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Management of Dental Implant in Esthetic Zone

A Project Submitted to

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Certification of the Supervisor

I certify that this project entitled “Management of Dental Implant in Esthetic Zone” was prepared by the fifth-year students Hawraa Khalid and Hussien Naji under my supervision at the College of Dentistry/University of Baghdad in partial fulfilment of the graduation requirements for the Bachelor Degree in Dentistry.

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Dedications

I dedicate this project to Allah first, and my family for their endless support and their love and efforts over the years to make the best version of me, they helped me be the confident person I am today. Also, I'd like to thank my friends for their encouragement and patience with me.

Furthermore, I want to thank myself for all the progress I had made to make my dream comes true. In the end a special thanks to the one who's always by my side throughout this journey.

Hawraa Khalid

This work is dedicated for my family for the support and encouragement they provided.

Hussien Naji

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Finally, special thanks to our families and friends who kept pushing us forward to give our best.

Abstract

The objective of this review is to discuss the proper way of treatment planning implant placement in aesthetic zone and to describe the different types of remaining tissues and their effect on the outcome. It will also describe modifications of traditional methods and materials used for horizontal and vertical bone augmentation. In addition, it will analyze the different approaches of surgical treatment of soft tissue around the dental implant using different types of flaps and techniques during the first and second stage of implant placement.

Articles on treatment planning, hard and soft tissue augmentation around implant were collected. We conclude that the pathway to esthetic success begins with an understanding of the features of an esthetic smile and an accurate diagnosis and treatment plan, that it is necessary to prepare the deficient ridge with ridge augmentation procedures and to modify these procedures to maximize tissue gain and that many types of flaps where used in the implant surgery to enhance soft tissue and to create a papillae around the final implant prosthesis with no proof of effectiveness of one procedure over another and the techniques are associated with great results if we stick to the basic principles of correct patient selection, proper surgical approach, gingival biotype, with appropriate implant positioning.

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List of Abbreviations

CEJ	**Cementoenamel Junction.**
RP-4	Removable Prosthesis-4.
FP	Fixed Prosthesis.
FP-2	Fixed Prosthesis-2.
FP-3	Fixed Prosthesis-3.
CT	Computerized Tomography.
HTM	Hard Tissue Management.
GBR	Guided Bone Regeneration.
FPD	Fixed Partial Denture.
rhPDGF	Recombined Human Platelet-Derived Growth Factor.
RhBMP-2	Recombined Human Bone Morphogenetic Protein-2.
PRP	Platelet Rich Plasma.
PRF	Platelet Rich Fibrin.
MRF	Modified Roll Flap.
FGG	Free Gingival Graft.
CTG	Connective Tissue Graft.
SCTG	Subepithelial Connective Tissue Graft.
IIPP	Immediate Implant Placement and Provisionalization.
Fig	Figure.
AOD	Alveolar Osteogenic Distraction.
PES	Pink Esthetic Score.
WES	White Esthetic Score.

INTRODUCTION

Dental implants are routinely utilized to replace missing teeth and have excellent success rates and several advantages over fixed or removable alternatives for tooth replacement. In the early years of modern implantology, the chief concern was tissue health and implant survival **(Gerard J. Lemongello, 2007)**. Over the last decade, there has been an increasing appreciation that esthetics is just as important to the success of the final restoration as health. Unlike implants in the early years of osseointegration, many implants now being placed are in the anterior maxillary region which can be known as an esthetic area **(Mohanad Al-Sabbagh, 2006).**

Single-tooth implants were first described in 1986, and survival rates varying between 90% and 96.3% after up to 10 years have been reported. Although highly predictable, complications may occur and may sometimes be difficult to overcome **(Bruna M. Vetromilla, 2018).**

The success of implant therapy, however, should not be solely dependent upon its long-term survival, but also on its functional, esthetic, hard and soft tissues stability, as well as patient reported outcomes. Indeed, over the years patients' esthetic demands have increased such that even a minimal apical shift of the gingival margin revealing the greyish color of the implant may be considered unacceptable, especially in the esthetic region (**Hom-Lay Wang, 2019).**

Implant restorations, however, do present the clinician with some challenges, since preserving the desired gingival and osseous architecture can be difficult. The framework for the development of healthy esthetic soft tissue is the osseous tissue, and soft tissue contours are dependent on the supporting hard tissue structures **(Gerard J. Lemongello, 2007).**

Anywise the transition between the restoration and the soft tissues must appear natural, and the emergence profile (EP) often requires customized modification **(Gomez-Meda et al., 2021).**

History of the Implant in Esthetic Zone

The “Esthetic Zone” refers to area of mouth that can be seen when we smile, which is why it is also known as “Smile Zone.” Implant placement and restoration to replace single or multiple teeth in the esthetic zone is especially challenging, particularly if there are multiple missing teeth and with deficiencies in soft tissue or bone. Rightfully, patients are highly sensitive to the appearance of their teeth and gums which are most prominent when they smile **(Kan JYK et al.,2000).**

Dental implants are routinely utilized to replace missing teeth and have excellent success rates and several advantages over fixed or removable alternatives for tooth replacement Implant restorations, however, do present the clinician with some challenges, since preserving **(Tarnow DP et al.,1992).**

the desired gingival and osseous architecture can be difficult. The framework for the development of healthy aesthetic soft tissue is the osseous tissue, and soft tissue contours are dependent on the supporting hard tissue structures **(Touati B, GuezG et al.,1999).**

Preservation of the interproximal bone level of adjacent teeth is essential in supporting the interdental papillae.

there is Precise fit between dental implants and the superstructure is important for the long term success of implants and implant supported prostheses **(Sahin S, Cehreli MC et al.,2001).**

One factor which may influence the accuracy of the definitive prosthesis is the stability of the impression coping in polymerized impression material. In some circumstances, an implant must be placed well below the gingival margin, meaning that most of the impression coping will also be situated subgingivally with no contact with the impression material **(Aesthet Dent et al.,1999).**

To achieve a successful esthetic result and good patient satisfaction, implant placement in the esthetic zone demands a thorough under-standing of anatomic, biologic, surgical, and prosthetic principles. The ability to achieve harmonious, indistinguishable prosthesis from adjacent natural teeth in the esthetic zone is sometimes challenging. Placement of dental implants in the esthetic zone is a technique-sensitive procedure with little room for error. Guidelines are presented for ideal implant positioning and for a variety of therapeutic modalities that can be implemented for addressing different clinical situations involving replacement of missing teeth in the esthetic zone.

Before inserting an implant in the esthetic zone, it is always important to assess the risk factors that may influence the results **(Kan JYK et al.,2000).** Smoke is an unfavorable factor for the success of the therapy. Smoke, as a matter of fact, can exert a negative effect on the carried-out implant procedures, on implant osseointegration and on the onset of long term peri-implantitis. It has been proved that people smoking more than 10 cigarettes a day are to be considered at "high esthetic risk".

A further element to be taken into consideration is the patient's smile line. A "medium" smile line exposes the coronal half of mandibular incisors and makes the upper lip touch the neck of the central incisors and the canines slightly. When this line is very high, the typical gingival smile, exposing a portion of soft tissues apically to the maxillary incisors, will be present. In this case it is very important to pay attention to the height, symmetry, and shape of the soft tissues, since they are integral part of the rehabilitation.

A thin and scalloped gingival biotype is definitely a high risk factor for the esthetic rehabilitation. A very thin gum cannot guarantee predictability in the long-term keeping of the interproximal papilla; moreover, there is also a high risk of soft tissues recession. A further problem that may arise with thin gingival tissue is that it may not disguise the greyish color of the implant or of subgingival metallic elements.

In order to avoid the risks associated with the biotype of soft tissues, during the surgical phase it is possible to bulk the soft tissues using connective tissue grafts and to thicken the buccal bone using grafts: these operations should minimize the risk of recession. A possible alternative to get rid of the typical greyness of the sub-gingival metallic elements is to use zirconia or alumina secondary aesthetic components **(Tarnow DP et al.,1992).**

The assessment of the attachment line on the teeth adjacent to the site to be treated is of primary importance for a good management of the case. If the teeth show an increased probing depth, it becomes necessary to carry out a periodontal treatment before starting any implant in an adjacent zone.

When the teeth show a deficit of both soft tissues and hard tissues there is always the need to take the patient's expectations into account. In these cases, it is indeed very probable that the papilla will not fully mature because of the distance between the contact point and the osseous level. If this distance is >7mm, the papilla will not fully fill the interproximal space.

Replacing a single tooth in the aesthetic zone with an implant has always to be approached with extreme caution by the implantologist. What may seem to be just a slight positioning fault may result in aesthetic problems of hard resolution. For these reasons it is always advisable to use a surgical stent as a guide in the various phases of the operation.

Chapter One: Literature Review

Part One: Diagnosis and Treatment Planning

1.1 Differences between periodontal and peri-implant tissue:

Currently the term most in use is osseointegration, which con notes a bone adaptation to the implant and is most utilized in connection with root form dental implants or fixtures, and "fibro-osseous integration" which describes the interposition of a peri-implant ligament between the bone and the implant resulting in a possible substantial load reduction in the bone. Plate-form (blade) implants fall into this latter category. Present guidelines of the Council of Dental Materials of the American Dental Association for acceptance for endosseous implants do not specify which bone adaptation is required or recommended. However, it is essential to understand the surface chemistry of the implant before a rational decision can be made as to the validity of either concept **(M. Meffert et al., 1992).**

Major differences between healthy peri-implant and periodontal tissues are the implant device lacks tooth characteristic structures such as root cementum, periodontal ligament, and bundle bone (alveolar bone proper). The dentoalveolar and the dentogingival fiber bundles connect the soft tissues with the tooth (Root cementum), while no such fiber bundles are apparent in the peri-implant tissues. At periodontally healthy sites, the margin of the gingiva follows the outline of the cementoenamel junction, while at a corresponding implant site the mucosal margin follows the contour of the crestal bone (multiple implants) or relates to the connective tissue adhesion at adjacent teeth (single implants). The tooth is mobile within its socket, while the implant is rigidly anchored (ankylosed) to the surrounding host bone **(Mauricio G. Araujo et al., 2017).**

As is the case with teeth, the transmucosal component of implants needs to provide a physical and physiological barrier between the external oral environment and the underlying tissues. The implant mucosa interface also includes a sulcus resembling that associated with teeth, as well as an attachment apparatus. Indeed, the architecture of the supra alveolar transmucosal components, consisting of a sulcus, junctional epithelium, and connective tissue attachment, is similar around implants and teeth. Although both the transmucosal component of implants and the transgingival component of teeth have a sulcus (in health)/pocket (in disease) and a connective tissue attachment, important differences exist, which have clinical implications for the maintenance of peri-implant mucosal health, as well as for the diagnosis and management of peri-implant disease **(Atsuta et al., 2016).**

Although the similarities between soft tissue-to-implant and soft tissue –to-tooth interfaces, some differences should be considered. At the bone level, the absence of the periodontal ligament surrounding an implant has important clinical consequences. This means that no resilient connection exists between implants and supporting bone. Implants cannot intrude or migrate to compensate for the presence of a premature occlusal contact (as teeth can). Implants and the rigidly attached implant restorations do not move. Thus, any occlusal disharmony will have consequences at either the restoration-to-implant connection, the bone-to implant interface, or both. Proprioception in the natural dentition comes from the periodontal ligament. The absence of a periodontal ligament around implants reduces tactile sensitivity and reflex function. This can become even more challenging when osseointegrated, implant-supported, fixed prostheses are present in both jaws. The lack of a periodontal ligament and the inability of implants to move contraindicates their use in growing individuals. Natural teeth continue to erupt and migrate during growth, whereas implants do not **(Newman et al., 2019).**

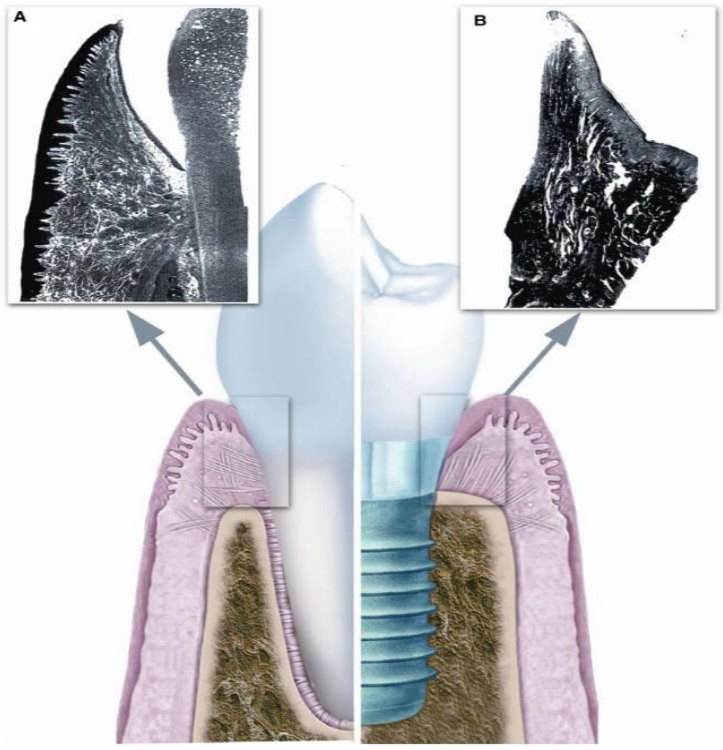


Fig.1: Cross-section of the buccal dentoalveolar region (A) and of buccal and coronal part of the peri-implant bone and mucosa (B). Similar anatomical components (i.e., sulcular epithelium, junctional epithelium, and connective tissue) are present in both periodontal and peri-implant mucosa.

1.1.1 Periodontal and Peri-Implant Mucosa

The gingival junctional epithelium is part of the attachment apparatus between the tooth and gingiva.

The innermost cells of the junctional epithelium form the epithelial attachment apparatus, which ensures a tight seal against the tooth surface. This adherence to the tooth surface means that the junctional epithelium plays a critical role in tissue homeostasis and defense against microorganisms and their constituents. It is universally accepted that the integrity or the epithelial attachment between the implant and the peri-implant mucosa is critical to maintaining osseointegration.

Consistent with the epithelial structure and arrangement of the natural dentition, the peri-implant mucosa consists of a well-keratinized oral epithelium at the outer surface, which is continuous with a sulcular epithelium lining the lateral aspect of the gingival sulcus. This inner lining epithelial attachment of the peri-implant mucosa resembles the junctional epithelium of the teeth in its histological characteristics. Berglundh et al. showed, in an experimental animal study, that an epithelial structure of a few cell layers in thickness extends approximately 2 mm apically from the soft-tissue margin. It is believed that the formation of this barrier epithelium facing the implant is a natural result of wound healing, with the epithelial cells proliferating along the exposed implant surface until continuity of the epithelium is restored **(Ivanovski & Lee, 2017)**. So, in the light of our knowledge of biomaterials and the implant interface, a prerequisite to a successful endosseous dental implant should be obtaining a peri-mucosal seal of the soft tissue to the implant surface. Failure to achieve or maintain this seal results in the apical migration of the epithelium into the bone/implant interface and possible complete encapsulation of the endosseous or root portion of the implant system. While in natural dentition, the junctional epithelium provides a seal at the base of the sulcus against the penetration of chemical and bacterial substances. If the seal is disrupted and/or the fibers apical to the epithelium are lysed or destroyed, the epithelium migrates apically, forming a periodontal pocket after cleavage of the soft tissue from the radicular surface. Since there is no cementum or fiber insertion of the surface of an endosseous implant, the peri-mucosal seal may be extremely important **(M. Meffert et al., 1992).**

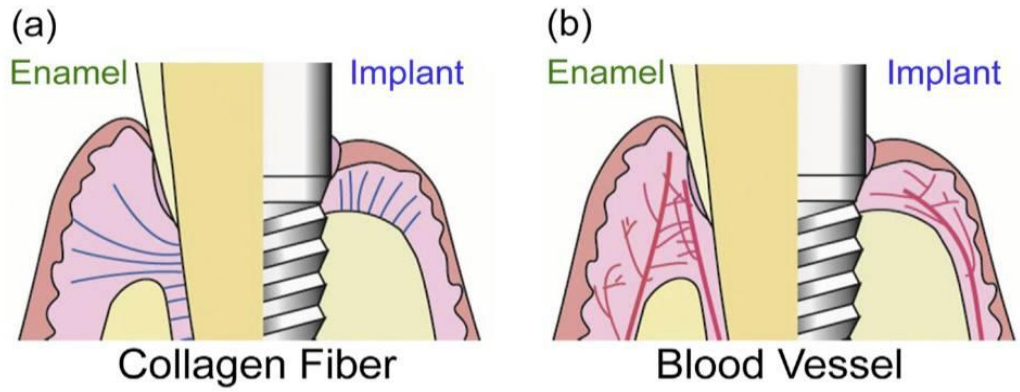


Fig.2: Locus of collagen fibers and blood vessels in gingiva. (a) Natural tooth has collagen fibers perpendicular to the cementum surface, whereas around implants, these fibers extend from the bone and run parallel to the implant surface. (b) Normal periodontal soft tissue is supplied by blood from vessels running both outside the alveolar bone and through the periodontal ligament: In contrast, the peri-implant tissue has a reduced blood supply as the periodontal ligament source is not present.

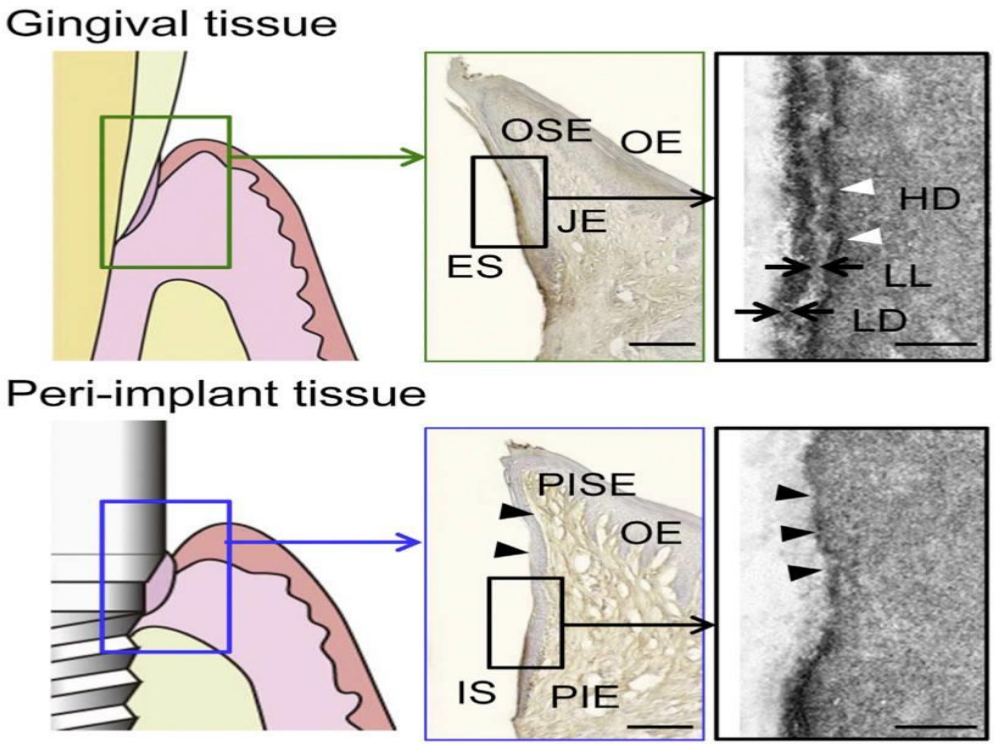


Fig.3: Epithelial-sealing structure of peri-implant and periodontal tissue. Middle panels showed that peri-implant epithelium (PIE) (Lower panel) had a structure similar to junctional epithelium (JE) around natural tooth (Upper panel). Ln was scarcely expressed along the upper portion of the implant-PIE interface in light micrographs. Electron microscopy was used to show the middle region of the PIE in more detail (Right panels).

1.1.2 The Biological Width

The term “biologic width” refers to the entire dimension extending from the supra-alveolar connective tissue attachment to the apical extent of the junctional epithelium.

The influence of mucosal thickness upon marginal bone loss around implant necks was discussed by Cochran et al, suggesting that soft tissue creates a protective barrier against inflammatory infiltration towards underlying alveolar bone. Later studies suggested that the vertical mucosal thickness necessary for biological width establishment around two-piece dental implants should be at least 2mm to avoid marginal bone loss **(Linkevicius et al., 2010)**. Other studies suggested that a variable amount of marginal bone loss may occur to provide the necessary space for biological width establishment.

More recently, this concept has been re-elaborated by Linkevicius et al. Specifically stating that vertical keratinized mucosal thickness is a significant factor in limiting peri-implant marginal bone loss around platform-switched implants placed at crestal level. One year after loading, implants with an initial vertical mucosal thickness greater than 2 mm maintained marginal bone levels more successfully than implants with an initial mucosal thickness ≤2 mm **(Sergio Spinato, 2017).**

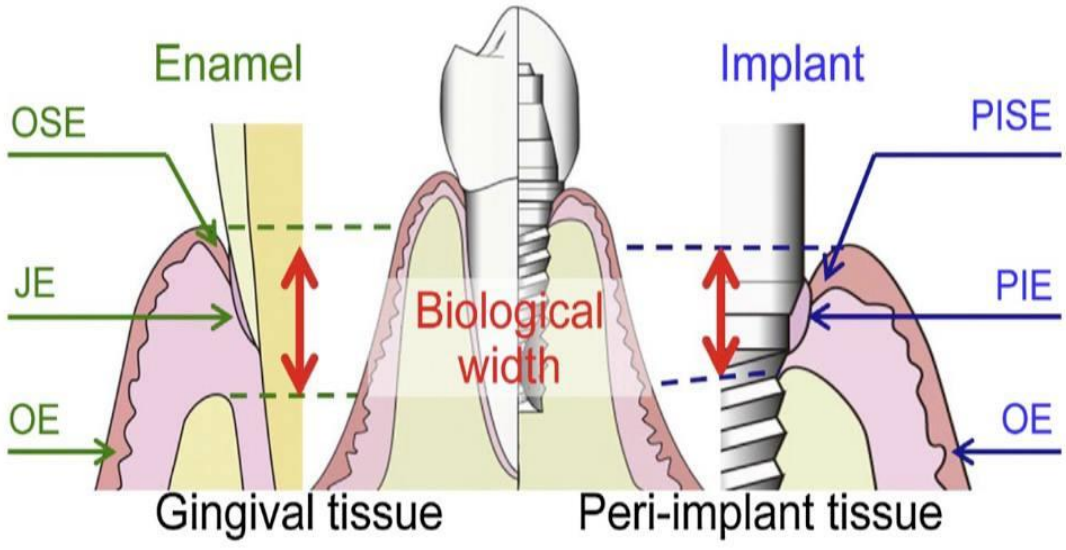


Fig.4: Landmarks of peri-implant and periodontal tissue. Diagram shows the key landmarks of the soft tissue attachment to natural tooth tissue (left panel) and their functional equivalents in the soft tissue attachment to an implant surface (right panel). (JE: junctional epithelium, OSE: oral sulcular epithelium, OE: oral epithelium, PIE: peri-implant epithelium, PISE: peri-implant sulcular epithelium).

1.1.3 Periodontal and Peri-Implant Diseases

The clinical characteristics of a healthy peri-implant site include absence of erythema, bleeding on probing, swelling and suppuration. Peri-implant disease is a serious problem that plagues today's dentistry, both in terms of therapy and epidemiology. With the expansion of the practice of implantology and an increasing number of implants placed annually, the frequency of peri-implant disease has greatly expanded. Its clinical manifestations, in the absence of a globally established classification, are peri-implant mucositis and peri-implantitis, the counterparts of gingivitis and periodontitis, respectively **(Nicola Alberto Valente et al., 2016).**

The term **peri-implantitis** is defined as an infectious condition of the tissues around osseointegrated implants with loss of supporting marginal bone (>2 mm) and clinical signs of inflammation, including bleeding on probing and suppuration.

While **Peri-implant mucositis** is defined as inflammation of the peri-implant mucosa without marginal bone loss **(Nicola Alberto Valente et al., 2016).**

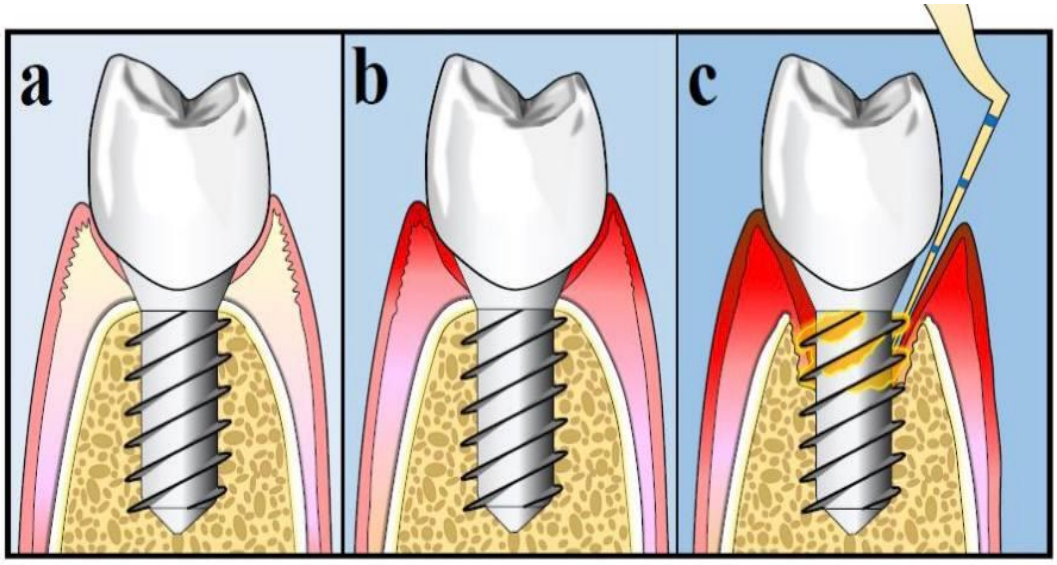


Fig.5: Peri-implant health/disease status: (a) Peri-implant health; (b) Peri-implant mucositis; (c) Peri-implantitis.

Many risk factors and indicators have been associated with peri-implant diseases, **(as seen in figure 6)**. The most well-established systemic risk factors that have been consistently associated with peri-implant diseases are smoking and diabetes mellitus **(Ioannis et al., 2020).** While plaque is recognized as an essential pathogenic factor in the development of both periodontitis and peri-implantitis.

However, two characteristics of implants that can play a role in the development and progression of peri-implant disease, are the implant-abutment/restoration connection and the implant surface **(Ivanovski & Lee, 2017).**

Fig.6: Risk factors and indicators of peri-implant diseases.

1.2 Dental Implant in Esthetic Zone

1.2.1 Implant Placement

A dental implant is a prosthesis that interfaces with the bone of the jaw or skull to support a dental prosthesis such as a crown, bridge, denture, or facial prosthesis or to act as an orthodontic anchor. The basis for modern dental implants is a biologic process called osseointegration, in which materials such as titanium or zirconia form an intimate bond to bone. The implant fixture is first placed so that it is likely to osseointegrate, then a dental prosthetic is added. A variable amount of healing time

is required for osseointegration before either the dental prosthetic (a tooth, bridge, or denture) is attached to the implant or an abutment is placed which will hold a dental prosthetic, crown.

Fig.7: Implant Component.

During surgery to place the dental implant, a surgeon makes a cut to open the gum and expose the bone. Holes are drilled into the bone where the dental implant metal post will be placed. Since the post will serve as the tooth root, it's implanted deep into the bone **(M.A. Pogrel et al., 2012).**

Complications -Placement too deep

When implant placement results in positioning 2 mm below CEJ or 3 mm below free gingival margin, many complications may result **(Randolph R. Resnik et al., 2018)**:

1. Unfavorable crown height space (crown-implant ratio).
2. Periodontal complications because of inability to perform proper hygiene and bone loss on adjacent teeth.
3. Higher moment forces may cause biomechanical overload with resultant crestal bone loss.
4. Prosthetics are more complicated with difficulty in impression taking, placing abutments, and seating the prosthesis.
5. With deeply placed implants, often the facial plate will resorb, especially if facial inclination is present.

6. Long-term sulcular health is decreased because the trabecular bone around the crest module is weaker against occlusal loads.
7. Resultant initial crown height is increased, as are moment forces. A further increased risk of soft tissue shrinkage occurs long term, with additional bone loss at the crest module. The result is longer clinical crowns, which also decrease gradually in width (as the narrowing dimensions approach the implant body), with resultant black triangular spacings in lieu of inter-dental papillae and compromised long-term esthetics.

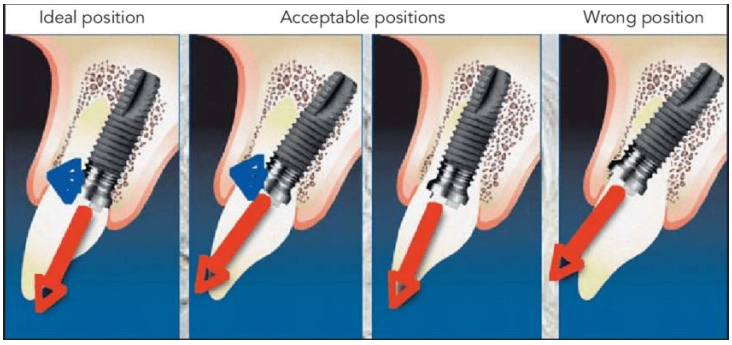


Fig.8: Ideal, acceptable, and wrong positions of the implant.

1.2.2 Complications Associated with Immediate Implant Placement

Immediate implant placement is generally recognized as a more complex procedure in contrast to implant placement in a healed ridge of adequate bone quality. The presence of infection adds an additional variable to this complexity. A site can be classified as having either periapical, endodontic, peri endodontic, or periodontal infection. Multiple studies have found the survival rates for implants immediately placed in infected sockets similar to those placed in noninfected sockets or healed ridges **(Glenn J. Jividen et al., 2018).**

Fig.9: Complication of Immediate Placement.

1.2.3 Fixed Prosthodontics Complications

Food impaction after placement of a fixed implant restoration can be a significant complication that is troublesome to the patient and the soft tissues. There are many reasons for the prosthesis to accumulate food.

Improper Implant Placement: When implant placement is nonideal, a compromised prosthesis must be fabricated. This leads to improper contours that compromise esthetics and the soft tissue health.

Inadequate Contact Area: If inadequate contact exists, food accumulation will result. This most often occurs when the restoration is fabricated with angled or tilted adjacent teeth, which prevent a long contact area.

Implant placement should be ideal, if conditions (lack of bone) do not allow this, hard and soft tissue augmentation should be completed to provide a more ideal condition for implant placement **(Randolph R. Resnik et al., 2018).**

Fig.10: Contact Areas.

Inadequate Contact Area: When angled or tilted adjacent teeth are present, prior to the fabrication of the prosthesis, guide planes should be made to allow for a long contact area in the prosthesis. This also allows for the greater force distribution, which is advantageous, especially in high stress areas.

Treatment: If food impaction occurs on a chronic basis, the prosthesis should be modified or refabricated, especially if soft tissue complications arise **(Randolph R. Resnik et al., 2018).**

1.2.4 Treatment Planning Complications

The implant placement criteria for an RP-4 prosthesis are different than that for an FP prosthesis. Denture teeth and acrylic require more prosthetic space for the removable restoration in comparison to a fixed prosthesis. The implants in an RP-4 prosthesis (and an FP-2 or FP-3 restoration) should be placed in the mesiodistal position for the best biomechanical and hygienic situation. Usually, in the mandible, implants are inserted between the two mental foramens in the A, B, C, D, and E positions **(Randolph R. Resnik et al., 2018).**

1.2.5 Microbiologic Considerations with Dental Implants

Implant placement for the restoration of teeth, partial edentulous segments, and entire dental arches are now considered a routine part of patient care. The benefits of implants and their ability to restore form and function for a patient have led to their widespread use in clinical practice. However, as noted from the orthopedic literature, the dental implant needs to survive in a potentially contaminated field.

As with any foreign body, the number of bacteria necessary to create an infection around an implant will be substantially less than in a clean surgical wound that does not involve any foreign body placement. For example, the placement of a suture reduces the number of bacteria necessary to create a wound infection by a factor of 1000. In addition, the placement of an intraoral endosseous implant is complicated by the initial bacterial load present at the time of surgery, as well as the continued bombardment of the tissue to implant bond by bacteria throughout the lifespan of the fixture **(Stuart E. Lieblich et al., 2016).**

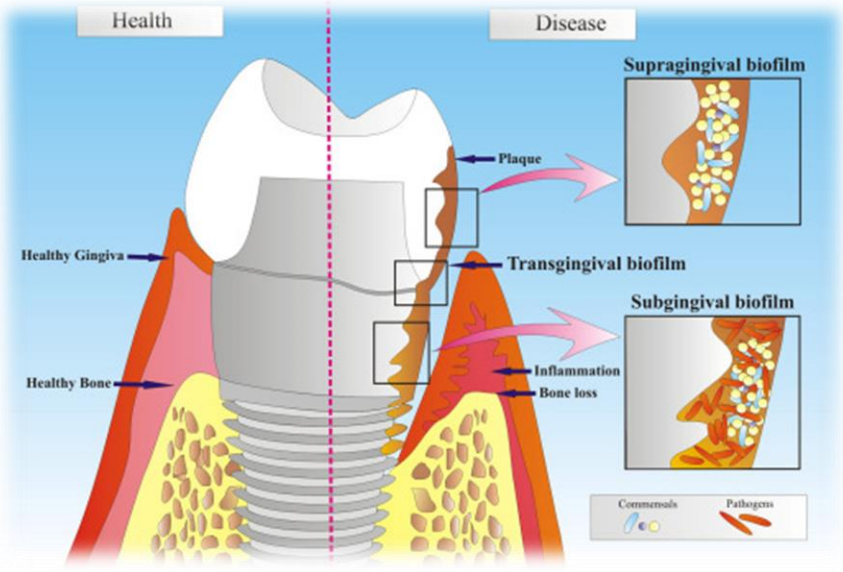


Fig.11: Differences Between Healthy and Disease Condition of Implant.

Endosseous implants are also placed in extraoral sites for the restoration of craniofacial defects. Other types of implants are placed transcutaneous, perhaps in conjunction with free flap reconstructions into the oral cavity, thus having to resist infection by both skin and intraoral bacterium. The vast majority of implant cases are successful and without complications. However, the development of infection can lead to loss of the implant, as well as the surrounding bone, teeth, nerves, and extension into adjacent spaces. The practitioner placing implants needs to be acutely aware of these risks, practice appropriate technique to minimize the chances of infection, and be able to intervene rapidly if an infection should occur.

Most authors recommend the administration of prophylactic antibiotics in conjunction with implant surgery, as with any type of antibiotic administration, the most important dose for the patient is administered before the initiation of the surgical procedure. The decision to continue the antibiotics postoperatively has not been investigated in well-controlled studies. Certain patient situations, such as complex grafting or preexisting compromise of the immune system, may dictate an empiric decision to continue antibiotics for a 5- to 7-day course **(Stuart E. Lieblich et al., 2016).**

Gynther et al studied the response of patients who received 1 g of penicillin preoperatively and every 8 hours thereafter for 10 days in comparison with a group that did not receive any antibiotics. They found no difference in the survival of implants in patients who did not receive any antibiotics preoperatively or postoperatively. They also reported no difference in the frequency of infections between the two groups. Despite this study, most other authors and protocols suggest the use of perioperative antibiotics. Verifying the use of antibiotics is the study by Dent et al,9 who showed a failure rate of 2.6% with presurgical antibiotics and 4.0% without. Recent meta-analyses by **(Ati-Ali et al and Sharf et al)** seem to present similar conclusions. Both reviews indicate that implant survival is improved with the use of a preoperative dose of antibiotics. The occurrence of postoperative infections is not clearly reduced with the use of antibiotics, but the survival rate of the implants is. Evidence supporting the continued use of antibiotics following surgery is not correlated with improved outcomes in most cases. However, both articles do discuss that implant procedures are highly heterogeneous because the sites may differ, grafting may be used, and host issues are difficult to control for (e.g., systemic disease, smoking). Therefore, the decision regarding postoperative antibiotic management is also dictated by the patient's condition. Certain medical conditions, such as diabetes, may increase the risk of implant failures, although a

recent study by Oates et al12 showed no difference in implant stability after 1 year in patients with a normal hemoglobin A1C in comparison with elevated levels. In their study of implants placed in the anterior mandible, the success rates with moderately elevated A1C levels (6 to 8%) and those with levels greater than 8% were equivalent. They used only postoperative antibiotics for 7 days without a preoperative dose. No site-specific infections were noted. Other host factors, such as cigarette smoking,13 have an increased risk of implant failures, but not necessarily because of infection **(Stuart E. Lieblich et al., 2016).**

The actual surgical procedure described by **Brånemark** and promulgated in the original protocols taught throughout the world used a full surgical patient draping technique. This originated through Dr. Brånemark's training as an orthopedic surgeon. Kraut14 has written on this controversy as to whether a full surgical drape is necessary for working in a known contaminated field. Newer implant surgical protocols recommended by other implant companies do not specifically promote the use of full surgical draping. It is reported that the use of full surgical preparation may increase the "awareness" of the surgical team to maintain asepsis as much as clinically possible with the understanding that the procedures are being performed in a contaminated field. However, surgically "clean" procedures using sterile instruments and gloves are acceptable as a minimum preparation.

There are two major classifications of endosseous implants placed: the endosseous fixture placed trans orally and extraoral placement. Endosseous implants are typically placed intraorally into the maxilla, mandible, or zygoma. Occasionally, endosseous fixtures are placed extraorally to support prosthetic ears, eyes, or other facial structures. Transosseous implants, such as the Small staple implant and Boskar trans mandibular implant, were placed using a submental incision; they are rarely used at this time because of the successful outcomes of intraoral placement of endosseous implants.

Chlorhexidine gluconate rinses (Peridex, Perioguard, and others) are recommended for use immediately preoperatively and to be continued for 5 to 7 days postoperatively. With the use of chlorhexidine, the rate of complications caused by infection was reduced from 8.7 to 4.1%.15 This will supplement the patient's use of saline rinses, as often their oral hygiene regimen will be negatively affected because of the discomfort of the surgical site **(Stuart E. Lieblich et al., 2016).**

Before placing an implant, it is important to survey the surgical site clinically and radiographically to ascertain that no residual infection is present in the bone.

Adjacent teeth should be evaluated for the presence of an occult periapical lesion, which could spread to and infect the implant.16 This evaluation is critical because many patients now having implant procedures are partially dentate, in contrast to the fully edentulous patients in Brånemark's original treatment groups. Most protocols recommend waiting at least 2 to 3 months following the removal of a tooth before inserting an implant. During that time, any residual infection in the bone should clear and form a soft tissue covering over the planned surgical site.

Infection adjacent to an implant site can potentially infect the implant as well. The surgical site needs to be clearly radiographed preoperatively to ascertain that the adjacent teeth are not endodontically involved. Ideally, any active endodontic lesions adjacent to the implant site are treated before endosseous implant placement. Endodontically involved teeth typically exhibit a mixed flora type of infection. The most common of these organisms are *Propionibacterium acnes, Staphylococcus epidermidis, Streptococcus intermedius, Wolinella recta, and Porphyromonas and Prevotella species*. These bacteria, when harbored in teeth or the periapical regions adjacent to an implant site, can contaminate the newly placed implant. The natural dentition can also be a source of bacteria that have been implicated in implant infections. Reducing plaque and overt bacterial contamination by presurgical hygiene visits should be considered.

The placement of an immediate implant into an extraction socket is a controversial procedure. Many authors advocate waiting a period of months following the removal of a tooth to ensure that any residual infection has cleared, and early bone healing has been initiated. Others recommend immediate placement if the extraction can be done atraumatically and no preexisting infection is present.

A final group proposes that even implants can be placed into infected teeth sockets.

1.2.6 Nerve Damage in Dentistry

Implant placement in the mandible posterior to the mental foramen carries a risk of involvement of the inferior alveolar nerve,

When damage occurs, it is more likely due to the drilling process itself rather than the actual implant insertion so that withdrawal of the implant, if it is impinging on the nerve, is a sensible precaution but rarely relieves the symptoms if they were caused by the drilling process. Unfortunately, if the involvement is from the drilling, spontaneous recovery tends to be poor, because the area of damage can be extensive.

Surgery, however, equally does not give a very satisfactory result, because the damaged segment often must be respected. Also, because of the extent of the damage, direct anastomosis is often not possible, meaning that a graft of some kind must be used with a subsequently lower success rate **(M.A. Pogrel et al., 2012).**

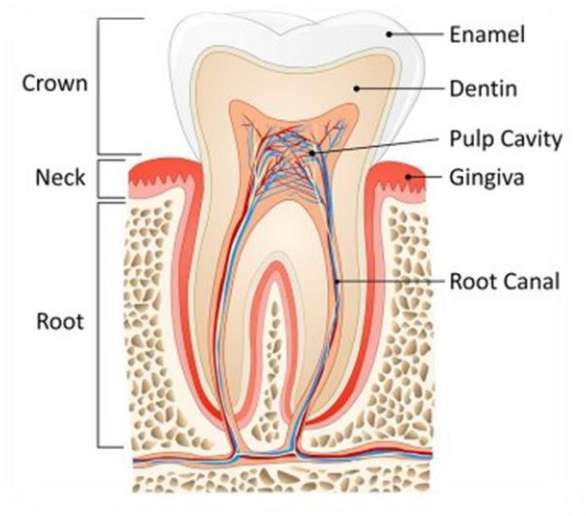
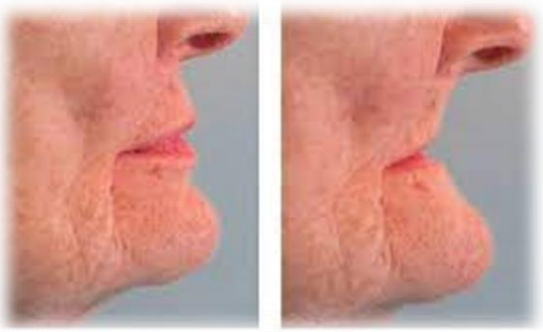


Fig.12: Component of Tooth Structure.

1.2.7 Implants for the maxillary edentulous patient

Implant placement using CT-generated, guided surgery begins with accurate placement of the surgical guide. If the surgical guide stent rotates slightly, the location of the implant is moved from its virtual planned location, and part of the implant will not be within bone. As the implant is driven into the bone, using the guide stent, the flush fitting of the driver mounts will meet with the master tubes of the guide stent without the surgeon realizing that the implant is not completely within bone. If the implant has a large dehiscence yet part is within bone, the resistance to rotational movement when abutments or cover screws are placed may be sufficient to obscure the inaccurate placement. Radiofrequency testing of implant stability immediately after removal of the guide stent can reveal poor implant stability from lack of bone contact. In such cases, implant failure occurs sometime during the healing or restorative process **(Michael S. et al., 2015).**



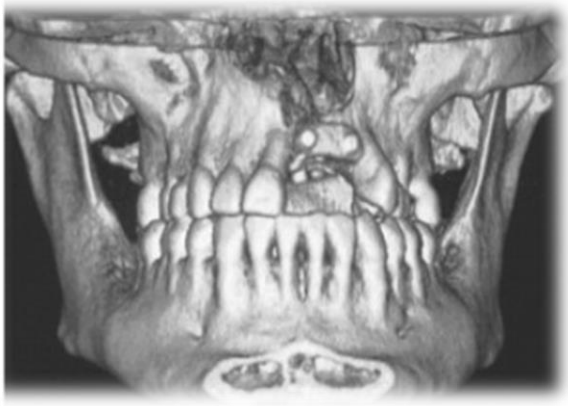
The surgical guide stent should not be handheld to position it, rather than being secured with fixation screws or pins, in the proper occlusion with complete mucosa seating. In an edentulous patient, the clinician should always use fixation screws when placing implants using CT guidance. The surgical guide stent can be held with the anterior region well adapted to the mucosa, but slight rotation will move the posterior implants from their ideal position, which can result with implants placed through the buccal bone or under palatal mucosa. This will occur in areas that have relatively thin ridges where accuracy is critical to avoid implant placement problems.

1.2.8 Alveolar reconstruction in cleft for implant rehabilitation

Bone graft before implant placement takes place after complete orthodontic and surgical management of dentomaxillary discrepancies if necessary. Tooth alignment and opening of the space for the missing tooth must be achieved.

Bone graft healing is achieved from the third month after surgery. Even though authors propose early implant placement with a short time for bone graft healing (6–8 weeks after bone graft surgery), on the basis of histological verification and clinical findings, the bone graft is mature enough to ensure a primary stability of a fixture in 12.5 weeks after reconstruction.

Comparing conditions of bone graft before implant placement, secondary or tertiary graft in the alveolar cleft has the most important resorption rate, with post-traumatic graft coming in second position. Achievement of graft osteointegration occurs between three and twelve months after surgery. Bony resorption is observed from four to six months after surgery and becomes more substantial without implant placement and loading. Despite several attempts to place early or immediate implants to stimulate bone graft, this chronology usually leads to failure while loading the implant **(Seigneuric et al., 2011).**



Outcome of grafted alveolar bone after implant placement is assessed by many authors.36 Residual alveolar bone level after secondary iliac cancellous bone graft is evaluated at one, three and six years after implant placement, while loading of the implant occurs six month after implant placement. The Global success rate of implant achievement is 90.9%. Six years after implant placement, bone loss of grafted alveolar height is only 12.5%, whereas cancellous iliac bone graft without implant placement generally reaches a resorption rate of 40% one year after surgery **(Seigneuric et al., 2011).**

1.2.9 Reconstruction After Tumor Ablation

Before implant placement, the correct positions of the facial implants must be determined. Therefore, virtual planning can be performed or a template of the epithesis can be made. Three-dimensional printed models can be generated from mirror images of three-dimensional x-ray or optical scans of the sound hemiface. Traditionally, wax ups are used. The templates are used to determine the required implant positions and to produce surgical stents. When the implant placement is done without surgical stents, a thorough analysis of the optimal implant site must be performed before surgery. The prospective implant sites should be marked on the skin to allow easy relocation during surgery.

For implant placement, full-thickness skin flaps are reflected. The incision is done in the periphery of the intended implant position. For facial implants, the standards that are well known from oral implantology must be followed. Copious irrigation with saline solution is mandatory to avoid thermal trauma to the bone during the preparation of the implant site with spiral drills.

In the past, several implant systems have been established for facial implantology. Sometimes it is advisable to use drill guides for safe determination of the implant position. Spiral drills of increasing diameter are used for the preparation of the implant site. In bone with a large cortical portion (like in the temporal bone), Implant placement is carried out under insertion torque control. During the healing period the implant is supplied with a cover screw **(Friedrich-Wilhelm Neukam et al., 2017).**

After healing periods of 3 months in nonirradiated bone and healing periods of up to 12 months in irradiated bone, stage 2 surgery is performed. These prolonged time intervals are especially recommended in the midface and the orbit, for which reduced implant survival rates are encountered frequently.

When the implants are uncovered, a thinning of the peri-implant soft tissue is routinely carried out. Thin, immobile, hairless skin should be established around the implants. It may be necessary to transfer hairless split-skin grafts. Because of color and texture, the retroauricular region is preferred as a donor site. In skin-penetrating abutments, it is most important that the abutment-gold interface is at least 2 mm above the tissue surface. Subdermal margins can lead to inflammation and cause implant failure.

Part Two: Hard Tissue Management in Esthetic Zone

The increasing demand over the years for highly esthetic results in all facets of dentistry has also influenced dental implants and has made achieving optimal esthetic results more challenging for the implant specialist and subsequently led to a greater consideration and study of all the contributing factors, both at the micro- and macroscopical level to achieve such a result. The challenge lies in the successful management and modeling of the papilla and gingiva, which are harmonious with the soft tissues of the adjacent natural dentition and must also be maintainable longterm. Implant esthetics has been thoroughly studied, **(Evans CDJ et al, 2008)** and several authors have proposed esthetic indices to assess peri-implant gingival **tissues (Fürhauser R et al., 2005)** and implant crowns **(Meijer HJA et al., 2005).** Belser et al proposed the New Esthetic Index: Pink Esthetic Score (PES)/White Esthetic Score (WES), **(Belser UC et al., 2009)** a variation of previously introduced indices.

Thus, an esthetically accepted result not only depends on the shade and form of the final restoration, but also in order to be achieved, it needs careful consideration, and often manipulation of the hard structures adjacent to the implant, the abutment, and final restoration. This demand for better esthetics should accordingly alter the way in which implant specialists' treatment plans and places dental implants, especially in the more esthetically demanding anterior region, by considering the hard tissue management (HTM) at the early treatment planning stage.

Onlay grafting of autogenous bone block has proven to be a predictable technique with high success rates in horizontal ridge augmentation and dental implantation. **(Zahrani AA et al, 2007; Schwartz-Arad D. et al., 2005).** However, standard autogenous onlay bone grafting for implants often necessitates three main consecutive surgical procedures: ridge augmentation, which often involves two surgical sites for both osseous recipient and donor with or without soft tissue grafting; delayed implant placement; and soft tissue grafting to cover the underlying bone graft (ie, at the time of bone graft placement) or to improve the keratinized gingiva around implants (ie, before or at the time of implant uncovering) **(Zahrani AA et al., 2007).** reality, patients often express significant concerns over the duration and extent of surgery. As such, treatment options involving many consecutive surgical phases may be refused or suspended by the patient. This clinical report presents a new procedure using an autogenous block bone graft combined with a subepithelial connective tissue pedicle graft to augment a horizontal defect in the anterior maxilla for simultaneous implant placement. All the primary surgical procedures are concentrated in one surgical procedure, and only one surgical site is involved for both the osseous recipient and donor.

2.1 Types of Ridge Augmentation Procedures

Although divided into horizontal or vertical ridge augmentation, both methods are often performed simultaneously.

2.1.1 Horizontal Ridge Augmentation

Recently in implant dentistry, minimally invasive horizontal ridge augmentations are widely performed using particulate or block autogenous bone grafts with ridge splitting or ridge expansion combined with guided bone regeneration (GBR). Each procedure has clear advantages and disadvantages with no significantly different clinical results. Surgeon should select adequate techniques based on evidence and principles. Horizontal ridge augmentation has been known to exhibit more predictable outcomes and higher success rates compared to vertical ridge

augmentation. The reconstruction amount has an average 3 to 4 mm target in horizontal ridge augmentations **(Hellem S. et al., 2003).**

2.1.2 Vertical Ridge Augmentation

For the reconstruction of one-wall defects, onlay grafts are generally performed as GBR with particulate or block type autogenous bone grafts. However, onlay grafts have been reported to have high complication risks such as wound dehiscence, infection, bone resorption, and graft failure. Alternative techniques such as interpositional bone grafts (sandwich osteotomy) and alveolar bone distraction have been used to avoid these complications. In particular, the sandwich osteotomy is known to have a successful prognosis because of its optimal soft tissue coverage and blood circulation. The vertical portion is positioned on cortical bone, which has the advantage of enduring occlusal loads and absorption. The average increase in onlay grafts is 3 to 4 mm, while sandwich osteotomies are reported to exhibit an increase of approximately 5 to 7 mm. Nevertheless, some cases cannot undergo sandwich osteotomies due to the limitation of anatomical structures such as the inferior alveolar canal and maxillary sinus. On the other hand, a technique (supraplant) was introduced to increase vertical bone height simultaneously with implantation on the top of the alveolar crest. Several reports have shown acceptable results, but long-term clinical results have been rarely reported. With regards to clinical practice with the supraplant technique, the incidence of complications has been high with most of the surrounding grafted bone exhibiting resorption **(Roos-Jansåker AM et al., 2002; Stenport VF et al., 2003; Simion M et al., 2007).**

2.2 Case Report

A 32-year-old Chinese male was referred for the replacement of 2 maxillary teeth (teeth #8 and #9) with implants. His medical history revealed that 2 central incisors and the buccal cortex involving these teeth were avulsed in an accident 3 months previous. The patient was interested in an implant-supported fixed partial denture (FPD) and anatomical rehabilitation of the alveolar defect, rather than merely creating an illusion of a ridge using a prosthesis. The patient was unwilling to undergo any surgical procedures except for the two basic surgical phases for implant placement and uncovering, and he refused additional surgical sites to obtain the bone graft. Clinical examination showed a buccal-lingual horizontal alveolar defect and minimal keratinized gingiva at the residual site, while a protuberant anterior nasal spine could be palpated apically to the deficiency (Fig.13, #1). Panoramic radiograph

confirmed a triangular area of low osseous density corresponding to the defect and a zone of high density associated with the nasal spine (Fig.13, #2). After the defect and remnant were scaled and evaluated, a protocol was discussed with the patient. The buccal depression was about 6 mm in width, at least 4 mm horizontally, and up to 12 mm vertically, which implied a bucket-shaped bony deficiency lacking more than half of the bucket wall. As it was difficult to maintain a stable space for ideal using of guide bone regeneration (GBR), this sort of deficiency is preferred to be restored through block bone grafting. Considering the ample bone at the anterior nasal spine, the defect would be rehabilitated through a block bone graft harvested from the anterior nasal spine so that one surgical site could cover both the donor and recipient sites. In a situation involving minimal keratinized gingiva at the donor site, a recreated bony protuberance may make primary closure over the bone graft more difficult. Therefore, a palatal split-thickness connective tissue flap was designed to simultaneously uncover the bone graft and increase the keratinized tissue. The residual crest bone was measured about 5 mm horizontally and seemed satisfactory for the placement of implants in optimal positions; therefore, the implants were expected to be inserted immediately. However, extremely thin buccal bony wall or even exposure of implants would occur at a high risk, and GBR would be necessary in this situation. The patient accepted the treatment plan options and subsequently underwent dental hygienic treatment. In case of insufficient residual bone for simultaneous implants placement, the patient was also informed of and acceded to a possible alternative method, which involved the use of GBR alone for primary augmentation, with immediate or delayed implant placement.

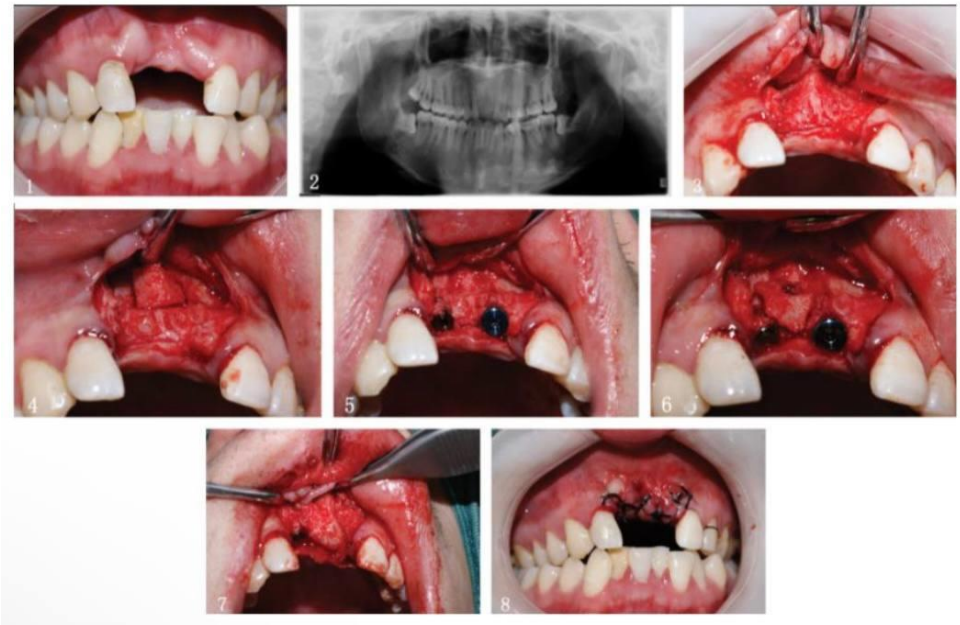


Fig.13: #1 Buccal view of an edentulous segment (missing teeth #8 and #9) with a horizontal alveolar defect and minimal keratinized gingiva. #2 Panoramic radiograph before surgery. #3 Occlusal view of a massive osseous defect and a protuberant anterior nasal spine after flap elevation. #4 A square bone graft was harvested from the anterior nasal spine. #5 Concomitant implant placement. #6 Fixture of the block graft to the recipient site. #7 A palatal split connective tissue flap for the bone graft and substitute package coverage. #8 Primary closure of the surgical site.

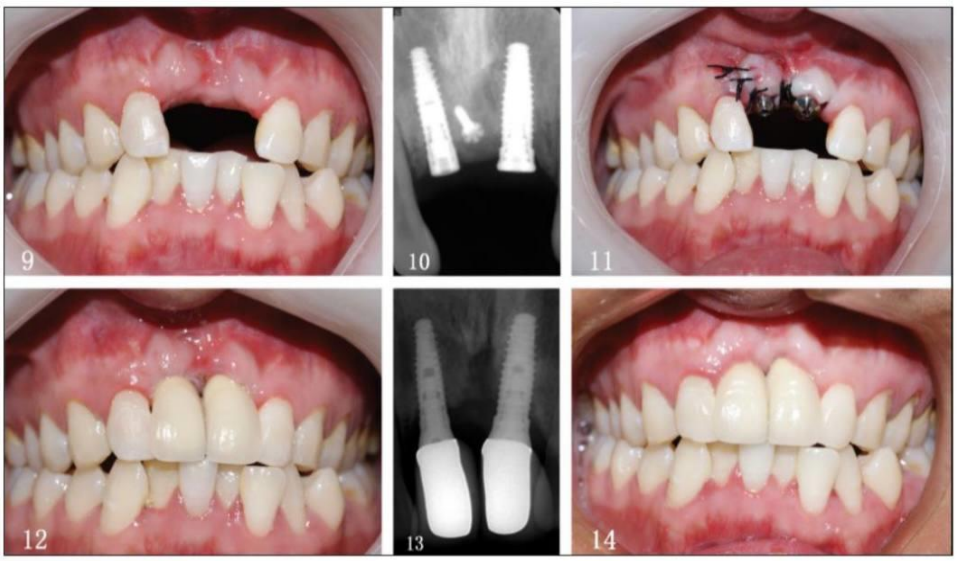


Fig.14: #9 Clinical view of a developed ridge and improved keratinized tissue 4 months after primary surgery. #10 Two well osseointergrated implants were documented on a periapical radiograph. #11 Second surgery to uncover the implants, remove the fixed screw, and place healing abutments. #12 The definitive implant-support restorations. #13 Radiographic appearance of implant fixtures 2 years after treatment. #14 Clinical condition after 2 years.

A horizontal incision of the edentulous ridge and two vertical releases were performed, excluding the lateral papillae at the buccal side. After elevation of a full-thick mucoperiosteal flap, a massive osseous defect and a protuberant anterior nasal spine were exposed (Fig.13, #3). Once an appropriate graft from the donor site could be obtained that was adaptable to the size of the defect, a square bone graft was harvested from the anterior nasal spine with an osteotome **(Surgerybone, Silfradent, S. Sofia, Forli, Italy)** (Fig.13, #4). When the graft was removed, the residual ridge appeared satisfactory for immediate implant placement. Two full osseotite tapered certain implants (3i Implant Innovation, Palm Beach, Fla) were placed into the located sites following the standard procedure; the #8 implant was 3.4 mm in diameter and 13 mm in length, whereas the #9 implant was 4.0 mm in diameter and 13 mm in length (Fig.13, #5). Subsequently, the block graft was fixed

to the recipient site with a screw. To attain a natural contour, one corner of the square graft was positioned supracrestally as the scaffold for the interdental papillae, and the rest of the space was packed with Bio-Oss spongiosa granules of 0.25-1 mm **(Geistlich Pharma, Wolhusen, Switzerland)** (Fig.13, #6). The connective tissue flap for graft coverage was initiated using the following three incisions: (1) a horizontal incision was extended to the palatal region of tooth #13 along the tooth arch, (2) a second parallel incision was made approximately 5 mm away from the gingiva to split the palatal flap, and (3) a third distant incision was made to detach the inter flap from the palate. Below the labial full-thickness flap, the split flap was repositioned apically to cover the bone graft and the particle substitutes, while a palatal pedicle was reserved for the blood supply (Fig.13, #7). In areas with free tension, the donor and recipient sites underwent primary closure with interrupted sutures (Fig.13, #8). Four months after the procedure, ridge development with improved keratinized tissue was noted, and two well osseointegrated implants were documented through periapical radiograph (Fig.14, #9 and #10). Two healing abutments were placed, and the screw securing the graft was removed (Fig.14, #11). Following 4 weeks of soft tissue healing for the development of gingival cuffs, a traditional prosthetic procedure was provided. According to the patient's wishes, 2 implant-supported metal-porcelain crowns were fabricated and cemented to properly seated abutments (Fig.14, #12). The patient was satisfied with the outcome from both esthetic and functional considerations. After 2 years of follow-up, the restorations were stable and esthetic. Although vertical bone resorption about 2 mm surrounding implants was present (Fig14, #13), the gingival tissue represented stable positioning, improved thickness, and continual maturation (Fig.14, #14).

Case Explanation

GBR can be used in conjunction with alloplast, allograft, or xenograft particulates as alternatives to autogenous bone. However, these matrices are often associated with limited or poor bone formation. On the other hand, in non–space-maintaining defects, block grafts may exhibit significant advantages over particulate grafts with regard to contour reconstruction and resistance to micromovement. In this case, harvesting of bone adjacent to the defect avoided additional trauma to the donor site. Moreover, transplant of the autogenous bone block resulted in an intrabony-like space with sufficient exposure of the bone marrow, which was suitable for filling and maintaining particulate bone substitutes and provided better vascularization for bone regeneration **(Lacerda SA et al., 2009; Joshi A. et al., 2004; Le B, Burstein**

J et al., 2008). In compromised clinical situations, it is recommended that implants be placed several months after bone grafting because their placement at the time of tissue grafting is appropriate only when optimal positioning can be achieved **(Nemcovsky CE et al., 2002).** In addition, implant placement usually occurs subsequent to the fixation of the graft. In this clinical report, implants were placed before graft fixation because the fixed block bone would obstruct the direct evaluation of the residual ridge and also because the screw used for graft fixation may block the osteotomy for implants in the optimal position.28 A pedicle subeptithelial connective tissue graft can be designed to rebuild the gingival papillae, close the wound after immediate implant placement, and provide coverage for denuded roots or bone grafts in free tension **(De Castro Pinto RC et al., 2010; M, Boyan BD et al., 2002; Kahn S et al., 2009; Herford AS et al., 2011).** With respect to blood flow, this type of tissue graft outperforms free tissue grafts. To maximize contact between the graft and host tissue, a free connective tissue is preferred for insertion between the underlying connective tissue and the overlying epithelia. Nonetheless, it is difficult to split thin gingiva supraperiosteally. Without successful vascular bridging, a free soft tissue graft can run the risk of graft necrosis, wound dehiscence, and lack of facial keratinized tissue with primary closure **(Greenstein G et al., 2009).** Comparatively, a pedicle connective tissue flap may provide more reliable coverage for the bone graft with a low incidence of complications, as mentioned. Furthermore, a bony scaffold for papillae regeneration and wide facial keratinized tissue for resistance to gingiva recession can both be obtained during a single surgical appointment **appointment (El Chaar ES. et al., 2010; Herford AS et al., 2011).**

2.3 Available Graft Material

2.3.1 Autogenous Bone Graft

Autogenous bone has been considered the golden standard for bone grafts because of its osteogenic properties, infection resistance, and secondary healing potential with wound dehiscence. Unfortunately, it also has critical disadvantages such as inevitable additional surgeries, limited amount of harvested material, and the possibility of significant resorption. Therefore, many researchers recommend a mixture with other bone substitutes and covering with a resorbable barrier membrane **(Chiapasco M et al., 2007; Restoy-Lozano A. et al., 2015; Draenert FG et al., 2014).**

2.3.2 Other bony substitutes

For alternatives to autogenous bone, many studies have been conducted for allogenic, xenogenic, and alloplastic bone substitutes. However, few instances of clinical success have been reported in cases of using them alone for ridge augmentation. In particular, block-type bone substitutes were strongly recommended not to be used for bone grafts because of their poor results and high incidence of complications **(Waasdorp J et al., 2010; Draenert FG et al., 2016).**

2.3.3 Bone Growth Factors

Bone tissue engineering studies have been conducted to overcome several disadvantages of autogenous bone grafts. As a result, many studies have reported successful results with a mixture of an adequate scaffold and bone growth factors such as recombinant human platelet-derived growth factor (rhPDGF) and recombinant human bone morphogenetic protein-2 (rhBMP-2). Recently, several studies reported good bone healing after bone grafts with platelet rich plasma (PRP) or platelet rich fibrin (PRF) which could be obtained and prepared from the venous blood of patients. Jeon et al. reported a 3.3 mm increase through vertical ridge augmentation using βtricalcium phosphate with PRP **(Hahn J. et al., 2004; Byun HY et al., 2008; Hartlev J et al., 2013).**

2.3.4 Barrier Membranes

There are no clear criteria for the use of barrier membranes, allowing clinicians to select membranes based on their preferences. Membranes could be effective for the stability of grafted bone in cases of particulate-type bone and an abundant amount of bone graft. Each resorbable and non-resorbable membrane has unique characteristics without a significant predominance. However, in one-wall defect reconstruction, titanium meshes have proven to be effective in stabilization of grafts due to its shape, rigidity, and ability to protect the underlying graft material. **(Molly L. et al., 2006).**

2.4 Particulate vs Block Type Autogenous Bone

There has not been significantly different bone regeneration capacity between particulate and block type autogenous bone. With regards to clinical situations, most cases use a mixture of particulate and block type autogenous bone with other additional bone substitutes.

2.4.1 Particulate Autogenous Bone Graft

The sandwich technique was introduced in the following order where autogenous bone is grafted in the contact area with the implant, a demineralized freeze-dried allogenic bone or bovine hydroxyapatite bone is grafted over the autogenous graft, and a collagen membrane covers the graft site **(Oh SH et al., 2008; Merli M et al., 2007).** In clinical practice, many bone augmentation procedures have been performed with similar principles to the sandwich technique. Some surgeons prefer to cover grafts with non-resorbable membranes such as titanium meshes. This method has been known to be effective for vertical and horizontal augmentation results with the stable mechanical properties of the membrane **(Wang HL et al., 2004).**

2.4.2 Block Autogenous Bone Graft

Block type autogenous bone, harvested mainly in intraoral sites, is fixed with screws after intimate adaptation to the recipient surface. Particulate autogenous bone or other particulate bone substitutes are then packed in the surrounding empty space. A resorbable membrane is generally used as a cover to provide additional stability to the grafts **(Longoni S, 2007; Proussaefs P et al., 2005; Carini F et al., 2014).**

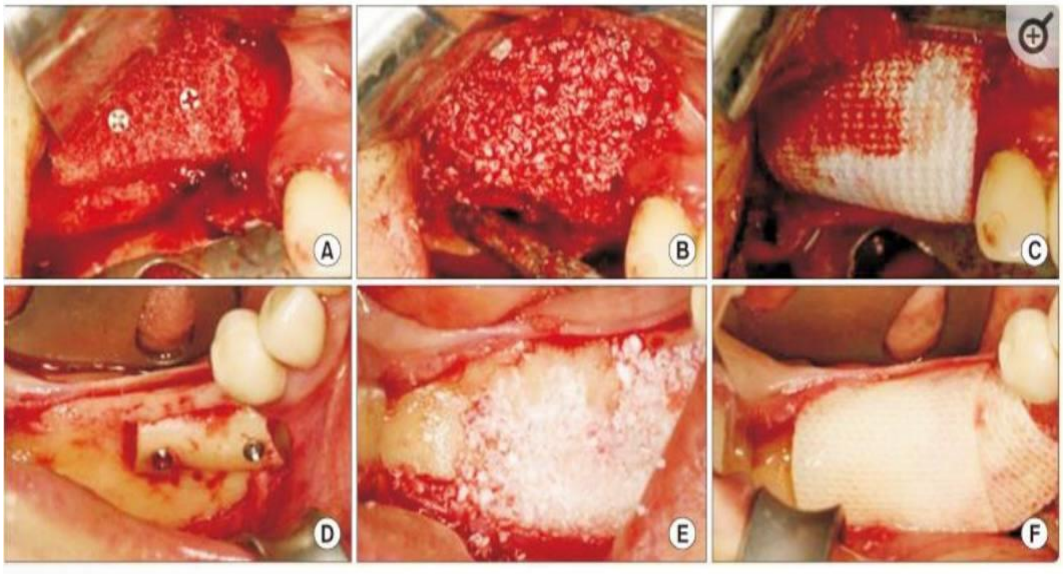


Fig.15: Horizontal ridge augmentation using a block type bone graft. An allogenic bone block was used on the upper site, while an autogenous bone block was used on the lower site. A. The allogenic bone block was fixed with titanium screws in a 68-year-old male. B. Bio-Oss (Geistlich, Switzerland) was packed surrounding the allogenic bone. C. An Ossix membrane (OraPharma, USA) was used to cover the surgical site. D. An autogenous ramus bone block was fixed with titanium screws in a 65-year-old female.

E. Bio-Oss was packed surrounding the bone block. F. An Ossix membrane was used to cover the surgical site

Part Three: Soft Tissue Management in Esthetic Zone

3.1 Flap and Flapless incisions and techniques

The most common flaps which used in dental implants in esthetic region are:

1. Vestibular Incision.
2. Papilla-Sparing.
3. Envelope Flap.
4. Triangular and Trapezoidal Flap.

3.1.1 Vestibular Incision

Although several minimally invasive techniques have been reported and developed over the years, a recent technique that allows preservation of interproximal tissue and allows access for buccal ridge contouring and soft tissue grafting is the vestibular incision technique **(Lance, Stuart).**

The technique involves:

- One or more full-thickness vertical incisions in the vestibule kept away from the gingival margin and sulcus. These incisions are typically located at the midline in mucosa where the most coronal portion of the incision is terminated well above the high smile line. Therefore, any scarring afterwards from the incision is kept above the smile line.

The number of incisions used depends on the extent of the area the graft is planning to augment.

This technique is associated with some limitations, which include:

1. Lack of visualization of the underlying osseous structure.
2. As well as difficulty in predictably manipulating biomaterials under the pouch, especially if greater amount of bone is missing and planned to be augmented **(Hutchens et al., 2018).**

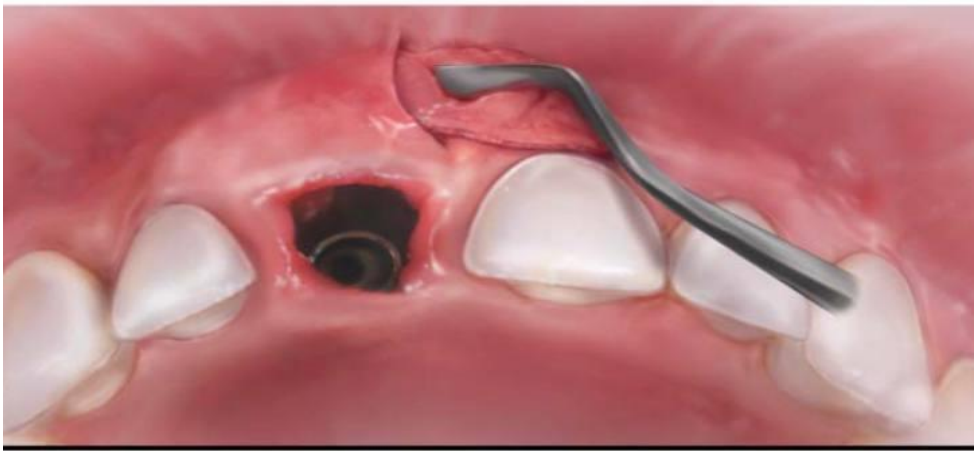
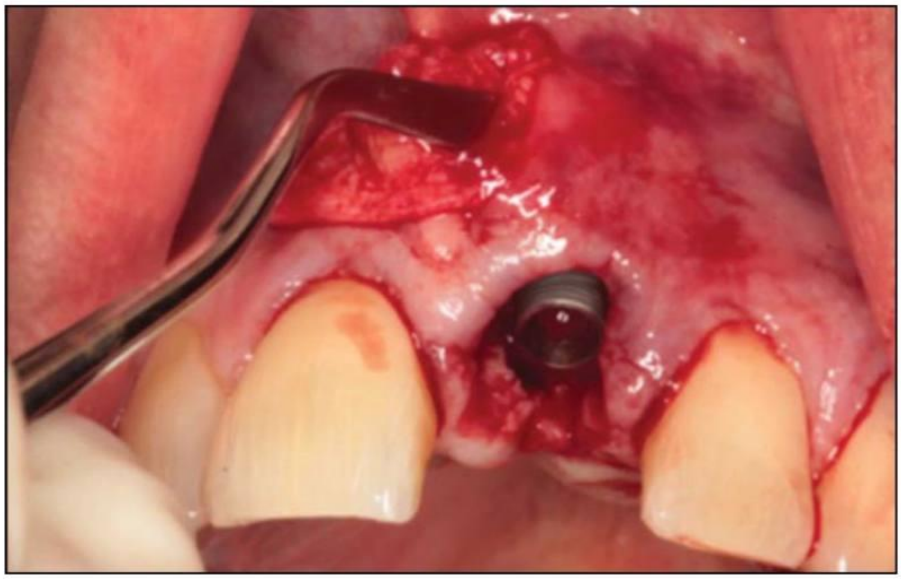


Fig.16: Vestibular incision. This technique involves one or more full-thickness vertical incisions in the vestibule kept away from the gingival margin and sulcus.



3.1.2 Papilla-Sparing Incision

The papilla-sparing technique, as described by **Greenstein and Tarnow**, avoids papilla elevation, which may help to prevent its loss, which is highly desirable goal in the esthetic zone. Reflection of a full-thickness flap on the palate as well as gentle release of the buccal tissue allows for the inspection of any hard tissue defects as well as augmentation, if indicated, without disruption of the papilla **(Hutchens et al., 2018).**

The papilla-sparing incision technique:

- Begins with a horizontal incision along the midcrestal or palatal ridge and terminates **1.0 mm** from the adjacent teeth. This 1.0-mm thickness is an arbitrary thickness, and it is possible that variable bands in thickness or widths of tissue could be left intact and be successful.
  If there is an indication to try and increase keratinized tissue on the buccal, this horizontal incision can be made more on the palatal aspect of the ridge and repositioning the tissue to the buccal. When this repositioning technique is used, the surgeon must keep in mind where the location of the avascular band of tissue is located and anticipate the potential for tissue necrosis.

- Next, bilateral buccal vertical releasing incisions that extend obliquely at an angle should connect to the horizontal incision.

An indication for this flap is a patient with a thin gingival biotype, in which preservation of the interproximal tissue level is of utmost importance **(Hutchens et al., 2018).**

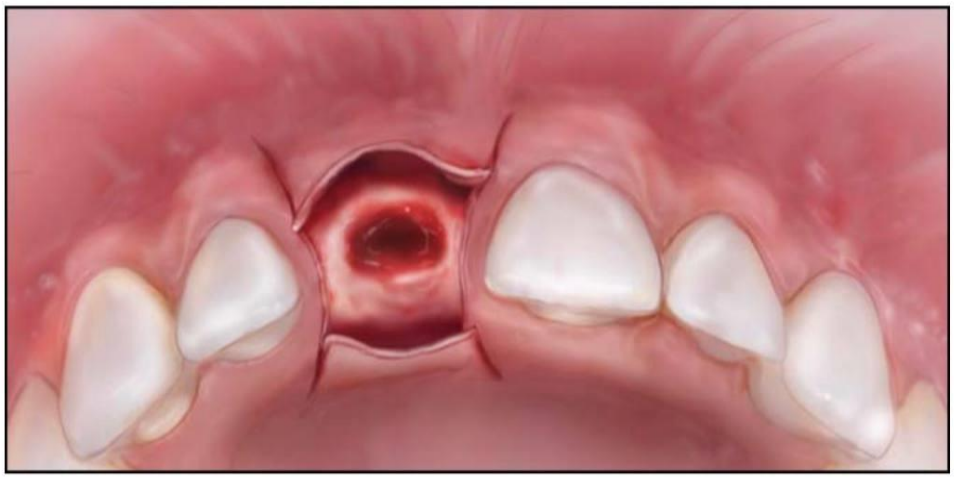
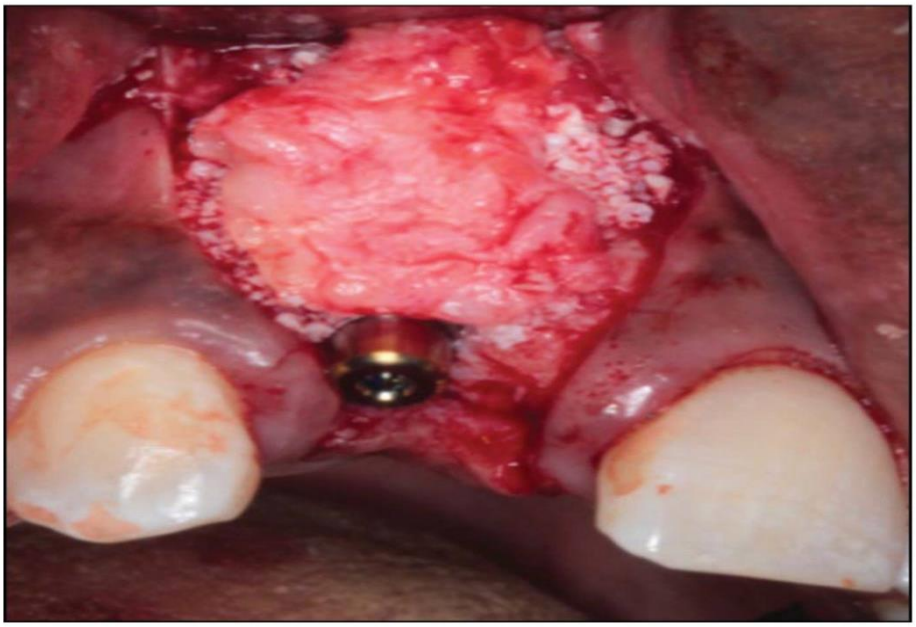


Fig.17: Papilla-sparing incision. This technique begins with a horizontal incision along the midcrestal or palatal ridge and terminates 1.0 mm from the adjacent teeth. Next, bilateral buccal or palatal vertical incisions that extend obliquely at an angle should connect to the horizontal incision.



3.1.3 Envelope Flap

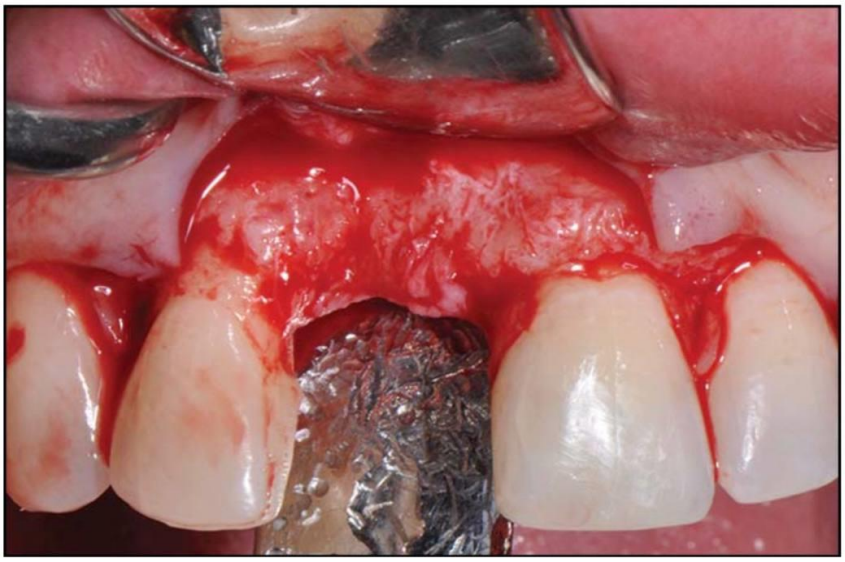
The envelope flap has limited expansion potential to allow for any graft material; however, it can allow for proper visualization of the surgical site **(Hutchens et al., 2018).**

Flap technique

- is designed with a midcrestal incision over the implant site followed by sulcular incisions on the buccal and palatal that extend at least one tooth to the mesial and distal. A full-thickness flap is reflected using blunt dissection.

A distinct advantage of the envelope flap is that upon reflection, vertical releasing incisions can be added to create a triangular or trapezoidal flap **(Hutchens et al., 2018).**

Fig.18: Envelope incision. This technique involves a midcrestal incision over the implant site followed by sulcular incisions on the buccal and palatal that extend at least one tooth to the mesial and distal.



3.1.4 Triangular and trapezoidal Flap

- triangular and a trapezoidal flap, both begin with the same midcrestal incisions over the implant site and sulcular incisions that continue horizontally to at least one adjacent tooth.
- A vertical releasing incision is then extended apically above the mucogingival junction.

  These vertical incisions are typically located distal to the canine to help conceal any scaring that may occur during the healing process **(Hutchens et al., 2018).**

Periosteal releasing incisions are then placed to aid in flap advancement to gain tension-free primary closure.

A distinct advantage in using a triangular and trapezoidal flap is that **(Hutchens et al., 2018)**:

1. Direct visibility of bone is obtained, which allows for great access to bone recontouring.
2. As well as bone grafting and can provide low to no tension on closure.

A contraindication to both flaps is a patient with thin

gingival biotype and space limitations (mesial-distal) result of lifting these flaps.

These full-thickness flaps should be adapted to obtain circumferential closure around the emerging implant abutment or to gain primary closure in a 2-stage approach **(Hutchens et al., 2018).**

Fig.19: Triangular incision. This technique involves a sulcular incision that continues horizontally to at least one adjacent tooth. One vertical releasing incision is then extended apically above the mucogingival junction.

Fig.20: Trapezoidal incision. This technique involves a sulcular incision that continues horizontally to at least one adjacent tooth. Two vertical incisions are then extended apically above the mucogingival junction.

3.1.5 Flapless Flap

A transmucosal "punch" technique was used to remove the soft tissue to the crest of bone, thereby allowing the implant to be placed employing a "flapless" technique. The trade-off in this technique is that implant placement surgery is more demanding since it is essentially performed "blind" through a 5-mm diameter opening.

The benefit of this flapless or punch surgical technique allows the soft tissues to be molded and stretched. At the time of implant placement since there are no vertical releasing incisions to negotiate flap adaptation and suturing. And most importantly, the blood supply to the labial aspect of the edentulous ridge is neither compromised nor interrupted since flap elevation is absent with this technique **(Chu/Tarnow, 2014).**

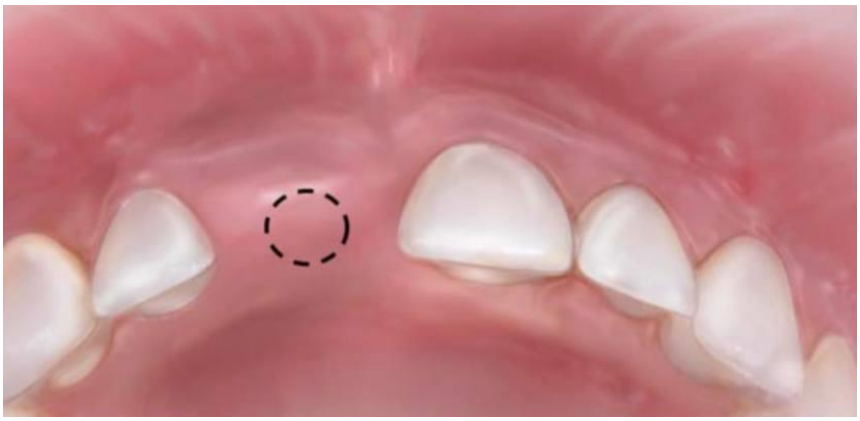
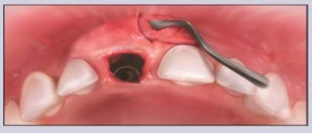


Fig.21: Flapless technique. This technique utilizes a tissue punch or a crestal incision with minimal flap elevation.

Table 1: This Table Shows the Advantages and Disadvantages for Each of the Flap Designs

Design		Advantages	Disadvantages
Flapless		•Less invasive •Maintain tissue vasculature •No vertical incisions	•Limited visibility •Potential to over-heat bone •Limited access to bone grafting/ resection •Unless guided, placement can be compromised
Papilla-sparing flap		•No disruption of the papillae •Less interproximal bone loss •Slight/mod disruption of vasculature	•Limited/no access to additional sites •Potential for scaring/clefting in keratinized gingiva •Crown lengthening not possible
Envelope flap		•No vertical incisions •Good approximation •Easy to modify	•Limited access •Moderate disruption of vasculature •Increased risk for tension •Guided bone regeneration not possible
Triangular flap		•Adequate visibility •Less tension on closure •Easy to modify	•Limited access •Increased tension when grafting •Potential for bone loss and recession •Increased disruption of blood supply
Trapezoidal flap		•Good visibility •Tension free closure •Good access to additional sites	•Potential for bone loss and recession •Increased disruption of blood supply
Vestibular incision		•Less invasive •No disruption of papillae	•Limited access •Low visibility

3.2 Management of Soft Tissues During the Second- Stage of Implant Surgery

The management of soft tissues during the second-stage of implant uncovering surgery is an important parameter to improve the final esthetic aspect around the implant-supported restoration. Traditionally, a tissue-punch or a full thickness flap opening prior to abutment connection have been used at this stage.

This may lead to bone loss resulting in soft tissue recession and causes unaesthetic implant restorations **(Belser et al., 2000).**

Many different flap designs have been advocated to reduce these negative consequences. Like:

3.2.1 Modified Roll Flap (MRF)

The Modified Roll Flap (MRF) is a new technique that depends on utilizing the gingival tissues over the implant cover screw and rolling it under the buccal mucosa to augment the soft tissue labial to the implant. MRF was first described by **Abrams in 1980 (Abrams, 1980)** for correction of mild to moderate soft tissue horizontal defects**. Hu¨zeler et al (Hürzeler et al., 2010)**, translated this technique to the peri-implant tissues for the purpose of management of mild soft tissue defects around implants in the esthetic zone. He made use of the usually discarded gingival tissues over the covering screw to augment the thin buccal gingival tissues.

MRF technique:

A trapezoidal shaped full thickness flap was incised over the covering screw. The horizontal arm was placed 2-3 mm palatal to end of the cover screw, then two small vertical incisions were performed similarly as wide as possible preserving the papilla and extending labial to include all the keratinized mucosa. The flap was then carefully freed all around from the underlying bone and screw. The two same vertical incisions were then reextended labial again to approximately equal its length but deepened to include only a partial thickness flap leaving the deep layer in place. The gingiva that was situated over the screw including the palatal

extension was precisely de-epithelialized using a double sided microsurgical blade to allow its rolling underneath the flap enlarging the thickness of the thin labial mucosa. The rolled part was sutured to its overlying counterpart **(Barakat et al., 2013).**

This technique can spare the problem of donor site morbidity, post-surgical bleeding and anatomical limitations that may limit the palatal harvesting. It also eliminates the need for second surgical site with consequent post-operative complications and

patient discomfort. Moreover, it overcomes the cost problems of acellular dermal matrix **(Barakat et al., 2013).**

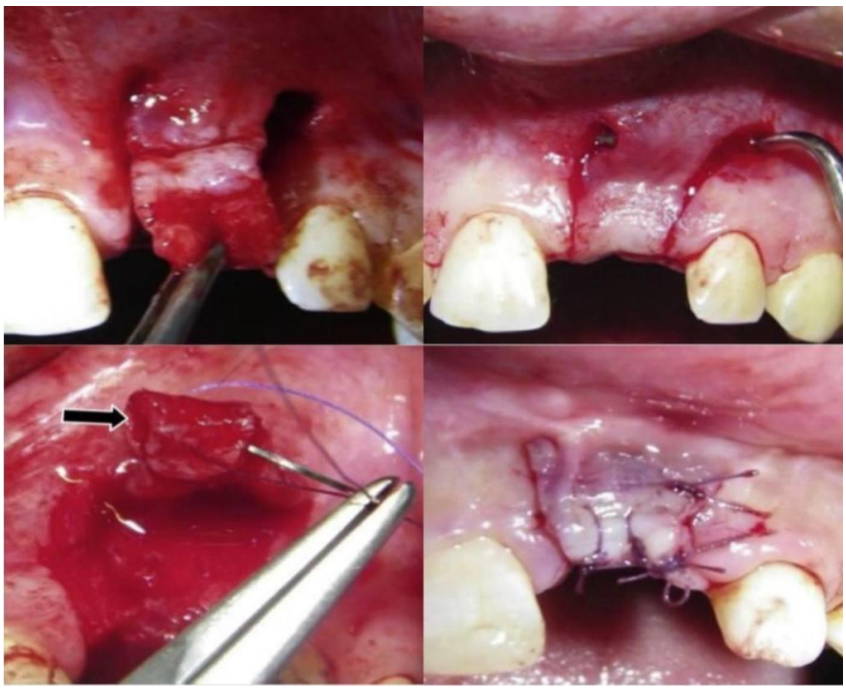


Fig.22: Modified Roll Flap Technique (1). Incised flap showing transition between full and partial thickness areas prior to complete release (2). Freed flap, arrow demarcating epithelialized from de-epithelialized zones prior to rolling. (3). De-epithelialized part was rolled underneath and sutured together (arrow). (4). MRF sutured in place, note the immediate increase in labial thickness

3.2.2 Vertical Mid-crestal Incision Flap

This technique is used, to prevent buccal marginal recession and to achieve an esthetic peri-implant soft tissue remodeling and predictable implant-supported gingival prosthetic integration, particularly during the single tooth rehabilitations.

A mid-crestal vertical incision extended buccopalatally was performed, midway between the two adjacent teeth. By exposing the cover screw, it was removed and

expansion of the flap carried out by using a healing abutment without suturing. After 3 weeks, soft tissue modeling was apparently complete. An abutment was placed, and soft tissue integration was controlled. **(A. H. and S. M. B., 2016),** it assures a better flap vascularization with a tension-free flap healing, and thus reduces the risk of buccal gingival recession **(Araújo et al., 2006).** By this way, the esthetic results are more predictable, especially in more demanding cases. This procedure offers the

following advantage such as minimal soft tissue trauma, minimal bone exposure, and high ease of performance **(A. H. and S. M.B., 2016).**

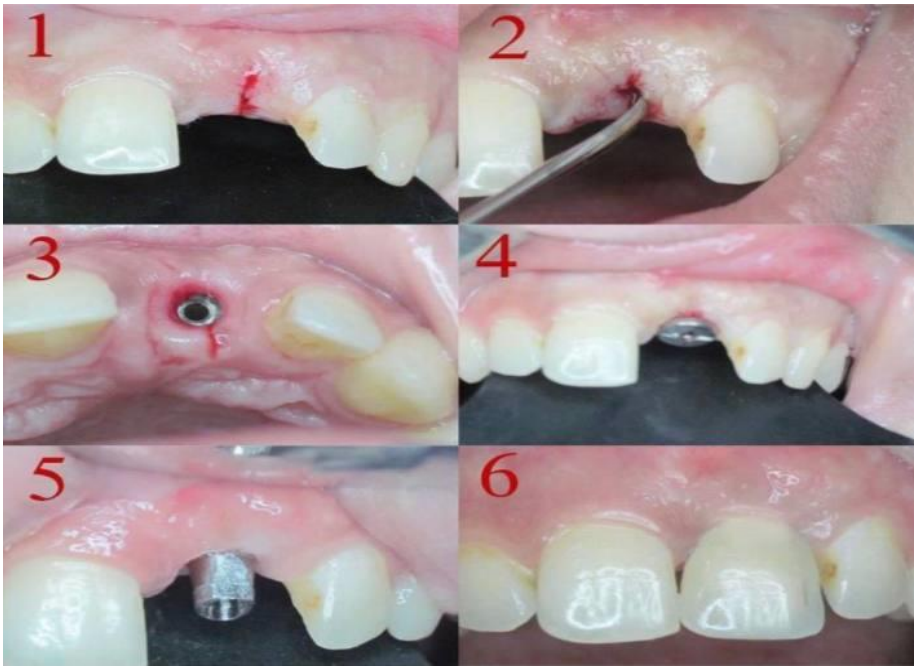


Fig.23: Vertical mid-crestal incision flap (1) Vertical mid-crestal incision on Missing anterior teeth , (2) Incision on #21i , (3) Healing abutment connection on #21i facial view , (4) Healing abutment connection on #21i occlusal view , (5) Two weeks after second-stage surgery , (6) Final restoration in place

3.2.3 Pouch Roll Technique (U shaped flap with rolling)

A modification of roll flap technique was described by **Park and Wang et al.** This technique is simple, versatile for mild to moderate ridge deficiency by thickening the soft tissue around implant. In this buccal mini-pedicle flap 1-mm wider than the diameter of the implant platform would be raised and then de epithelized followed by rolling of this mini-pedicle underneath the buccal pouch.

Fig.24: roll technique, (left) A buccal mini-pedicle flap outlined the platform of the implant at the maxillary right first molar site and was 1 mm wider than the diameter of the underlying implant platform. It was then de-epithelialized. (b) (right) Full-thickness flap elevation extended to the buccal aspect of the implant site. (c) (left) Mini-pedicle flap rolled underneath the buccal pouch. (d) (right) Occlusal view 2 weeks after surgery. (e) (left) Occlusal view 3 months after surgery. (f) (right) Clinical presentation at 4 months during the impression-taking appointment showed a maintained gingival height.

3.2.4 Split Finger Technique

The procedure outlined uses a split-finger approach to create both a cervical emergence and an elevated interdental / inter implant soft tissue**. (CE, 2001).** A sulcular incision is made 2 to 3 mm to the palatal side from each tooth with a loop design (at least 2.0-2.5 mm) adjacent to the implant location. The incisions are then joined facially with a semicircular incision at the preplanned free tissue margin of the implant crown. The facial fingers are elevated to the desired inter implant height for the papillae. The middle palatal finger is then split and is reflected to the respective mesial and distal sides. and later would be secured by vertical mattress sutures. The split-finger papillae approach can also be used for 2 or more adjacent implants.

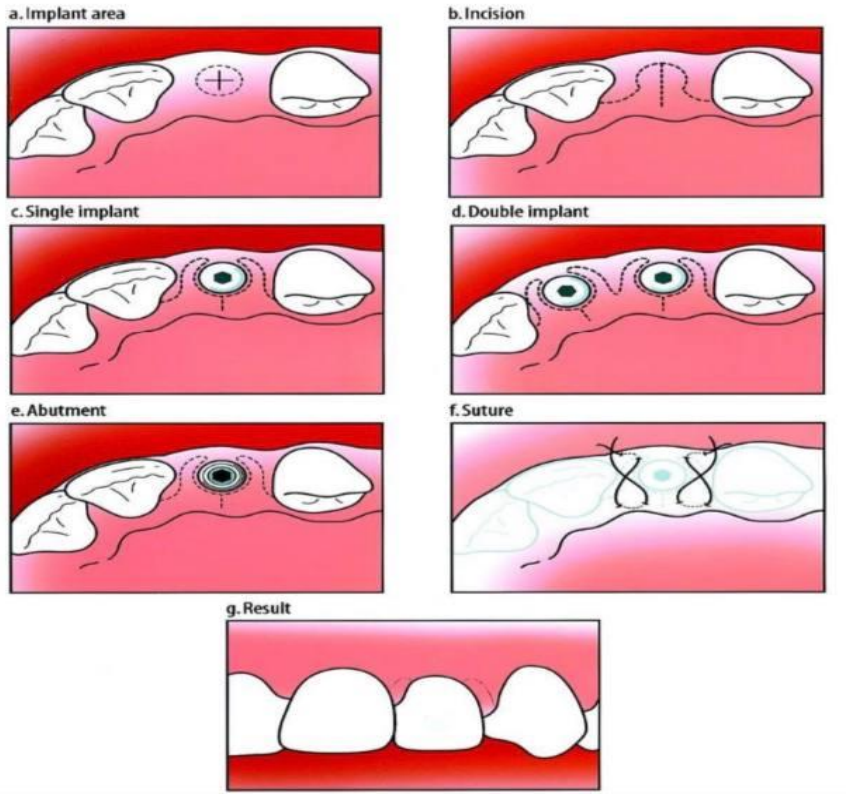


Fig.25: Diagram of the split-finger procedure. (A) Initial implant area. (B) Incision design. (C) Split-finger flap design for the single implant. (D) Split-finger flap design for 2 implants. (E) Abutment (or permucosal extension) connection. (F) Modified vertical mattress suture. (G) Final clinical appearance.

3.3 Soft Tissue Graft Types

3.3.1 Free Gingival Graft (FGG)

A soft tissue graft harvested from the palate with the overlying epithelium is defined as the free gingival graft (FGG), and it was first introduced for increasing keratinized tissue developmentally missing or lost.

Several features were suggested as risk factors for the outcomes of FGG, these include but are not limited to:

1. Improper preparation of the recipient site.
2. Inadequate graft size and thickness.
3. Poor adaptation to the recipient bed.
4. failure to stabilize the graft.

FGG undergoes a significant shrinkage (around 30%) during the healing process **(Yildiz et al., 2019).** A graft wider than the site needing soft tissue augmentation

must be harvested. and this may account for the postoperative discomfort and complications reported at the donor site **(Giriffin et al., 2006).**

One of the main indications of FGG is to re-establish an adequate keratinized tissue width and gingival thickness in the presence of mucogingival defects.

The long-term efficacy of an FGG compared with contralateral untreated sites has been assessed by **Agudio et al.,** that observed the stability (or coronal migration) of the gingival margin and the prevention (or worsening) of gingival recessions after the FGG; however, untreated contralateral sites were associated with increased recession depth or development of gingival recession. several trials showed that soft tissue augmentation using FGG was effective in reducing mucosal inflammation, patient discomfort, and facilitating optimal plaque control around implants lacking keratinized tissue width.

3.3.2 Connective Tissue Graft (CTG)

CTG-based approaches demonstrate the strongest potential of achieving complete root coverage, together with better esthetic results. It has been speculated that the CTG acts as a biologic filler, improving the adaptation and the stability of the flap to the root during early wound repair **(Cairo et al., 2016)**. In the presence of an increased soft tissue thickness, the coronal migration of the gingival margin over time, a phenomenon defined as "creeping attachment," can also occur. This may explain the trend toward stability of the gingival margin over time of recession defects treated with CTG. Several harvesting approaches, such as the trap-door, the single incision, and parallel incisions technique have been proposed for obtaining a CTG from the palate **(Agudio et al., 2016).**

3.3.3 Subepithelial Connective Tissue Graft (SCTG)

SCTG procedures have been used successfully throughout the years for the management of recession and soft tissue defects around natural teeth and for augmenting alveolar ridge contours **(Happe et al., 2013; Nemcovsky et al., 2004**), In thin-tissue phenotype cases, its usage has shown a remarkable increase in the overall buccal tissue volume and routine doubling of thickness in cases involving thin labial plate of bone **(Grunder, 2011).** It ensures at least 3 mm of keratinized tissue width **(Moergel et al., 2016).**

3.4 Soft and Hard Tissue Augmentation with Platelet-Rich Fibrin

Placement of dental implants in the anterior maxillary region can be achieved by different methods **(Belser et al., 2000)**. The optimal method is dependent on anatomical parameters such as bone volume, bone density, alveolar crest position, adjacent teeth, and gingival morphology. Moreover, esthetic outcomes are important for successful dental implantation which are determined by the smile and lip line. When the implant is placed into bone with inadequate bone height and thickness, harmonious gingival contour is difficult to achieve. **(Chu/Tarnow, 2014).**

Autologous PRF is prepared from the patient's blood using a dedicated centrifugation protocol. PRF consists of a polymerized fibrin network containing platelets and sometimes white blood cells (depending on the used protocol). The membrane releases growth factors that influence the wound healing process. PRF can be applied in both hard and soft tissue augmentations.

The benefit of PRF compared with standard procedures is the reduction in bone augmentation time. For soft tissue augmentation and remodeling of the gingiva, the PRF membrane is especially placed in which strong fibrin architecture could be used as a matrix for wound repair.

The role of PRF in wound healing has been demonstrated by **Agrawal et al** include:

1. Prolonged release of platelet-derived growth factors at the wound site.
2. Proliferation of fibroblasts and osteoblasts.
3. Promoted angiogenesis, induced collagen synthesis.
4. Guided wound coverage.
5. Mechanical adhesion by fibrin.
6. Trapped circulating stem cells.
7. Regulation of immunity.

In addition, the membrane acts as a bio-barrier and an engineering scaffold. **(Chu/Tarnow, 2014).**

One of the benefits of PRF is that PRF increases the bone-to-implant contact compared with other bone augmentation techniques.

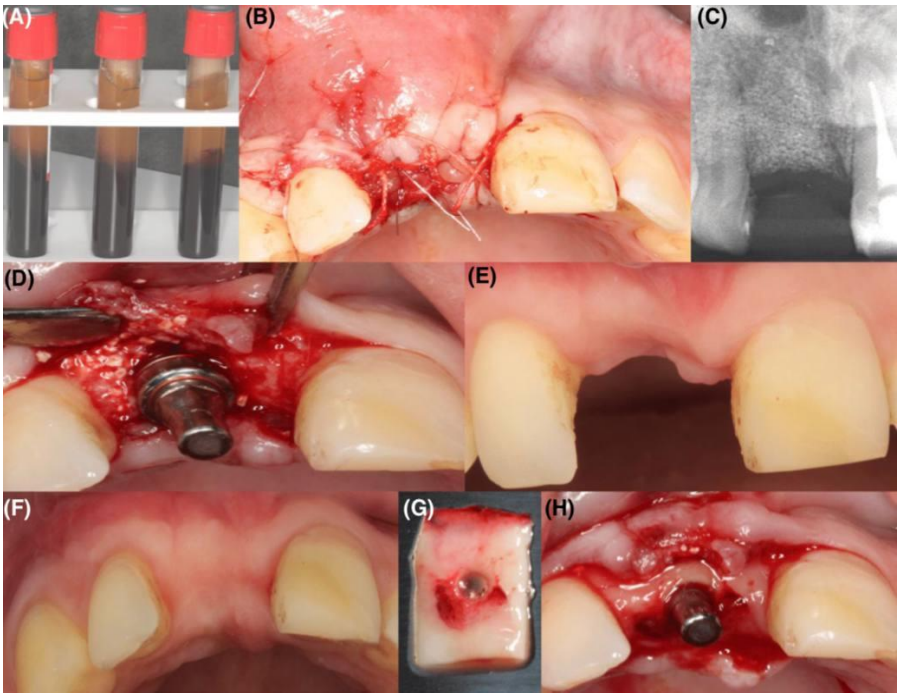


Fig.26: Preparation and the use of the PRF membrane. A, shows the PRF clot obtained after centrifugation. B, shows PRF membrane inserted into the cavity. C, shows the radiologic assessment of deficiency at 3 months after augmentation. D, shows implant placement with immediate temporary abutment. E and F, shows buccal deficiency after the buildup and occlusal appearance after buildup, respectively. G, shows the punched PRF membrane. H, shows PRF membrane placed in the buccal/ palatal envelope

3.5 Developing Optimal Peri-Implant Papillae within the Esthetic Zone

In a significant number of individuals, the osseous topography resulting from previous tooth loss is not scalloped but flat and does not naturally support the recreation of interproximal papillae. Where an ovoid tooth form is desired, this complicating factor prevents the establishment of harmony, balance, and continuity of form between the fixture-supported restoration and the adjacent teeth within the esthetic zone.

One of the most challenging is the recreation of the anterior interproximal papilla, especially when it relates to implant-supported restorations. In the anterior region, however, where the creation of papillae requires that a vertical component be added to any soft tissue enhancement of a flat profile, a modified surgical protocol becomes necessary. **(Salama et al., 1995).**

In order to specifically plan treatment for peri-implant papillae within the esthetic zone, the authors have altered their sequence of therapy as follows:

1. A palatal incision is designed to extend to the palatal and interproximal sulci of adjacent teeth.
2. Full thickness elevation of the labial flap is undertaken to the labial margin of the fixture. A partial thickness dissection apically is then utilized to fully mobilize the flap coronally without tension.
3. The cover screw is removed, and an implant coping transfer impression is acquired.
4. A healing abutment of a length capable of supporting the vertical needs of the augmentation is inserted. The labial flap is advanced coronally in order to cover and submerge the healing abutment and allow for three-dimensional GSTA.
5. Six to eight weeks later, at Stage I, the healing abutment is exposed, and a temporary restoration is placed to guide final healing of the coronally positioned soft-tissue-restoration-generated site development.

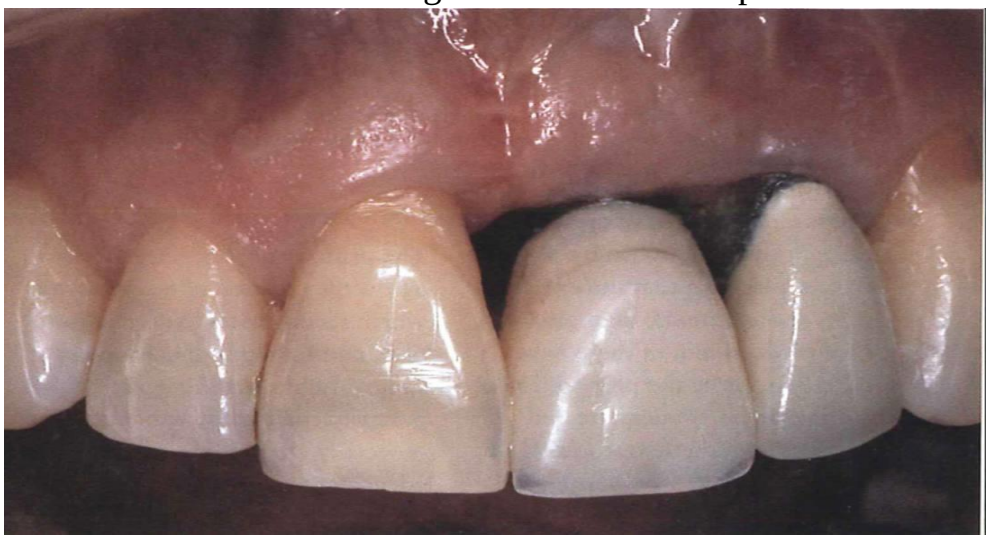


Fig.27: Maxillary left central incisor with a single-tooth implant-supported restoration with flat gingival form and complete loss of interdental papillae is an inadequate restoration frame. Treatment planning for an alteration of second-stage surgery could have prevented this poor cosmetic result by compensating with soft tissue.

3.6 Fabrication of Provisional Restoration

A diagnostic waxing of the failing tooth on the study cast should represent, as closely as possible, that the definitive restoration, match the contralateral tooth,

and **(Vacek et al., 1994)** be harmonious with the adjacent dentition. Provisional restoration, as well as implant and soft tissue surgical templates, can be accurately fabricated from a well-executed diagnostic waxing **(Joseph Yun Kwong Kan et al., 2018)**. For immediate provisualization, a prefabricated zirconium abutment or metal

temporary abutment is manually prepared extraorally and then hand-tightened onto the implant. The provisional shell is then relined with light polymerized acrylic resin to capture the cervical gingival emergence of the extracted tooth and adjusted to clear all centric and eccentric functional contacts**. (Joseph Y. K. Kan & Rungcharassaeng, 2019)** The cementation of the provisional restoration with provisional cement should be performed simultaneously with the SCTG placement. The amount of cement used should be minimal.

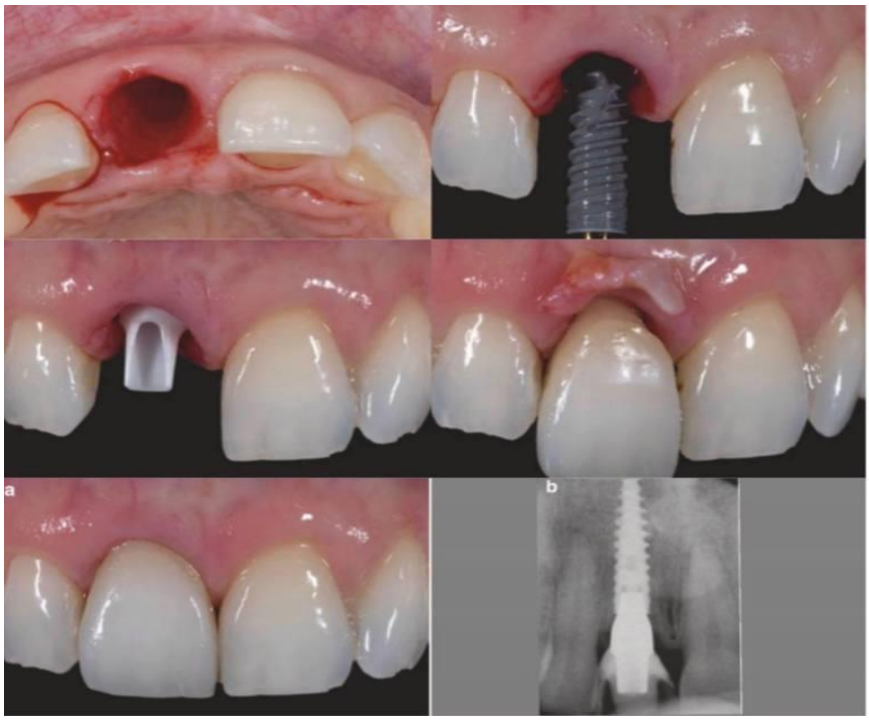


Fig.28: Papilla Management and Development Using Provisional Prosthesis (A) Intact extraction socket (B) The implant should be placed at the center of the predetermined mesiodistal width of the final restoration with a minimal distance of 2 mm from the adjacent tooth (C) Prefabricated zirconium abutment as provisional abutment (D) Subepithelial connective tissue graft (SCTG) can be placed simultaneously with cementation of the provisional restoration Fig. (E) (a) Clinical and (b) radiographic images of IIPP of #8 (Joseph Y. K. Kan & Rungcharassaeng, 2019)

The final implant impression is usually made 6 months after the surgery. A customized zirconium/gold alloy abutment is fabricated, duplicating the gingival emergence profile of the provisional restoration **(Joseph Y. K. Kan & Rungcharassaeng, 2019)**.

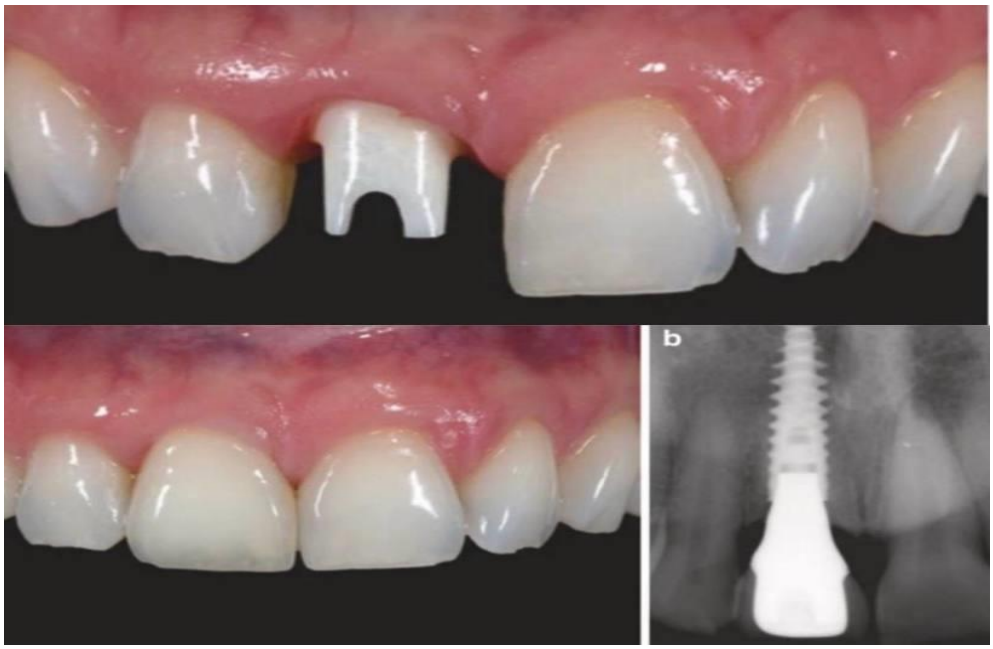


Fig.29: Customized zirconium abutment (a) Clinical and (b) radiographic images of the definitive restoration 12 months after the surgery (Joseph Y. K. Kan & Rungcharassaeng, 2019)

The main objectives of temporary restorations at immediate implants, besides patient comfort and esthetics during healing are (Ayoub & Belal, 2021):

1. Maintaining the existing soft tissue architecture.
2. Supporting the existing gingival margin and papilla height.
3. A smooth and polished surface that will help create a gentle transition and minimize contamination during healing**.**

Chapter Two: Discussion

Implant specialists have gained a greater understanding of the anatomical and biological concepts of the periodontium and peri-implant tissues, **(D'Addona et al., 2012)**, along with other factors effecting the stability of the dental implant like: the biotype of the mucosa, the papilla height and the amounts of soft-tissue volume and keratinized tissue; and. Since the biotype of the mucosa is congenitally set, many other parameters can, be influenced by the treatment itself.

Clinically, the choice of the dental implant and the position in a vertical and horizontal direction can substantially influence the establishment of the biologic width and subsequently the location of the buccal mucosa and the papilla height **(Thoma et al., 2014).**

Thus, the gingival biotype should be evaluated to determine the risk factors involved after the implant surgery. Two variants of gingival biotype are seen among the common masses that is the thin scalloped biotype (15%) and the thick flat biotype (85%). Regarding bone augmentation, in a study by **(Khairnar, Khairnar and Bakshi, 2014),** a modification of the ridge splitting technique using osteotomes for horizontal ridge augmentation advocated by (Summers, 1994a) was proposed. It involved using chisels to relieve the stress concentration at the crestal bone and proven successful without loss of patient bone associated with using osteotomes alone.

Various modifications of the sandwich osteotomy technique for vertical bone augmentation were also proposed. In a study by **(Mansour et al., 2018)**, nine patients suffering from multiple missing anterior maxillary teeth were selected with vertical dimension not less than 10 mm. Anterior maxillary sandwich osteotomy technique was carried out for all patients using xenograft bone particulate with simultaneous implant placement at single stage surgery. The outcome after 1 year shows esthetically satisfactory result. The post-operative Xray after 1 year shows very minimal bone loss at crest. Two patient treatment examples were elucidated in a study by **(Jensen, 2020)**, to illustrate sandwich osteotomy modification strategies needed to create orthoalveolar form, both of which enabled recovery of the alveolar facial plate, crestal bone for central papillary support, as well as emergence profile implant restoration**. (Marcantonio et al., 2019)** described the oral rehabilitation with dental implants of a patient with a vertical bone defect in the maxillary anterior

region using the AOD technique. He concluded that the use of AOD to increase the alveolar ridge was effective and ensured rehabilitation with dental implants.

Alveolar ridge reconstruction using either a resorbable or non-resorbable membrane over the defect often along with a graft material has been used increasingly to prevent soft tissue ingrowth **(McAllister and Haghighat, 2007)**. The graft materials that are available include both particulate and block graft form. An autogenous particulate bone graft heals by immediate and continuous bone formation that results in a larger and more rapidly consolidated graft.

Autologous onlay block grafts may resorb more rapidly, and block grafts do take a longer time to integrate than autogenous particulate bone grafts **(Louis et al., 2008)**. A study by **(Bramanti et al., 2018)** suggests that the socket shield technique is safe and provides better aesthetic results compared with the conventional post extractive technique. However, further randomized clinical trials are needed to confirm such preliminary results. The obtained results seem to confirm the data published by **(Hürzeler et al., 2010).**

In soft tissue management around dental implants that was performed at the time of implant surgery. This timing has several advantages: it requires fewer surgeries; enables simultaneous hard tissue and soft tissue healing; results in a shorter healing time; produces less pain and discomfort; causes less stress; lowers the costs; and provides greater patient satisfaction comparable to soft tissue management at second stage **(Kadkhodazadeh et al., 2017).** Also, in the study of **(Esposito et al., 2012)** soft tissue augmentation can be performed simultaneously with implant placement and/or during the second stage surgery. There is no evidence in the literature to support any advantage of simultaneous soft tissue augmentation over augmentation during second stage surgery. Both treatment modalities have been shown to lead to better esthetics and increased soft tissue thickness.

Even though both techniques yield favorable esthetics, the earlier the intervention is performed, the more opportunities the clinician must better control the final outcome. For instance, in a case where the residual ridge has undergone significant atrophy, the simultaneous soft tissue augmentation in conjunction with first stage surgery will allow sufficient healing time to properly assess the site during second stage surgery. Consequently, additional soft tissue augmentation can be performed simultaneously when uncovering the implant(s) in order to achieve a more ideal outcome **(Ioannou et al., 2015). Shamsan, Y. A et al (Shamsan et al., 2018)** discussed the flaps used in soft tissue management and make a comparison between

flapless group A and flap elevation group B. The patients in group B reported more pain severity and duration following surgery. The difference between the 2 groups was statistically significant. In the year 2006 Fortin et al **(Fortin et al., 2006)** stated that pain decreased faster with flapless procedure and the number of patients who felt no pain was higher with the same procedure. They stated that one objective of the flapless procedure is to reduce the invasiveness of surgery and thus reduce surgical outcomes such as pain, edema, and hematoma.

In the year 2006 Oh et al **(Oh et al., 2002)** stated that the study reported mean probing depth between the flapless versus conventional only statistically significant at 4 months. In the current study, cone beam CT was done at 6 months to compare the marginal bone loss and bone density around dental implants placed using flapless and flapped surgical techniques **(Shamsan et al., 2018).**

From the results of this study, the patients in group B reported more marginal bone loss round dental implants. The difference between the 2 groups was statistically significant **(Shamsan et al., 2018).**

In the study of (Greenstein & Tarnow, 2014) There is a comparison between flap elevation with papilla sparing (0–1.0 mm) verses flap elevation with papilla elevation (0–3.5 mm), the amount of interproximal tissue loss was far less on a papilla-sparing flap/incision. It is for this reason that if either the papilla preservation technique or a flapless surgical technique can be used, there will be a far more predictable outcome with respect to the interproximal bone loss and healing.

Barakat at 2013 found that the modified roll flap technique was effective in increasing the soft tissue thickness within the same group and when compared to the standard crestal incision (Barakat et al., 2013). The soft tissue thickness increased from (1.2 _+ 0.2) to (3.0_+ 0.5) mm which means the validity of the MRF in transforming the thin gingival biotype to a thick one and hence improving the peri-implant environment **(Barakat et al., 2013)**. These results are quite comparable to standard palatal connective tissue graft technique used by **(Weisner et al; Wiesner et al., 2010).**

Soft Tissue Augmentation Using Platelet Rich Fibrin is a good suggestion or alternative for peri-implant soft tissue augmentation in the esthetic zone, as it is a simple procedure, a cost-effective source of growth factors and is easy toprepare. As the results showed, improvement in gingival thickness has been achieved and approved by **(A. H. Ayoub & Belal, 2016).** In the literature of **(De Angelis et al., 2021)** a lot of interest has taken place regarding type 1 implants, which are placed

immediately after extraction and provisionalized within 24 hours (IIPP) **(Chen et al., 2004; Farronato et al., 2014; van Nimwegen et al., 2018).** Among the advantages of this approach exist the possibilities of lowering the number of surgeries and the time required without affecting the predictability in terms of survival **(Chen et al., 2004; Guarnieri et al., 2014; van Nimwegen et al., 2018).** However, peri-implant tissue stability is a key factor that can impact the success of implant restorations because the postoperative tissue remodeling has the potential to compromise the esthetic results **(Del Amo et al., 2020; Guarnieri et al., 2015).**

However, IIPP does not avoid loss of the buccal bone wall nor mucosal recession or ridge dimensional changes. For this reason, different approaches, which were combined or used separately, have been introduced to minimize hard and soft tissue volume alterations and improve esthetic aspects using such methods as bone grafts and soft tissue grafting **(De Angelis et al., 2021).**

References

A

- Abrams, L. (1980). Augmentation of the deformed residual edentulous ridge for fixed prosthesis. The Compendium of Continuing Education in Dentistry, 1, pp.205-213.
- Adell R, Lekholm U, Rockler B, Brånemark PI, Lindhe J, Eriksson B, et al. Marginal tissue reactions at osseointegrated titanium fixtures (I). A 3-year longitudinal prospective study. Int J Oral Maxillofac Surg 1986; 15:39-52.
- Agrawal AA. Evolution, current status and advances in application of platelet concentrate in periodontics and implantology. World J Clin Cases. 2017;5(5):159.
- Agudio G, Cortellini P, Buti J, Pini Prato G. Periodontal conditions of sites treated with gingival augmentation surgery compared with untreated contralateral homologous sites: an 18- to 35-year long- term study. J Periodontol. 2016;87:1371-1378.
- Andersson B, Odman P, Lindvall AM, et al. Single-tooth restorations supported by osseointegrated implants: results and experiences from a prospective study after 2 to 3 years. Int J Oral Maxillofac Implants 1995;10(6):702–11.
- Angelis, P., Manicone, P. F., Gasparini, G., De Angelis, S., Liguori, M. G., De Filippis, I., & D'Addona, A. (2021). Influence of Immediate Implant Placement and Provisionalization with or without Soft Tissue Augmentation on Hard and Soft Tissues in the Esthetic Zone: A One- Year Retrospective Study. BioMed Research International, 2021, 9.
- Araújo, M. G., Wennström, J. L., & Lindhe, J. (2006). Modeling of the buccal and lingual bone walls of fresh extraction sites following implant installation. Clinical Oral Implants Research, 17(6), pp.606-614.
- Assoian RK, Komoriya A, Meyers CA, Miller DM, Sporn MB. Transforming growth factor-beta in human platelets. Identification of a major storage site, purification, and characterization. J Biol Chem. 1983;258(11):7155-7160.
- Atsuta, Ikiru, et al. "Soft tissue sealing around dental implants based on histological interpretation." Journal of prosthodontic research 60.1 (2016):3-11.
- Ayoub, A. H. and S. M. B. (2016). VERTICAL MID-CRESTAL INCISION" FLAP DESIGN IN SECOND STAGE DENTAL IMPLANT SURGERY IN

ESTHETIC ZONE - A CASE REPORT. (IJMOR) International Journal of Medical and Oral Research ;1(1):14-17.

- Ayoub, A. H., & Belal, S. M. (2016). Peri-Implant Soft Tissue Augmentation Using Platelet Rich Fibrin (PRF) in Esthetic Zone: A Case Report. EC Dental Science, 6, pp; 1418–1423.
- Ayoub, A., & Belal, S. (2021). A NOVEL TEMPLATE DESIGN FOR IMMEDIATE PROVISIONALIZATION OF ONE-PIECE IMPLANT IN ESTHETIC REGION: CLINICAL ASSESSMENT. APOLONIA, 5–14.
- Ayoub, A., & Belal, S. (2021). A NOVEL TEMPLATE DESIGN FOR IMMEDIATE PROVISIONALIZATION OF ONE-PIECE IMPLANT IN ESTHETIC REGION: CLINICAL ASSESSMENT. APOLONIA, 5–14.

B

- Banks R, Forbes MA, Kinsey SE, et al. Release of the angiogenic cytokine vascular endothelial growth factor (VEGF) from platelets: significance for VEGF measurements and cancer biology. Br J Cancer. 1998;77(6):956.
- Barakat, K., Ali, A., Abdel Meguid, A., & Abdel Moniem, M. (2013). Modified roll flap a handy technique to augment the peri-implant soft tissue in the esthetic zone: A randomized controlled clinical trial. Tanta Dental Journal ,10(3), pp.123-128.
- Barone A, Covani U.Maxillary alveolar ridge reconstruction with nonvascularized autogenous block bone: clinical results. J Oral Maxillofac Surg. 2007;65:2039–2046.
- Belser UC, Buser D, Hess D, Schmid B, Bernard JP, Lang NP. Aesthetic implant restorations in partially edentulous patients–a critical appraisal. Periodontol 2000. 1998;17(1):132-150.
- Belser UC, Grütter L, Vailati F, Bornstein MM, Weber HP, Buser D. Outcome evaluation of early placed maxillary anterior single-tooth implants using objective esthetic criteria: a cross-sectional, retrospective study in 45 patients with a 2- to 4-year follow-up using pink and white esthetic scores. Journal of Periodontology. 2009;80(1):140–151.
- Belser, U. C. et al. (2004) 'Outcome analysis of implant restorations located in the anterior maxilla: a review of the recent literature.', The International journal of oral & maxillofacial implants. 19(Suppl):30–42.

- Berglundh T, Lindhe J, Ericsson I, Marinello CP, Liljenberg B, Thomsen P. The soft tissue barrier at implants and teeth. Clin Oral Implants Res 1991: 2: 81–90.
- Berglundh T, Lindhe J, Jonsson K, Ericsson I. The topography of the vascular systems in the periodontal and peri- implant tissues in the dog. J Clin Periodontol 1994: 21: 189– 193.
- Bosshardt DD, Lang NP. The junctional epithelium: from health to disease. J Dent Res 2005: 84: 9–20.
- Bra˚nemark PI, Svensson B, van Steenberghe D. Ten-year survival rates of fixed prostheses on four or six implants ad modum Bra˚nemark in full edentulism. Clin Oral Implants Res 1995;6(4):227–31.
- Bramanti, E., Norcia, A., Cicciù, M., Matacena, G., Cervino, G., Troiano, G., Zhurakivska, K. and Laino, L. (2018). Postextraction Dental Implant in the Aesthetic Zone, Socket Shield Technique Versus Conventional Protocol. Journal of Craniofacial Surgery, 29(4), pp.1037–1041.
- Buser D, Ingimarsson S, Dula K, et al. Long-term stability of osseointegrated implants in augmented bone: a 5-year prospective study in partially edentulous patients. Int J Periodontics Restorative Dent 2002;22(2):109–17.
- Buser D, Martin W, Belser UC. Optimizing esthetics for implant restorations in the anterior maxilla: anatomic and surgical considerations. Int J Oral Maxillofac Implants. 2004;19(7):43-61.
- Buser D, Sennerby L, De Bruyn H. Modern implant dentistry based on osseointegration: 50 years of progress, current trends and open questions. Periodontol 2000 2017; 73:7-21.
- Byun HY, Wang HL. Sandwich bone augmentation using recombinant human platelet-derived growth factor and beta-tricalcium phosphate alloplast: case report. Int J Periodontics Restorative Dent. 2008;28:83–7.

C

- Cairo F, Cortellini P, Pilloni A, et al. Clinical efficacy of coro- nally advanced flap with or without connective tissue graft for the treatment of multiple adjacent gingival recessions in the aesthetic area: a randomized controlled clinical trial. J Clin Periodontol. 2016;43:849-856.
- Cairo F. Periodontal plastic surgery of gingival recessions at single and multiple teeth. Periodontol 2000. 2017;75:296-316.

- CairoF,NieriM,PagliaroU.Efficacyofperiodontalplasticsurgery procedures in the treatment of localized facial gingival recessions. A systematic review. J Clin Periodontol. 2014;41(Suppl 15):S44- S62.
- CE, M. (2001). The split finger technique for creation of interimplant papilla. A pilot study. Continium, 12, pp.1-3.
- Chen, S. T., Wilson Jr, T. G., & Hammerle, C. H. (2004). Immediate or early placement of implants following tooth extraction: review of biologic basis, clinical procedures, and outcomes. Int J Oral Maxillofac Implants, 19(Suppl), 12–25.
- Chiapasco M, Tommasato G, Palombo D, Scarnò D, Zaniboni M, Del Fabbro M. Dental implants placed in severely atrophic jaws reconstructed with autogenous calvarium, bovine bone mineral, and collagen membranes: a 3- to 19-year retrospective follow-up study. Clin Oral Implants Res. 2018;29:725–40. doi: 10.1111/clr.13281.
- Chiapasco M, Zaniboni M, Rimondini L. Autogenous onlay bone grafts vs. alveolar distraction osteogenesis for the correction of vertically deficient edentulous ridges: a 2-4-year prospective study on humans. Clin Oral Implants Res. 2007;18:432–40. doi: 10.1111/j.1600-0501.2007.01351.x.
- Chu SJ, Kan JY, Lee EA, et al. Restorative emergence profile for single-tooth implants in healthy periodontal patients: clinical guide- lines and decision-making strategies. Int J Periodontics Restorative Dent. 2019; 40:19-29.
- Cosyn J, Eghbali A, De Bruyn H, Collys K, Cleymaet R, De Rouck T. Immediate single-tooth implants in the anterior maxilla: 3-year results of a case series on hard and soft tissue response and aesthetics. Journal of Clinical Periodontology. 2011;38(8):746–753.

D

- D'Addona, A., Ghassemian, M., Raffaelli, L. and Manicone, P.F. (2012). Soft and Hard Tissue Management in Implant Therapy—Part I: Surgical Concepts. International Journal of Biomaterials, 2012(531202), pp.1–8.
- De Bruyn H, Raes S, Matthys C, Cosyn J. The current use of patient-centered/reported outcomes in implant dentistry: a systematic review. Clin Oral Implants Res 2015;26 Suppl 11:45-56.
- De Castro Pinto RC, Colombini BL, Ishikiriama SK, Chambrone L, Pustiglioni FE, Romito GA. The subepithelial connective tissue pedicle graft

combined with the coronally advanced flap for restoring missing papilla: a report of two cases. Quintessence Int. 2010;41:213–220.

- de Resende DRB, Greghi SLA, Siqueira AF, Benfatti CAM, Damante CA, Ragghianti Zangrando MS. Acellular dermal matrix allograft versus free gingival graft: a histological evaluation and split-mouth randomized clinical trial. Clin Oral Investig. 2019;23:539-550.
- Dohan DM, Choukroun J, Diss A, et al. Platelet-rich fibrin (PRF): a second-generation platelet concentrate. Part I: technological concepts and evolution. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2006;101(3):e37-e44.
- Dohan Ehrenfest DM, Del Corso M, Diss A, Mouhyi J, Charrier JB. Three-dimensional architecture and cell composition of a Choukroun's platelet-rich fibrin clot and membrane. J Periodontal. 2010;81(4):546-555.
- Draenert FG, Huetzen D, Neff A, Mueller WE. Vertical bone augmentation procedures: basics and techniques in dental implantology. J Biomed Mater Res A. 2014;102:1605–13. doi: 10.1002/jbm.a.34812.
- Draenert FG, Kämmerer PW, Berthold M, Neff A. Complications with allogeneic, cancellous bone blocks in vertical alveolar ridge augmentation: prospective clinical case study and review of the literature. Oral Surg Oral Med Oral Pathol Oral Radiol. 2016;122:e31–43. doi: 10.1016/j.oooo.2016.02.018.

E

- El Chaar ES.Soft tissue closure of grafted extraction sockets in the posterior maxilla: the rotated pedicle palatal connective tissue flap technique. Implant Dent. 2010;19:370–377.
- Esposito, M., Maghaireh, H., Grusovin, M. G., Ziounas, I., & Worthington, H. V. (2012). Soft tissue management for dental implants: what are the most effective techniques? A Cochrane systematic review. Eur J Oral Implantol, 5(3), 221–238.
- Evans CDJ, Chen ST. Esthetic outcomes of immediate implant placements. Clinical Oral Implants Research. 2008;19(1):73–80.

F

- Farronato, D., Mangano, F., Briguglio, F., Iorio-Siciliano, V., Riccitiello, F., & Guarnieri, R. (2014). Influence of Laser-Lok surface on immediate functional loading of implants in single-tooth replacement: a 2-year

prospective clinical study. The International Journal of Periodontics & Restorative Dentistry, 34(1), 79–89.
- Fortin, T., Bosson, J. L., Isidori, M., & Blanchet, E. (2006). Effect of flapless surgery on pain experienced in implant placement using an.
- Friedrich-Wilhelm Neukam, ... Rainer Lutz, in Maxillofacial Surgery (Third Edition), 2017.
- Fürhauser R, Florescu D, Benesch T, Haas R, Mailath G, Watzek G. Evaluation of soft tissue around single-tooth implant crowns: the pink esthetic score. Clinical Oral Implants Research. 2005;16(6):639–644.

G

- Gassling V, Douglas T, Warnke PH, Açil Y, Wiltfang J, Becker ST. Platelet-rich fibrin membranes as scaffolds for periosteal tissue engineering. Clin Oral Implant Res. 2010;21(5):543-549.
- Glenn J. Jividen, Carl E. Misch, in Misch's Avoiding Complications in Oral Implantology, 2018
- Goldstein M, Boyan BD, Schwartz Z.The palatal advanced flap: a pedicle flap for primary coverage of immediately placed implants. Clin Oral Implants Res. 2002;13:644–650.
- Greenstein G, Greenstein B, Cavallaro J, Elian N, Tarnow D.Flap advancement: practical techniques to attain tension-free primary closure. J Periodontol. 2009;80:4–15.
- Greenstein G, Tarnow D. Using papillae-sparing incisions in the esthetic zone to restore form and function. Compend Contin Educ Dent. 2014; 35:315– 322.
- Griffin TJ, Cheung WS, Zavras AI, Damoulis PD. Postoperative complications following gingival augmentation procedures. J Peri- odontol. 2006;77:2070-2079.
- Grunder, U. (2011). Crestal ridge width changes when placing implants at the time of tooth extraction with and without soft tissue augmentation after a healing period of 6 months: report of 24 consecutive cases. International Journal of Periodontics and Restorative Dentistry, 31(1), 9.

H

- Hahn J. 8-year onlay bone graft and ridge augmentation with PepGen P-15: a clinical and radiographic case study. Implant Dent. 2004;13:228–31. doi: 10.1097/01.id.0000136916.28634.d3.

- Happe, A., Stimmelmayr, M., Schlee, M., & Rothamel, D. (2013). Surgical Management of Peri-implant Soft Tissue Color Mismatch Caused by Shine-Through Effects of Restorative Materials: One-Year Follow-up. The International Journal of Periodontics and Restorative Dentistry, 33(1), pp.81-88.
- Hartlev J, Spin-Neto R, Schou S, Isidor F, Nørholt SE. Cone beam computed tomography evaluation of staged lateral ridge augmentation using platelet-rich fibrin or resorbable collagen membranes in a randomized controlled clinical trial. Clin Oral Implants Res. 2019;30:277–84. doi: 10.1111/clr.13413.
- Hellem S, Astrand P, Stenström B, Engquist B, Bengtsson M, Dahlgren S. Implant treatment in combination with lateral augmentation of the alveolar process: a 3-year prospective study. Clin Implant Dent Relat Res. 2003;5:233–40. doi: 10.1111/j.1708-8208.2003.tb00206.x.
- Henry PJ, Laney WR, Jemt T, et al. Osseointegrated implants for single-tooth replacement: a prospective 5-year multicenter study. Int J Oral Maxillofac Implants 1996;11(4):450–5.
- Herford AS, Cooper TC, Maiorana C, Cicciù M.Vascularized connective tissue flap for bone graft coverage. J Oral Implantol. 2011;37:279–285.
- Hürzeler, M. B., von Mohrenschildt, S., & Zuhr, O. (2010). Stage-two implant surgery in the esthetic zone: a new technique. The International Journal of Periodontics & Restorative Dentistry, 30(2), p.187.
- Hürzeler, M.B., Zuhr, O., Schupbach, P., Rebele, S.F., Emmanouilidis, N. and Fickl, S. (2010). The socket-shield technique: a proof-of-principle report. Journal of Clinical Periodontology, 37(9), pp.855–862.

I

- Iacono VJCommittee on Research, Science and Therapy, the American Academy of Periodontology. Dental implants in periodontal therapy. J Periodontol 2000; 71:1934-42.

J

- J.-B. Seigneuric, M.-P. Vazquez, in Preprosthetic and Maxillofacial Surgery, 2011.

- Jemt T. Regeneration of gingival papillae after single-implant treatment. International Journal of Periodontics and Restorative Dentistry. 1997;17(4):327–333.
- Jensen, O.T. (2020). Modifications of Anterior Maxillary Sandwich Osteotomy for Vertical Bone Augmentation. Bone Augmentation by Anatomical Region, pp.163–167.
- Jeon IS, Heo MS, Han KH, Kim JH. Vertical ridge augmentation with simultaneous implant placement using β-TCP and PRP: a report of two cases. J Oral Maxillofac Surg Med Pathol. 2013;25:226–31. doi: 10.1016/j.ajoms.2012.05.016.
- Joshi A.An investigation of postoperative morbidity following chin graft surgery. Br Dent J. 2004;196:215–218.

K

- Kadkhodazadeh, M., Amid, R., Kermani, M. E., Mirakhori, M., & Hosseinpour, S. (2017). Timing of soft tissue management around dental implants: a suggested protocol. Gen Dent, 65(3), 50–56.
- Kahn S, Egreja AM, Barceleiro Mde O. Subepithelial connective tissue graft associated with apicoectomy and root-end fillings in the treatment of deep localized gingival recession with apex root exposure: case report. Int J Periodontics Restorative Dent. 2009;29:445–449.
- Kan JYK, Rungcharassaeng K. Immediate placement and pro-visionalization of maxillary anterior single implants: A surgical and prosthetic rationale. Pract Periodont Aesthet Dent 2000;12(9):817-824.
- Khairnar, M.S., Khairnar, D. and Bakshi, K. (2014). Modified ridge splitting and bone expansion osteotomy for placement of dental implant in esthetic zone. Contemporary Clinical Dentistry, 5(1), pp.110–114.
- Kleinheinz J, Buchter A, KruseLosler B, et al. Incision design in implant dentistry based on vascularization of the mucosa. Clin Oral Implants Res. 2005; 16:518–523.
- Klinge B, Meyle J. Soft-tissue integration of implants. Con- sensus report of Working Group 2. Clin Oral Implants Res 2006: 17: 93–96.

L

- Lacci KM, Dardik A. Platelet-rich plasma: support for its use in wound healing. Yale J Biol Med. 2010;83(1):1.

- Lacerda SA, Lanzoni JF, Bombonato-Prado KF, Campos AA, Prata CA, Brentegani LG.Osteogenic potential of autogenous bone associated with bone marrow osteoblastic cells in bony defects: a histomorphometric study. Implant Dent. 2009;18:521–529.
- Lang NP, Berglundh T, on Behalf of Working Group 4 of the Seventh European Workshop on Periodontology. Periim- plant diseases: where are we now? – Consensus of the Seventh European Workshop on Periodontology. J Clin Periodontol 2011: 38 (Suppl. 11): 178–181.
- Le B, Burstein J, Sedghizadeh PP.Cortical tenting grafting technique in the severely atrophic alveolar ridge for implant site preparation. Implant Dent. 2008;17:40–50.
- Lekholm U, Wannfors K, Isaksson S, et al. Oral implants in combination with bone grafts. A 3-year retrospective multicenter study using the Bra˚nemark implant system. Int J Oral Maxillofac Surg 1999;28(3):181–7.
- Levin L, Nitzan D, Schwartz-Arad D.Success of dental implants placed in intraoral block bone grafts. J Periodontol. 2007;78:18–21.
- Linkevicius, T., Apse, P., Grybauskas, S. & Puisys A. (2009) The influence of soft tissue thickness on crestal bone changes around implants: a 1-year prospective controlled clinical trial. The International Journal Oral & Maxillofacial Implants 24: 712-719.
- Listgarten MA, Lang NP, Schroeder HE, Schroeder A. Peri- odontal tissues and their counterparts around endosseous implants. Clin Oral Implants Res 1991: 21: 1–19.

M

- M.A. Pogrel, in Current Therapy In Oral and Maxillofacial Surgery, 2012.
- Mansour, H.H., Badr, A., Osman, A.H. and Atef, M. (2018). Anterior maxillary sandwich osteotomy technique with simultaneous implant placement: A novel approach for management of vertical deficiency. Clinical Implant Dentistry and Related Research, 21(1), pp.160–168.
- Marcantonio, C., Nícoli, L.G., Pigossi, S.C., Araújo, R.F. de S.B., Boeck, E.M. and Junior, E.M. (2019). Use of alveolar distraction osteogenesis for anterior maxillary defect reconstruction. Journal of Indian Society of Periodontology, 23(4), pp.381– 386.
- McAllister BS, Haghighat K. Bone augmentation techniques. J Periodontol. 2007;78(3):377-396.

- McAllister, B.S. and Haghighat, K. (2007). Bone Augmentation Techniques. Journal of Periodontology, 78(3), pp.377–396.
- Mehta S, Watson JT. Platelet rich concentrate: basic science and current clinical applications. J Orthop Trauma. 2008;22(6):432-438.
- Meijer HJA, Stellingsma K, Meijndert L, Raghoebar GM. A new index for rating aesthetics of implant-supported single crowns and adjacent soft tissues—the Implant Crown Aesthetic Index: a pilot study on validation of a new index. Clinical Oral Implants Research. 2005;16(6):645–649.
- Meijndert L, Meijer HJA, Stellingsma K, Stegenga B, Raghoebar GM. Evaluation of aesthetics of implant-supported single-tooth replacements using different bone augmentation procedures: a prospective randomized clinical study. Clinical Oral Implants Research. 2007;18(6):715–719.
- Michael S. Block DMD, in Color Atlas of Dental Implant Surgery (Fourth Edition), 2015.
- Miller PD, Jr. Root coverage with the free gingival graft. Factors associated with incomplete coverage. J Periodontol. 1987;58:674- 681.
- Moergel, M., Rocha, S., Messias, A., Nicolau, P., Guerra, F., & Wagner, W. (2016). Radiographic evaluation of conical tapered platform-switched implants in the posterior mandible: 1-year results of a two-center prospective study. Clinical Oral Implants Research,. 27(6), pp.686-693.
- Molly L, Quirynen M, Michiels K, van Steenberghe D. Comparison between jaw bone augmentation by means of a stiff occlusive titanium membrane or an autologous hip graft: a retrospective clinical assessment. Clin Oral Implants Res. 2006;17:481–7. doi: 10.1111/j.1600-0501.2006.01286.x.

N

- Nabers JM. Free gingival grafts. Periodontics. 1966; 4:243-245.
- Nemcovsky CE, Artzi Z.Comparative study of buccal dehiscence defects in immediate, delayed, and late maxillary implant placement with collagen membranes: clinical healing between placement and second-stage surgery. J Periodontol. 2002;73:754–761.
- Newman, Michael G., et al. Carranza's clinical periodontology. Elsevier health sciences, 13th edition, 2019.

O

- Oh SL, Masri RM, Williams DA, Ji C, Romberg E. Free gingi- val grafts for implants exhibiting lack of keratinized mucosa: a prospective controlled randomized clinical study. J Clin Periodontol. 2017;44:195-203.
- Oh, T.-J., Yoon, J., Misch, C. E., & Wang, H.-L. (2002). The Causes of Early Implant Bone Loss: Myth or Science? Journal of Periodontology, 73(3), 322–333.
- Oncü E, Bayram B, Kantarci A, Gülsever S, Alaaddinoğlu EE. Positive effect of platelet rich fibrin on osseointegration. Med Ora Patol Oral Cir Bucal. 2016;21(5):e601.

P

- Park JC, Kim CS, Choi SH, et al. Flap extension attained by vertical and periosteal-releasing incisions: A prospective cohort study. Clin Oral Implants Res. 2012; 23:993–998.
- Park YJ, Choi GH, Jang JR, Jung SG, Han MS, Yu MG, et al. The effect of new bone formation of onlay bone graft using various graft materials with a titanium cap on the rabbit calvarium. J Korean Assoc Maxillofac Plast Reconstr Surg. 2009;31:469–77.
- Park, S.-H., & Wang, H.-L. (2012). Pouch roll technique for implant soft tissue augmentation: a variation of the modified roll technique. The International Journal of Periodontics & Restorative Dentistry, 32(3), pp.e116-21.

Q

- Qian J, Wennerberg A, Albrektsson T. Reasons for marginal bone loss around oral implants. Clin Implant Dent Relat Res 2012: 14: 792–807.
- Raes F, Cosyn J, Crommelinck E, Coessens P, De Bruyn H. Immediate and conventional single implant treatment in the anterior maxilla: 1-Year results of a case series on hard and soft tissue response and aesthetics. Journal of Clinical Periodontology. 2011;38(4):385–394.

R

- Raigrodski AJ, Block MS.Clinical considerations for enhancing the success of implant-supported restorations in the aesthetic zone with delayed implant placement. Pract Proced Aesthet Dent. 2002;14:21–28.

- Randolph R. Resnik, Carl E. Misch, in Misch's Avoiding Complications in Oral Implantology, 2018.
- Randolph R. Resnik, in Misch's Avoiding Complications in Oral Implantology, 2018
- Randolph R. Resnik, in Misch's Avoiding Complications in Oral Implantology, 2018.
- Rasperini G, Acunzo R, Pellegrini G, et al. Predictor factors for long-term outcomes stability of coronally advanced flap with or without connective tissue graft in the treatment of single maxillary gingival recessions: 9 years results of a randomized controlled clin- ical trial. J Clin Periodontol. 2018;45:1107-1117.
- Restoy-Lozano A, Dominguez-Mompell JL, Infante-Cossio P, Lara-Chao J, Espin-Galvez F, Lopez-Pizarro V. Reconstruction of mandibular vertical defects for dental implants with autogenous bone block grafts using a tunnel approach: clinical study of 50 cases. Int J Oral Maxillofac Surg. 2015;44:1416–22. doi: 10.1016/j.ijom.2015.05.019.
- Roccuzzo M, Gaudioso L, Bunino M, Dalmasso P. Surgical treatment of buccal soft tissue recessions around single implants: 1-year results from a prospective pilot study. Clin Oral Implants Res 2014; 25:641-646.
- Roccuzzo M, Grasso G, Dalmasso P. Keratinized mucosa around implants in partially edentulous posterior mandible: 10-year results of a prospective comparative study. Clin Oral Implants Res. 2016;27:491-496.
- Roccuzzo M, Ramieri G, Bunino M, Berrone S. Autogenous bone graft alone or associated with titanium mesh for vertical alveolar ridge augmentation: a controlled clinical trial. Clin Oral Implants Res. 2007;18:286–94. doi: 10.1111/j.1600-0501.2006.01301.x.
- Roos-Jansåker AM, Franke-Stenport V, Renvert S, Albrektsson T, Claffey N. Dog model for study of supracrestal bone apposition around partially inserted implants. Clin Oral Implants Res. 2002;13:455–9. doi: 10.1034/j.1600-0501.2002.130502.x.

S

- Sahin S, Cehreli MC. The significance of passive framework fit in implant prosthodontics: current status. Implant Dent 2001;10:85-92.

- Schliephake H, van den Berghe P, Neukam FW. Osseointegration of titanium fixtures in onlay grafting procedures with autogenous bone and hydroxylapatite. An experimental histometric study. Clin Oral Implants Res. 1991;2:56–61. doi: 10.1034/j.1600-0501.1991.020202.x.
- Schmid J, Hämmerle CH, Stich H, Lang NP. Supraplant, a novel implant system based on the principle of guided bone generation. A preliminary study in the rabbit. Clin Oral Implants Res. 1991;2:199–202. doi: 10.1034/j.1600-0501.1991.020407.x.
- Schmitt A, Zarb GA. The longitudinal clinical effectiveness of osseointegrated dental implants for single-tooth replacement. Int J Prosthodont 1993;6(2):197–202.
- Schoenbaum TR, Swift EJ Jr. Abutment emergence contours for single-unit implants. J Esthet Restor Dent. 2015; 27:1-3.
- Schroeder HE. The Periodontium. Berlin: Springer-Verlag; 1986.
- Schwartz-Arad D, Levin L, Sigal L. Surgical success of intraoral autogenous block onlay bone grafting for alveolar ridge augmentation. Implant Dent. 2005;14:131–138.
- Shamsan, Y. A., Eldibany, R. M., El Halawani, G. N., & Fahmy, R. A. (2018). Flapless versus conventional flap approch for dental implant placement in the maxillary esthetic zone. Alexandria Dental Journal, 43(2), 80–85.
- Simion M, Dahlin C, Rocchietta I, Stavropoulos A, Sanchez R, Karring T. Vertical ridge augmentation with guided bone regeneration in association with dental implants: an experimental study in dogs. Clin Oral Implants Res. 2007;18:86–94. doi: 10.1111/j.1600-0501.2006.01291.x.
- Simion M, Fontana F, Rasperini G, Maiorana C. Vertical ridge augmentation by expanded-polytetrafluoroethylene membrane and a combination of intraoral autogenous bone graft and deproteinized anorganic bovine bone (Bio Oss) Clin Oral Implants Res. 2007;18:620–9. doi: 10.1111/j.1600-0501.2007.01389.x.
- Spear FM. Maintenance of the interdental papilla following anterior tooth removal. Pract Periodont Aesthet Dent 1999;11(1):21-28.
- Spear FM. Maintenance of the interdental papilla following anterior tooth removal. Pract Periodont Aesthet Dent 1999;11(1): 21-28.
- Spear FM. Maintenance of the interdental papilla following anterior tooth removal. Pract Periodont Aesthet Dent 1999;11(1): 21-28.

- Spinato, S., Bernardello, F., Sassatelli, P. & Zaffe, D. (2017a) Hybrid Implants in Healthy and Periodontally Compromised Patients: A Preliminary Clinical and Radiographic Study. International Journal of Periodontics and Restorative Dentistry 37: 195-202.
- Stanford JW. Acceptance Program for Endosseous Implants: A service of ADA Membership. Int J Oral Maxillofac Implant 1991; 6:15-18.
- Stenport VF, Roos-Jansåker AM, Renvert S, Kuboki Y, Irwin C, Albrektsson T, et al. Failure to induce supracrestal bone growth between and around partially inserted titanium implants using bone morphogenetic protein (BMP): an experimental study in dogs. Clin Oral Implants Res. 2003;14:219–25. doi: 10.1034/j.1600-0501.2003.00861.x.
- Stuart E. Lieblich, Scott T. Claiborne, in Head, Neck, and Orofacial Infections, 2016.

T

- Tarnow DP, Magner AW, Fletcher P. The effect of the distance from the contact point to the crest of the bone on the presence or absence of the interproximal dental papilla. J Periodontal 1992;63(12):995-996.
- Tarnow DP, Magner AW, Fletcher P. The effect of the distance from the contact point to the crest of the bone on the presence or absence of the interproximal dental papilla. J Periodontal 1992;63(12):995-996.
- Tarnow DP, Magner AW, Fletcher P. The effect of the distance from the contact point to the crest of the bone on the presence or absence of the interproximal dental papilla. J Periodontal 1992;63(12):995-996.
- Tavelli L, Barootchi S, Cairo F, Rasperini G, Shedden K, Wang HL. The effect of time on root coverage outcomes: a net- work meta-analysis. J Dent Res. 2019.
- Touati B, Guez G, Saadoun A. Aesthetic soft tissue integration and optimized emergence profile: Provisionalization and cus- tomized impression coping. Pract Periodont Aesthet Dent 1999;11(3):305-314.

V

- Vacek, J. S., Gher, M. E., Assad, D. A., Richardson, A. C., & Giambarresi, L. I. (1994). The dimensions of the human dentogingival junction. International Journal of Periodontics & Restorative Dentistry, 14(2).
- van Nimwegen, W. G., Raghoebar, G. M., Zuiderveld, E. G., Jung, R. E., Meijer, H. J. A., & Mühlemann, S. (2018). Immediate placement and provisionalization of implants in the aesthetic zone with or without a connective tissue graft: A 1-year randomized controlled trial and volumetric study. Clinical Oral Implants Research, 29(7), 671–678.

W

- Waasdorp J, Reynolds MA. Allogeneic bone onlay grafts for alveolar ridge augmentation: a systematic review. Int J Oral Maxillofac Implants. 2010;25:525–31.
- Weiss CM. A comparative analysis of fibro-osteal and osteal integration and other variables that affect long term bone maintenance around dental implants. / Oral Implant 1987; 13:169-214.
- Wessel JR, Tatakis DN. Patient outcomes following subepithelial connective tissue graft and free gingival graft procedures. J Peri- odontol. 2008;79:425-430.
- Wiesner, G., Esposito, M., Worthington, H., & Schlee, M. (2010). Connective tissue grafts for thickening peri-implant tissues at implant placement. One-year results from an explanatory split-mouth randomised controlled clinical trial. European Journal of Oral Implantology, 3(1), pp.27-35.

Y

- Yildiz MS, Gunpinar S. Free gingival graft adjunct with low- level laser therapy: a randomized placebo-controlled parallel group study. Clin Oral Investig. 2019;23:1845-1854.
- Zadeh HH. Minimally invasive treatment of maxillary anterior gingival recession defects by vestibular incision subperiosteal tunnel access and plateletderived growth factor BB. Int J Periodontics Restorative Dent. 2011; 31:653–660.

Z

- Zahrani AA.Augmentation in two stages of atrophic alveolar bone prior to dental rehabilitation: a case report. J Contemp Dent Pract. 2007;8:57–63.
- Zamzok J. Avoiding ridge laps through nonsurgical soft tissue sculpting on implant restorations. J Esthet Dent. 1996:8(5):222-8.
- Zucchelli G, Felice P, Mazzotti C, et al. 5-year outcomes after coverage of soft tissue dehiscence around single implants: a prospective cohort study. Eur J Oral Implantol. 2018;11:215- 224.
- Zucchelli G, Mele M, Stefanini M, et al. Patient morbidity and root coverage outcome after subepithelial connective tissue and de- epithelialized grafts: a comparative randomized-controlled clinical trial. J Clin Periodontol. 2010;37:728-738.
- Zucchelli G, Mounssif I. Periodontal plastic surgery. Periodontol 2000. 2015;68:333-368.
- Zucchelli G, Tavelli L, Barootchi S, et al. The influence of tooth location on the outcomes of multiple adjacent gingival recessions treated with coronally advanced flap: a multicenter re-analysis study. J Periodontol. 2019.
- ZuhrO,BaumerD,HurzelerM.The addition of soft tissue replacement grafts in plastic periodontal and implant surgery: critical elements in design and execution. J Clin Periodontal. 2014;41(Suppl 15):S123-S142.