBCT), intraoral scanners, CAD/CAM software, and S-CAIS are four typical digital technologies used in flapless surgery. Preoperative CBCT is the initial stage of digital implant surgery. It offers cross-sectional imaging and then reconstructs the maxillofacial skeleton in three dimensions. A relatively low radiation dose CBCT has excellent linear bone measurement accuracy and dependability.[29] CBCT is required for buccal wall assessment during placement of implant. For exact implant location, intraoral scanners record the body. The digital impression accuracy of implant restorations in the edentulous arch has improved as a result of this scanning method.

6. Discussion

Implant placement with flap reflection is a conventional, well- established method, whereas implant placement without flap has been an experimental, developing technique that still needs support from convincing data. There are many varying viewpoints around this issue, and no clear resolution has yet been found. Early research revealed that implants could inhibit a fibrous repair at the bone-implant interface brought on by micromotion when implant lifespan was taken into consideration.

Any surgical procedure, including the implantation of implants, attempts to reduce as much as possible the stressful preparation of soft tissues. Keeping in mind the drawbacks of conventional flap, specifically crestal bone loss and long-term cosmetic consideration, a redesigned flap design was employed in order to preserve the post-surgical crestal bone loss that occurred after implant installation.

In their 2013 study, Al-Juboori et al. evaluated the effects of the initial implant site on the crestal bone level in both flap and flapless approaches over the course of the healing process. 22 non-submerged implants were implanted with a 12-week follow-up utilising both the flapless and flap methods. The initial implant location and the mean bone level were shown to be positively correlated in the flapped group, but not in the flapless group. The authors asserted that the flapless group's abundant blood supply to the alveolar bone was caused by shielding the periosteum and blood vessels from cutting. According to Al-Juboori et al. (2013), this abundant vascularity served as an effective defence against bacterial invasion.[30]

For instance, the flapless technique for site preparation and drilling precision is significantly hindered by the loss of sight.[31] Although open-flap surgery is less safe than flapless surgery, there are still some issues or even life-threatening events that can occur. Flapless surgery has been shown to be inferior to traditional methods, and implant failure is recognised as a noteworthy complication.

Flapless surgery is not always appropriate because it requires enough keratinized gingiva and enough bone. Flapless surgery is not always favoured, as it is not known if it is preferable than flap protocol in terms of the extent of bone and soft tissue alterations. The initial stage in choosing clinical patients who will benefit from the implant method is evaluating pertinent CBCT parameters, such as the buccal wall width, angulation of tooth, and alveolar ridge.[32,33]

Flapless surgery is now progressing quickly because to auxiliary approaches. Because piezosurgery efficiently increases implant success and favourable prognosis, the piezosurgery-associated flapless protocol is often employed. Additionally, digitally based computer-guided surgery is gaining popularity due to its precision and ease in surgical operations.[34] Virtual prosthesis placement is possible because to 3D imaging and software, and it seems more exact than freehand or flapping surgery in the intended implant site.

A drawback of flapless surgery is that because the mucogingival tissues are not elevated, the real architecture of the underlying accessible bone cannot be seen. This might raise the possibility of perforations (such as fenestration or dehiscence), which in turn could

cause complications or even implant failure. Long-term outcomes on the integration of numerous procedures, corrections of errors, and avoidance of difficulties will be necessary. Comparatively to traditional techniques, the flapless approach now requires surgeons to be informed and skilled. We expect that advanced flapless surgery will significantly increase accuracy and safety to meet patients' expectations while also being more suited for emerging dentist.

7. Conclusion

Implant placements are becoming more effective, thanks to recent developments in implant treatment. The standard way of implant insertion has proven less effective than the minimally invasive approach, which also has a high patient compliance rate. Compared to the flap approach, placing dental implants without a flap results in much reduced crestal bone loss. Decreased post-operative discomfort, improved aesthetic outcomes, and decreased bone loss and bone resorption are all proven to be benefits of the flapless procedure. Therefore, flapless implant surgery can be considered as a promising alternative to conventional flap. It is important to pay attention to surgical avoidance of problems, and additional research is required for implant failure brought on by deviations.

8. Source of Funding

None.

9. Conflict of Interest

None.

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