شبكة المعلومات الجامعية

التوثيق الإلكتروني والميكروفيلم

بسم الله الرحمن الرحيم

HANAA ALY

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جامعة عين شمس

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قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار

HANAA ALY

Review of Literature

Teeth loss is a major concern today. Caries and periodontal disease are the two main reasons for tooth loss leading to different consequences affecting many aspects as mastication, vertical dimension loss, general health, life quality, aesthetic concerns, and self-esteem ***(Emami et al., 2013; Nuvvula and Chava, 2016).***

Different treatment options are available for partially edentulous patients with missing single or multiple teeth including a removable prosthesis, fixed partial denture, or implants. Implant replacement therapy showed great success as it provides a lot of benefits over conventional treatment options providing optimal esthetic results that improve the quality of life of the patient ***(Jivraj et al., 2006; D'Souza et al., 2011; Suprakash et al., 2013).***

Implant success has been assessed by survival rate, prosthetic outcome, perimplant soft tissue, esthetic outcome, radiographic bone stability, absence of infection, and patient satisfaction. Successful implant requires correct implant placement in the dental arch which is achieved by prosthetically driven implant placement. This technique directs the occlusal force correctly to decrease marginal bone loss, avoid biomechanical complications, and achieve good esthetics outcomes. Prosthetically driven implant placement allows for optimal support and stability of the implant ***(Buser et al., 2004; Papaspyridakos et al., 2012; Fu et al., 2012).***

Correct implant placement should be: in the Bucco-palatal position, 2mm of bone thickness should lie buccal to the implant platform in the anterior region, and 1mm of bone thickness in the posterior region. In the mesiodistal direction; 1.5mm should exist between implant and roots, and 3 mm between neighboring implants, however, more space may be needed for creating emergence profile of the restoration. Maintaining the rules during implant placement, preserve bone support and the interdental papilla for good esthetics**.** In the apico-coronal position; implant platform is placed 3 to 4 mm apical to adjacent CEJ in the anterior zone to achieve esthetics emergence profile. In the posterior region, implant platform is placed 2 mm apical to the adjacent CEJ ***(Tarnow et al., 2000; Botticelli et al., 2004; Zetu et al., 2005; Grunder et al., 2005).***

Planning for three-dimensional implant position depends on defining the comfort and danger zone during implant position. Implant shoulder should be positioned in the comfort zone to avoid esthetics and biological shortcoming. ***The*** Comfort zone starts from imaginary line highlighted from the point of emergence of the adjacent teeth and extends palatal 2mm. Implant should be placed within this area for proper emergence profile ***(Buser et al 2004).***

The goals of the treatment plan are to achieve an esthetic, functional, and long-lasting outcome that matches the patient's expectations and needs. First step is establishing adequate and realistic treatment plan. Systemic diagnostic steps should be followed to reach successful implant treatment in a correct prosthetic position and to avoid complications. Correct diagnosis includes; patient's chief complaint, patient medical history, extraoral and intraoral examination, and radiographic examination ***(Zitzmann et al., 2008).***

The patient's chief complaint and treatment goals should be addressed on realistic endpoints, described to the patient, and the expected outcomes should be clarified before starting the treatment. Systemic diseases such as uncontrolled diabetes, rheumatoid arthritis, osteomalacia, or developmental bone disorders may affect oral tissues by increasing their susceptibility to other diseases or by interfering with wound healing. Medical questionnaire to review past and present diseases, and medication can be useful ***(Zitzmann et al., 2005; Mombelli et al., 2006).***

Risk assessment should be the key part of the individual treatment plan. The main goal is to identify variables that increase the risk factors for implant loss. Patient-related risk factors include smoking, alcohol, periodontal disease, diabetes, medication, radiotherapy, and parafunctional habits are taken in count ***(Chrcanovic et al., 2016).***

Smoking increases implant failure rate as it affects osteogenesis and angiogenesis. Nicotine decreases osteoblast proliferation, differentiation, and apoptosis leading to an apparent effect on one remodeling, and maturation. Smoking changes the equilibrium between microbial load on implants and the human host response and decreases the longevity of implant ***(MaL et al., 2010; Trisi et al., 2013; Chrcanovic et al., 2016).***

Diabetes is a relative contraindication for implant therapy. Poor controlled glycaemic patient is not suitable for implant therapy. Tissue hyperglycemia affects the immune system and wound healing which leads to greater risk of wound infection. Hyperglycaemia has a negative effect on bone formation and remodeling causing reduction of bone-implant contact (BIC) leading to implant failure ***(Michaeli et al., 2009; Oates et al., 2013).***

Oral hygiene is a main issue for implant survival. Patients with good or medium oral hygiene showed higher implant survival rate. Bruxism and parafunctional habits increase implant failure rate due to increase of micromotion on implants beyond the critical level resulting in fibrous encapsulation around the implant. Aging may affect wound healing to be slower in elders, jawbone density and osseous healing capacity may also be compromised in elderly persons, however, healthy elder patients have the same prognosis as young patients ***(Glauser et al., 2001; Kourtis et al., 2005; Gosain et al., 2004).***

Extraoral examination evaluates the correct facial proportions, facial symmetry, parallelism of pupillary line, smile line and occlusal plane, lip and cheek support in case of the removable prosthesis, occlusal vertical dimension, skeletal classification, maxillary central incisors edge position, and temporomandibular joint examination ***(Zitzmann et al., 2008).***

Intraoral examination includes existing dentition, condition of restoration, decay, periodontal examination, teeth malposition, occlusal state, and parafunctional habits. Moreover, the edentulous region is examined for ridge deficiency and how to compensate for it with soft tissue or hard tissue, next soft tissue phenotype and the contour of the underlying bone ***(Henry et al., 2002; Rathee et al., 2015).***

Thick periodontal flat phenotype is advantageous around the dental implant as it is more stable and resistant to recession than thin scalloped. Absence of adequate keratinized mucosa around implants is associated with higher plaque accumulation, gingival inflammation, bleeding on probing, and mucosal recession ***(Linkevicius et al., 2008)***.

Radiographic imaging has a great value in implant as a diagnostic aid. Radiographs have been utilized to identify the location of vital anatomical structures such as the inferior alveolar nerve and maxillary sinus, bone quantity, dimensions, and angulation of alveolar process, and to detect any possible pathological conditions, and choose ideal length, width, and the number of implants, the location and orientation, and the possible need for additional procedure before implant placement, and to estimate the prognosis ***(Jayadevappa et al., 2010).***

Different diagnostic imaging modalities are available. Computed tomography (CT) was invented by Sir Godfrey Hounsfield and was introduced in 1972. This modality gives rise to high-density resolution images and allows soft tissues to be visualized. Narrow x-ray beam used to acquire multiple axial images of the patient. These images are processed using computer-based process called multiplanar reformatting to generate axial, panoramic, and cross-sectional images that allow rapid correlation of the different views ***(Lindh et al., 1996; Siu et al., 2010).***

CT produces uniform high contrast image with well-defined layers free of blurring that allow easier identification of bone and gives well-formed three-dimensional reconstructed views of implant site in addition to availability of soft tissue. Disadvantages include limited availability of CT scanners, high cost of machines, and high radiation dose ***(Lingeshwar et al., 2010).***

Cone-beam computerized tomography (CBCT) was developed to serve in dentistry specifically. This technique employs a cone-shaped X-ray beam not the flat fan-shaped cone of the conventional CT which needs lower radiation dose. With the help of digital imaging and

communications in medicine (DICOM) data, computer-generated surgical guides, presurgical models, and provisional restoration fabrication is possible. Other advantages of CBCT are; vertical scanning of the patient in seated position unlike CT and high-resolution images. Unfortunately, CBCT has low contrast range, restricted field of view (FOV), reduced scanned volume caused by limited detector size, which gives little information about the inner soft tissue ***(Lingeshwar et al., 2010; Nagarajan, et al., 2014; Bathwarr et al., 2015).***

Tooth extraction and alveolar ridge changes

After tooth extraction, events occur at the following sequence in the healing socket: (1) hemostasis; (2) inflammation; (3) mesenchymal cell differentiation, proliferation, and migration to the wound site; (4) angiogenesis;(5) re-epithelialization over the wound surface (6) collagen synthesis and cross-linking. These events need multiple growth factors and proinflammatory cytokines of transforming growth factor (TGF)-β, platelet-derived growth factor (PDGF), fibroblast growth factor (FGF), and epidermal growth factor (EGF), and inflammatory cells of neutrophils, macrophages, lymphocytes, fibroblasts, and endothelial cells ***(Gosain et al., 2004).***

Thus, the sequence of healing of the alveolar socket involves four main phases: hemostasis, inflammation, proliferation, and maturation. These stages must occur in proper sequence at a specific timing, lasting for optimal time with specific intensity, failure in progress at these stages impair wound healing ***(Mathieu et al., 2006; Menke et al., 2007).***

Generally, the sequence in the healing of an alveolar socket after exodontia is as follows : (1) clot formation; (2) replacement of blood clot by granulation tissue (seventh day); (3) replacement of granulation tissue by connective tissue (twentieth day); (4) appearance of osteoid at the base of the socket (seventh day) and filling of at least two-thirds of socket fundus by trabeculae (thirty-eighth day), and (5) evidence of epithelization (fourth day) ***(Pagni et al., 2012).***

The healing process of the extraction sockets is a dynamic process that leads to alveolar ridge atrophy which continues for the following 12 months leading to 50% reduction of the alveolar ridge width which corresponds to 5 to 7mm loss. This bone loss is evident for both jaws on the buccal aspect more than the palatal or lingual. The resorption of the extraction site occurred in two phases, initially vertical reduction of the buccal crest occurs, followed by "horizontal resorption". The main cause of such bone loss due to bundle bone remodeling and replacement with the woven bone and the fact that resorption starts from the outside inward ***(Lekovic et al., 1997; Schropp et al., 2003; Araújo et al., 2005).***

Elian et al., 2007 provided extraction socket classification depending on horizontal and vertical hard- and soft-tissue loss:

- **Type 1—**Labial bone plate and associated soft tissues are completely intact.

- **Type 2—**Soft tissue is present, but a dehiscence osseous defect exists that is indicative of the partial or complete absence of the labial bone plate.

- **Type 3—**Midfacial recession defect is present, representing the loss of the labial bone plate and soft tissues.

Chu et al., 2015 added further sub-classification of Type 2 was done to describe the condition of the labial plate of bone when the soft tissue is intact:

- Type 2A—absence of the coronal one-third of labial bone plate of the extraction socket 5 mm to 6 mm from the free gingival margin (FGM).

- Type 2B—absence of the middle to coronal two-thirds of the labial bone plate of the extraction socket approximately 7 mm to 9 mm from the free gingival margin (FGM).

- Type 2C—absence of the apical one-third of the labial bone plate of the extraction socket 10 mm or more from the FGM.

To resist post-extraction alveolar ridge changes, different techniques are used such as; flapless extraction, alveolar ridge preservation, or immediate implant placement. Immediate implant provides single surgery, minimal bone loss, preserve soft tissue, better esthetics outcome, and fewer steps till the final prosthesis. Immediate implant placement can reduce the number of required surgical stages and the entire treatment period, and should be performed flapless to avoid mid-facial mucosal recession associated with open flap procedure. Potential disadvantages of immediate implant placement include failure due to associated infection, insufficient soft tissues, gap between an implant surface and the socket bone wall, and complications associated

with barrier membranes and bone grafts used to enhance healing. Moreover, placement of an implant into a fresh extraction socket is a complex surgical procedure that requires a skilled surgeon with experience for implant bed preparation to gain good primary stability and correct implant position ***(Fickl et al., 2008a&b; Rocchietta et al., 2008; Raes et al., 2011; Furhauser et al., 2015).***

Immediate implant placement is associated with gap developed as the implant is placed more palatal. The gap between the implant surface and the socket bony wall should be maintained 2mm to provide a space for bone graft to reduce post resorption**.** In the presence of thick intact bone around the immediate implant, healing occurs by secondary intention without the need for grafting, however in case of thin buccal bone plate of less than 1mm or presence of fenestration gap grafting is recommended to reduce postoperative bone resorption ***(Chen et al., 2007; Tarnow et al., 2011; Morton et al., 2014).***

According to the international team of implantology (ITI) recommendation, immediate implant placement should be performed by experienced clinician when ideal anatomical conditions present which include fully intact facial bone wall, thick wall phenotype (> 1 mm), thick gingival biotype, absence of acute infection in the extraction site and a sufficient bone volume apical and palatal of the extracted root to allow a correct implant positioning with sufficient primary stability. When these ideal conditions are not available, early implant placement or even delayed is recommended ***(Vera et al., 2012; Morton et al., 2014).***

Alveolar ridge preservation

To overcome the disadvantages and limitations of immediate implantation the concept of **alveolar ridge preservation** (ARP) has been introduced. Alveolar ridge preservation stands for any procedure undertaken at the time of tooth extraction to minimize alveolar ridge resorption and maximize bone formation within the socket ***(Darby et al., 2008; Choi et al., 2015).***

Three options of (ARP) are available: use of soft tissue graft, use of hard tissue graft material, or a combination of both techniques. Main goals are to decrease post extraction ridge alteration, promote soft and hard tissue healing, and facilitate placement of implant in correct prosthetically position without the need for further augmentation procedure. The preservation aims to enhance soft tissue quality and quantity. This is done prior to or after tooth extraction using autogenous grafting or soft tissue substitute, or resorbable membrane to enhance closure of soft tissue. Hard tissue preservation includes using bone substitute covered with membrane or by flap advancement to achieve complete or partial wound closure ***(Vignoletti et al., 2012; Horvath et al., 2013; Mardas et al., 2015; Barone et al., 2015)***.

To ensure success of alveolar ridge preservation, atraumatic tooth removal with minimal bone damage, cleaning the socket after extraction, removal of all periapical granulation tissue, socket evaluation after extraction, copious irrigation with sterile saline, ensure good blood supply to the graft, choose the correct graft material, good primary closure, and enough healing time are required ***(Kassim, 2014; Choi et al., 2015).***

Flapless technique preserves soft and hard tissue as it causes less pronounced bone remodeling of the alveolar ridge, preserves the hard tissue dimension, minimizes loss of keratinized mucosa, and preserves the papilla ***(Fickl et al., 2008a; Blanco et al., 2011)***.

Atraumatic extraction is very important to preserve alveolar bone volume and the surrounding soft tissue. Application of appropriate instrument with minimal force is recommended to sever the attachment of the coronal fiber, loosening the tooth until the forceps can gently deliver it. Atraumatic extraction utilizes multiple techniques such as fine luxators or periotome which is used to cut the periodontal ligament (PDL) of the tooth circumferentially before extraction, sectioning the multirooted teeth to facilitate the procedure, piezosurgery, and vertical extraction system ***(Baltee et al., 2001; Darby et al., 2008; Dym et al., 2012; Jiang et al., 2015).***

A powered periotome is an electric unit controls the quantity of force exerted through the periotome tip into the PDL space which provides flapless removal of teeth with minimal or no alveolar bone loss, maintaining the periosteal blood supply to the alveolus, decreasing post-operative pain, and discomfort and preserving bone ***(Levitt et al., 2001).***

Vertical extraction systems have a common feature of screw placed in the root of the tooth. Force transmitted to the screw to extract the tooth, the currently available three systems are Benex, Easy X-TRAC, and Apex Control ***(Saund et al., 2013).***

Piezosurgery produces a modulated ultrasonic micro-vibration amplitude between 60 and 200 mm/s which allows a very clean and precise bone cut. Piezosurgery scalpel tip is very small and selective,

utilized to create space between teeth and bone with maximum protection for hard and soft tissue. Other advantages of piezosurgery include a clearer field of vision by producing a very restricted bloody region, and good control of the device with minimal effort ***(Kotrikova et al., 2006; Sortino et al., 2008).***

Partial extraction therapies (PET) are different alveolar ridge preservation techniques to maintain the hard and soft tissue dimensions after atraumatic tooth extraction for successful final treatment in anterior aesthetic and posterior implant placement**.** (PET) utilize the tooth itself to decrease the loss of alveolar tissue. By retaining the tooth root and its attachment to bone, the bundle bone-periodontal ligament complex with its vascular supply may be maintained. This technique demonstrated success in the preservation of the post-extraction ridge and development of pontic sites**.** At present, the concept of PET as a collective group of treatments includes root submergence, socket-shield, pontic shield, and proximal socket shield. These techniques use tooth that is no longer restorable or that is indicated for extraction, and healthy tooth pulp or endodontic treatment of the tooth root is complete ***(Salama et al., 2007; Avila et al., 2014; Gluckman et al., 2016).***

Alveolar ridge preservation can be performed via socket grafting using different biomaterials (e.g., bone particles, collagen sponge, or autologous blood-derived products) and the application of barrier material to protect the underlying bone compartment, which is commonly termed as socket sealing ***(Horvath et al., 2013; Stumbars et al., 2019).***