شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكروفيلم

بسم الله الرحمن الرحيم

HANAA ALY

شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكروفيلم

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

HANAA ALY

شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكروفيلم

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

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

Extraction is indicated generally when a tooth cannot be restored or maintained in acceptable conditions for long-term health, esthetics or function. Tooth loss has a direct impact on quality of life by impairing the ability to speak, masticate and, in some instances, socialize **(Gerritsen et al., 2010).**

One of the restorative techniques practiced today successfully for the replacement of missing teeth is dental implants **(Solderer et al., 2019; Mously et al., 2020; Machuca et al., 2020; Roy et al., 2020; Vasamsetty et al., 2020).**

The success of dental implant depends on several factors including periodontal health, age, bone quality and quantity, occlusion, smoking, genetics, systemic diseases, microorganisms, antibiotics, implant stability, type of implants and periodontal phenotype **(Branemark et al., 1985; Van Steenberghe et al., 1990; Tonetti and Schmid, 1994; Beer et al., 2003; Raikar et al., 2017; Yazdani et al., 2018).**

Periodontal health is a factor to be taken into consideration during implant planning. It is important to control periodontal condition before placement of the implant. There is a high risk for peri-implantitis and implant failure when the patients have periodontal diseases. In addition, professional maintenance and meticulous oral hygiene became important prerequisites for successful dental implants **(Hardt et al., 2002; Santoro et al., 2007).**

Systemic diseases may interfere with the healing of the implant. In addition, systemic conditions may be treated with medications or other therapy that tend to affect implants and the tissues carrying them**.** Therefore, it is also important to screen risk factors like uncontrolled medical conditions, radiation therapy, prolonged use of bisphosphonates, corticosteroids and smoking habits **(Chen et al., 2013; Levine et al., 2014).**

Until the 1990s several general diseases were considered as strict contraindications for implant placement such as diabetes, hyperthyroidism, hypertension, ischemic heart disease, osteoporosis, and hemorrhagic diathesis. Today, these conditions indicate implant treatment under medical supervision and particular precautions should be considered such as antibiotic prophylaxis, calcium substitution, or substitution of coagulation factors as prerequisites for successful implants in these cases **(Marder, 2004; Scully et al., 2007).**

Occlusal forces affect the bone surrounding a dental implant. According to **Frost in 2004,** mechanical overload can have a negative impact on surrounding bone tissue and also on the osseointegration of dental implants. The occlusal forces when exceeding the mechanical or biological load-bearing capacity of the osseointegrated implants, cause a mechanical failure of the dental implant **(Frost, 1994; Frost, 2004; Isidor, 2006).**

Implant stability plays a critical role in successful osseointegration, which is defined as the direct structural and functional connection between bone and the surface of a load-carrying dental implant. Achieving and maintaining this implant stability is a prerequisite for a successful clinical outcome. Implant stability is measured at two different stages, primary and secondary. Primary stability comes from mechanical engagement of the implant with bone while, secondary stability refers to bone formation and remodeling around the implant **(Gapski et al., 2003; Lioubavina-Hack et al., 2006; Sennerby and Roos, 2008).**

There are different methods, both invasive and non-invasive used for measuring implant stability. Tensional test, push-out/pull-out test, removal torque test, radiographic and computed tomography. However, due to invasive and problem in accuracy, these methods are no longer used today hence are limited to animal studies. Percussion test, cutting torque test, periotest and resonance frequency analysis (RFA) being noninvasive are used in the clinical scenario **(Brunski, 2006; Atsumi et al., 2007; Gupta and Padmanabhan, 2011; Oh and Kim, 2012).**

Meredith et al in **1996** reported the use of RFA to evaluate implant stability and proved in vitro the ability of the device in evaluating the stiffness change of the surface. Currently, there is two RFA device in clinical use, Osstell (Integration Diagnostics) and Implomates (Biotech One). The first commercial product of the RFA, the first generation was Osstell™ introduced in 2001 which was followed by second generation Osstell™ Mentor in 2004 and recently in 2009 Osstell™. The first generation Osstell uses electronic technology and other devices (Osstell™ Mentor, Osstell™ ISQ) use magnetic technology **(Meredith et al., 1996; Dario et al., 2002; Valderrama et al., 2007; Park et al., 2011).** The resonance frequency analysis (RFA) provides an assessment of implant mechanical stability expressed as the implant stability quotient (ISQ).

Age is another factor that should be taken into consideration. Implant placement should be delayed after the age of 18 due to the growth of the jaw, particularly in women. Evidence to date suggests that the osseointegration of implant is unaffected by age. But in elderly persons, the wound healing may be slower and jawbone density and osseous healing capacity may also be compromised, which could put their osseointegration response in some jeopardy. Furthermore, aging tends to be associated with increased osteoporosis or arthritis, and with medical treatments, such as bisphosphonate, corticosteroid or radiation therapy, which can alter bone physiology and could modify the potential for osseointegration **(Bryant and Zarb, 2003; Engfors et al., 2004; Jemt et al., 2007).**

During treatment planning for dental implants, a prosthetic-driven concept has been recommended which is placing dental implants in surgical positions that will result in optimal implant restoration. This means that the desired final restoration should be first planned and used as a guide for three-dimension (3-D) positioning of the supporting dental implant fixtures. Implant site development (both hard and soft tissue) and regenerative procedures should be considered to allow the correct positioning of the implants **(Funato et al., 2007; Ishikawa et al., 2010; Singh et al., 2013; Levine et al., 2014).**

Available bone describes the amount of bone in the edentulous area considered for implantation. It has to be present to position dental implants in the correct position in three dimensions, mesiodistal, bucco-palatal and apico-coronal dimension. As general guidelines, a dental implant has to be positioned: a minimum of 1.5 mm distance between adjacent roots of natural teeth and dental implants, a minimum of 3 mm between adjacent dental implants, 2 mm from the midfacial gingival margin of the planned restoration and 1 mm palatal to an imaginary line at the point of emergence profile of adjacent teeth to the implant site. Placement of dental implants more than 2 mm palatal to this line can result in a potential ridge lap restoration with impeded oral hygiene. The goal is to stay within the advised distance to prevent problems with potential bone loss, restorations that are too long, and failure to develop complete papilla inter-proximally **(Buser et al., 2004).**

❖ Classification of alveolar bone

There are different classification systems for the alveolar bone reported in the literature. According to morphology, radiographic density obtained through computed tomography, and clinician tactile analysis. **Misch and Judy, 1987** classify alveolar bone to:

D1 represents a homogenous, dense cortical bone, mostly found in anterior mandibles with moderate bone resorption (radiographic density >1250 House field unit (HU)), **D2** is a combination of dense-to-porous cortical bone on the crest and trabecular bone from 40% to 60% on the inside (850–1250 HU), **D3** is composed of thinner porous cortical bone on the crest and fine trabecular bone within the ridge (350–850 HU), **D4** has the least trabecular density with little or no cortical crestal bone (150–350 HU) and **D5** (<150 HU).

In implant treatment, to get optimal esthetic results, the following criteria are needed, (1) adequate bone quantity, (2) optimal implant location and angulation, (3) proper soft tissue forms, (4) stable and sound peri-implant soft tissue and (5) perfect emergence profile **(Jovanovic, 2007).**

Different radiographic imaging techniques have been used to determine the feasibility of implant placement and post-treatment evaluation of hard tissues surrounding implants **(Truhlar et al., 1993; Frederiksen, 1995)**.

In the last decade, CT scans (Computed Tomography) have become one of the most frequently used imaging techniques for preoperative evaluation of the jaws before implant treatment and postoperative assessment of the implant. The first commercially developed program was DentaScan (General Electric, Milwaukee, Wis).

CT scan is the most accurate imaging technique in evaluating recipient sites and locating vital structures such as the maxillary sinus and the mandibular canal. The biological effects and the dose of radiation delivered during CT examinations for implant patient assessment have been investigated. The risk associated with CT is assumed to be low **(Rothman et al., 1988; Lindh and Petersson, 1989; Clark et al., 1990; Lindh et al., 1992; Ekestubbe et al., 1993; Sonick et al., 1994; Scaf et al., 1997).**

The application of cross-sectional imaging using cone-beam computed tomography (CBCT) in dental implants has rapidly grown as a popular tool, enhanced by continued scientific and technological advances**.** CBCT has been positioned as the best choice for cross-sectional imaging as an application that certainly has tangible implications for implant therapy **(Bornstein et al., 2014; Bornstein et al., 2017)**.

CBCT technology is a radiographic tool that has many advantages as increased accuracy, higher resolution, lower radiation dose, and reduced cost for patients compared with other volumetric imaging modalities for the assessment of mineralized tissues **(Pauwels., 2015).**

Series studies compare the image performance between CT and CBCT for dental use. They concluded that, in terms of image quality, reproducibility, and validity, the CBCT produced superior images to the helical CT, with approximately 400-fold less radiation exposure in the dental radiology field but as regards contrast resolution, CBCT can only demonstrate limited contrast resolution, mainly due to relatively high scatter radiation during image acquisition and inherent flat panel detector related artifacts **(Hashimoto et al., 2007; White and Pharoah, 2009).**

The available literature supports and validates the accuracy of CBCT for the evaluation of the following parameters, 1) linear measurements of the available ridge height, width, and relative bone quality; 2) characterization of vital anatomic structures relevant to the implant site; 3) assessment of 3D surface alveolar ridge topography; and 4) recognition of various pathology**.** Moreover, CBCT provides digital information which facilitates communication among the implant team members regarding the diagnosis, treatment plan and the fabrication of CBCT-derived implant surgical guides **(Rios et al., 2017)**.

The soft tissue phenotype is considered one of the important key factors in implant aesthetics and preventing future gingival recession. **Ochsenbein and Ross** in **1969** indicated that there are two main types of gingival morphology, namely the scalloped and thin or flat and thick gingiva. Furthermore, **Seibert and Lindhe** in **1989** divided the gingiva into "thick flat" and "thin scalloped" biotypes. The gingival biotype has been used to describe the thickness of the gingiva in the faciopalatal dimension which is a genetically determined trait **(Ochsenbein and Ross, 1969; Seibert and Lindhe, 1989; Evans and Chen, 2008; Kao et al., 2008; Kan et al., 2009).**

Egreja et al in **2012,** defined the thick biotype when the gingival thickness was >1mm and the thin biotype when the gingival thickness was ≤1 mm**. The World Workshop** in **2017,** on the Classification of Periodontal and Peri-Implant Disease and Conditions, has recommended the adoption of the term "periodontal phenotype" Periodontal phenotype is determined by gingival phenotype (gingival thickness and keratinized tissue width) and bone morphotype (thickness of the buccal bone plate).

Conversion of thin biotype to thick biotype is essential for maintaining oral hygiene around dental implants and improving immediate implant success as well as essential to prevent gingival inflammation, aesthetic failures as metal showing through the gingival tissue, soft tissue recession, loss of marginal bone around the implant, and loss of interdental papilla **(Evans and Chen, 2008; Romeo et al., 2008; Lee et al., 2011; Levine et al., 2014; Bazzetti et al., 2017).**

The first endosteal titanium implant was placed successfully by **Brånemark** in **1965**. During the 1980s, Brånemark introduced the classical protocol for implant placement and the guidelines included waiting 5 - 6 months of healing time after extraction before the implant was placed into the alveolar ridge. The conventional protocol was established based on that only complete healing of hard and soft tissue would guarantee a favorable osseointegration **(Ebenezer et al., 2015; Blanco et al., 2019; Bassir et al., 2019)**. However, due to the preservation of esthetics, the maintenance of the alveolar walls and a reduction in the time of treatment, it is sometimes advisable to place the implant immediately after extraction, without waiting for complete healing **(Lazzara, 1989; Vanden Bogaerde et al. 2005).**

Depending on the timing of implant placement, tooth replacement with a dental implant can be performed via four approaches**:**

- **Immediate implant placement**, when the implant is placed directly after the extraction
- **Early implant placement**, the implant is placed 1 - 2 months after the extraction

- **Delayed implant placement**, the implant is placed 3 - 4 months after the extraction
- **Late implant placement**, when the implant is placed more than 4 months after the tooth extraction **(Canellas et al., 2019)**.

In 1989, Lazzara first reported immediate implant placement in an extraction socket in humans. Since then, this protocol has received much attention in the literature. The immediate implant was defined by **Gomez-Roman et al** in **1997** as an implant placed between 0 and 7 days of extraction. While **Schropp et al** in **2003** defined immediate implantation as implants placed between 3- and 15-days following tooth extraction.

Barzilay et al in **1991**, suggested that immediate implant placement potentially reduces the extent of alveolar ridge resorption after tooth extraction. It was also demonstrated that substantially less ridge remodeling was induced in the immediate implant group and that histologically bone to implant contact was similar within the different anatomic regions of the oral cavity **(Barzilay et al., 1991; Barzilay et al., 1996).**

Other authors reported that the placement of an implant in the fresh extraction site failed to prevent the remodeling that occurred in the walls of the socket. The height of the buccal and lingual walls at 3 months was similar compared to natural healing without intervention and vertical bone loss was more pronounced at the buccal aspect **(Botticelli et al., 2004; Araujo et al., 2005; Botticelli et al., 2006).**

However, immediate implant placement does not always provide optimal clinical outcomes and has been documented that this surgical protocol does not prevent post extraction horizontal and vertical bone resorption process and may lead to unpredictable aesthetics result and significant risk of marginal soft tissues recessions, especially if treating the buccal side of maxillary sites in patients with a high smile line **(Cosyn et al., 2012; Chen and Buser, 2014**; **Vignoletti and Sanz, 2014; Discepoli et al., 2015; Tonetti et al.,2017).**

There are different prognostic factors for predictable single tooth peri-implant esthetics when immediately placing implants in extraction sockets such as tooth position relative to the free gingival margin (FGM), form and biotype of the periodontium, tooth shape, and position of the osseous crest before tooth extraction **(Kois, 2004).**

For predictable immediate implant placement, a sufficient amount of crest ridge with a width of 4 to 5 mm and a height of 10 mm or more are minimal requirements. The height is necessary for a stable implant and maintaining a safe distance from vital anatomical structures (maxillary sinus, mandibular canal or nasal floor). A distance of 5 mm from the alveolar crest to the future prosthesis contact point can ensure the appearance of dental implant papillae. In regards to the immediate approach, the ideal extraction socket would present little or no periodontal bone loss **(Tarnow et al., 2003).**

Immediate post-extraction implant placement offers advantages such as, reduced number of surgical interventions and shortening of the treatment procedure, ultimately leading to increased patient satisfaction and psychological benefit for patients by replacing a tooth loss with an implant simultaneously, optimal soft tissue aesthetics due to the preservation of soft tissue envelope, idealize the position of the implant appropriately with the better rehabilitation of normal contour to the facial aspect of the final restoration, and reduce the alveolar bone resorption process **(Agliardi et al., 2010; Ebenezer et al., 2015; Tonetti et al.,**

2017; Waasdorp., 2018; Liu et al., 2019).

Despite the benefits of immediate placement of a dental implant, it is accompanied by some drawbacks such as lack of adequate available bone apical to a socket that may compromise primary stability, site morphology may complicate preferable placement and anchorage, tension-free closure may be difficult to achieve, difficulty in preparing the osteotomy due to drill movement on the walls of the extraction site **(Paolantonio et al., 2001; Hammerle et al., 2004).** Moreover, increased risk of recession at gingival margins especially in patients with thin tissue biotype and presence of facial bone dehiscence have been documented **(Tunkiwala et al., 2011).**

Moreover, it cannot completely preserve the entire bony walls surrounding the implant and the use of barrier membranes and bone grafts have sometimes been recommended to enhance healing**.** However, there are complications when using barrier membranes varied from a minor situation, such as soft tissue dehiscence requiring no treatment or treatment with chlorhexidine and/or systemic antibiotics to major problems such as treatment failure **(Jung et al., 2007; Bhola et al., 2008; Rocchietta et al., 2008; Shinnawi et al., 2014).**

Immediate implant placement is contraindicated in some clinical situations like large sockets (more than 5 mm around implant), buccal bone defects, roots that are longer than usual and the presence of acute periapical or periodontal infections **(Alves and Neves, 2009).**

Frequently, compromised teeth that are indicated for extraction are enveloped in chronic infection, which conventionally contraindicates the immediate placement of endosseous dental implants because of the risk of microbial interference with the healing process. Some studies on immediate implants suggest that this procedure should be avoided in the presence of periapical or periodontal pathosis**.** Clinical reports have suggested that history of periodontal or endodontic infections is a predictive marker for implant infection and failure. **Alsaadi et al, 2007**, noted a greater tendency toward implant failure in sites with apical lesions, especially with machined-surface implants. Additionally, cases of retrograde peri-implantitis have been thought to result from placement into such sites. The presence of the chronic periodontal disease has also been correlated with an increased risk of implant failure. This clinical experience has led most clinicians to avoid the immediate placement of endosseous dental implants at infected sites and to consider infection a contraindication for immediate implantation **(Quirynen et al., 2003; Evian et al., 2004; Alsaadi et al., 2007; Casap et al., 2007; Horwitz et al., 2008; Deng et al., 2010).**

When an extracted tooth is associated with infection, the clinician may have to delay implant placement to permit resolution of the infection **(Grunder et al., 1999)**. Implants placed in healed extraction sockets had a lower failure rate than implants placed immediately in fresh extraction sockets **(Antetomaso and Kumar, 2018).**

Delayed implant placement protocol (more than 6 months of healing) based on the need for complete healing of the alveolar socket, a process that is usually associated with increased treatment time **(Lautenschlager and Monaghan, 1993)** but has the advantage of allowing time for resolution of pre-existing infections at the extraction site **(Demirel et al., 2003).** Such protocol permits an excellent soft tissue closure over the implant which eliminates the need for flap advancement