GUIDELINES FOR

IMPLANT DENTISTRY

Version 1

Health Policies and Standards Department

Health Regulation Sector (2021)

INTRODUCTION

Dubai Health Authority (DHA) is the responsible entity for regulating, licensing and monitoring health facilities and healthcare professionals in the Emirate of Dubai. The Health Regulation Sector (HRS) is an integral part of DHA and was founded to fulfil the following overarching strategic objectives and program:

Objective #1: Position Dubai as a global medical destination by introducing a value-based, comprehensive, integrated and high quality service delivery system.

Objective #2: Direct resources to ensure healthy and safe environment for Dubai population.

Strategic Program #5: Oral & Dental Care- This program focuses on improving the oral health outcomes and ensure that all individuals have access to high quality treatments and effective prevention programs for dental care.

ACKNOWLEDGMENT

This document was developed by Dental Services Department, Primary Healthcare Services Sector (PHCSS). It has further been reviewed by the Health Policy and Standards Department (HPSD).

HRS would like to acknowledge and thank all parties that participated and worked toward developing these guidelines to ensure improving the quality and safety of healthcare services.

The Health Regulation Sector

Dubai Health Authority

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EXECUTIVE SUMMARY

Clinical guidelines to enhance the standard of care in health facilities are increasingly becoming part of current practice and will become more common over the next decade. These Clinical Guidelines aim to improve the quality and the level of healthcare provided to the clients. Healthcare providers can use these guidelines to answer specific questions in day-to-day practice and as an information source for continuing professional education.

This document presents a framework for dentists to:

- To assist relevant dental specialists to facilitate successful Surgical Management of Dental Implant treatment in DHA licensed health facilities.
- To meet the increase in dental Implant treatment among patients aligned with current international standards of care to ensure increase in success rate and minimize complications.

DEFINITIONS

Dental implant abutment: the supplemental component of a dental implant that is used to support and/or retain any fixed or removable dental prosthesis.

Dental implant attachment: 1. The biochemical/mechanical interconnection between the dental implant and the connective tissue complex to which it is attached; 2. the biochemical/mechanical interconnection between the dental implant and the bone to which it is attached; 3. Expression describing the mechanism for the retention of the dental implant abutment to the dental implant.

Dental implant: a prosthetic device made of alloplastic material(s) implanted into the oral tissues beneath the mucosal and/or periosteal layer and on or within the bone to provide retention and support for a fixed or removable dental prosthesis; a substance that is placed into and/or on the jaw bone to support a fixed or removable dental prosthesis

Hybrid prosthesis: nonspecific term applied to any prosthesis that does not follow conventional design; frequently used to describe a dental prosthesis that is composed of different materials, types of denture teeth (porcelain, plastic, composite resin), variable acrylic denture resins, differing metals or design, etc.; may refer to a fixed dental prostheses, removable dental prostheses, or maxillofacial prostheses.

Implant-supported bar connector: a bar connector that receives support and stability from the dental implants through the dental implant abutments.

Implant-supported crown: an artificial crown that receives support and stability from a dental implant.

Implant-supported prosthesis: is a dental prosthesis, such as artificial crown, fixed complete denture, fixed partial denture, removable complete overdenture, removable partial overdenture, as well as maxillofacial prosthesis, which are supported and retained in part or whole by dental implants.

Prosthodontics: is the dental specialty pertaining to the diagnosis, treatment planning, rehabilitation and maintenance of the oral function, comfort, appearance and health of patients with clinical conditions associated with missing or deficient teeth and/or maxillofacial tissues using biocompatible substitutes.

Provisional Prosthesis: is a fixed or removable dental prosthesis, or maxillofacial prosthesis designed to enhance aesthetics, stabilization, and/or function for a limited period of time, after which it is to be replaced by a definitive dental or maxillofacial prosthesis; often such prostheses are used to assist in determination of the therapeutic effectiveness of a specific treatment plan or the form and function of the planned definitive prosthesis.

ABBREVIATIONS

CAD-CAM	:	Computer-Aided Design & Computer-Aided Manufacturing
CBCT	:	Cone Beam Computed Tomography
CEJ	:	Cemento Enamel Junction
CT	:	Computed Tomography
DHA	:	Dubai Health Authority
DHIC	:	Dubai Health Insurance Corporation
EDTA	:	Ethylenediaminetetraacetic Acid
GBR	:	Guided Bone Regeneration
HIV	:	Human immunodeficiency virus
HPSD	:	Health Policy and Standards Department
HRS	:	Health Regulation Sector
OPG	:	Orthopantomogram
PHCSS	:	Primary Healthcare Services Sector
TMJ	:	Temporomandibular Joint

A. GUIDELINES FOR SURGICAL MANAGEMENT OF DENTAL IMPLANTS

1. BACKGROUND

The practice of implant dentistry requires expertise in planning, surgery and tooth restoration; it is as much about art and experience as it is about science.

The demand for dental Implant treatment among patients has been increasing constantly.

Over the past decade, dental implantology has become an indispensable part of mainstream dentistry, and has aided dentists improve the quality of life of patients. A dental implant (endosseous implant or fixture) is a surgical component that interfaces with the bone of the jaw or skull to anchor and support crowns, bridges, dentures and facial prosthesis. The success or failure of dental implants primarily relates to the surgeon's competencies, individual receiving treatment, the medications that affect osseo-integration, the amount of stress that will be placed on the implant and general health of tissues.

The risks and complications related to implant therapy can generally be divided into three areas, namely the surgical risk (for example, excessive bleeding or nerve injury), risk that may occur in the first three-six months (such as infection and failure to osseointegrate) and risk that may occur over the longer term (such as peri-implantitis and mechanical failures). Thus, dentists practising dental implantology require specialized knowledge, clinical skillset and training in the surgical, prosthetic after care aspects of treatment. Dental implant placement must be both biologically and restoratively driven. Dental implants should be placed only following a comprehensive examination and accurate diagnosis.

2. SCOPE

2.1. To facilitate management of efficient and successful Surgical Dental Implant treatment in DHA licensed health facilities.

3. PURPOSE

3.1. To ensure provision of high quality, safe surgical management of dental implant treatment to patients.

4. APPLICABILITY

4.1. DHA licensed Dentist and Dental specialist privileged for dental implantology by DHA except for Dental Radiology and Forensic Dentistry licensing categories.

5. RECOMMENDATION ONE: CLINICAL ASSESSMENT AND DIAGNOSIS

5.1. The primary step is to collect data that includes complete medical and dental history, clinical findings, photographs (not always indicated, advised in challenging cases), mounted diagnostic casts and radiographs.

5.2. Consult with other specialists (oral & maxillofacial surgeon, periodontist, orthodontist, endodontist) regarding the osseous ridge, periodontal and endodontic health and any occlusal, skeletal and space problems.

5.3. A correct diagnosis with long-term prognostic information is mandatory in order to develop an interdisciplinary treatment plan.

5.4. All the treating specialists on the team need to collaborate their findings, which includes the following examinations:

5.4.1. Periodontal,

5.4.2. Occlusion analysis,

5.4.3. Endodontic,

5.4.4. Prosthodontic,

5.4.5. Restorative

5.4.6. Orthodontic.

6. **RECOMMENDATION TWO:** PERIODONTAL EXAMINATION

6.1. A comprehensive periodontal examination includes the examination of the soft and hard supporting tissues of the dentition.

6.2. The patient's tissue biotype is classified according to how thick or thin the supporting bone and gingival soft tissues are defined.

6.3. Becker and Oschenbein classified three distinct types: Pronounced Scalloped, Scalloped and Flat.

6.3.1. A thin periodontium will be pronounced scalloped or scalloped. A thick periodontium will present with flat gingival architecture, usually supported by thick buccal and lingual plates of alveolar bone. A thin skeletal pattern with scalloped architecture will have root dehiscence and fenestrations even in a healthy periodontium.

6.4. If periodontal disease is present, it is important to establish the attachment level (probing depths and gingival recession) as well as any contributing factors, such as mucogingival problems (lack of keratinised attached tissue) and furcation involvement, which will alter the prognosis of the remaining teeth.

6.5. It is critical to measure not only probing depths, but also identify the level of the crestal alveolar bone.

6.6. Kois classified a high crest when the crestal bone level is close to the Cemento Enamel Junction (CEJ); delayed passive eruption.

6.7. The normal crest is defined as two (2) millimetres from the CEJ and the low crest is present in patients with recession.

6.8. Sounding to bone is the best clinical parameter to help identify the attachment level. This is extremely important in the aesthetic zone, when considering replacing partially edentulous teeth.

6.9. The interproximal attachment level on the teeth adjacent to a future implant site will dictate the future gingival architecture.

6.10. In the aesthetic zone it is extremely important to identify the amount of teeth and soft tissues visible not only from the frontal view, but from the lateral view, both with the lip at rest and when smiling.

6.11. Uneven gingival architecture, the position of teeth relative to the arch shape and opposing occlusion will all affect and dictate the decision making process.

6.12. The presence of bone loss due to periodontal disease or trauma will greatly affect the outcome of treatment.

6.13. If teeth are already missing then the amount of ridge collapse needs to be measured according to both horizontal and vertical collapse. (Siebert Classification type I, II and III.)

6.14. Lekholm and Zarb classified the hard tissue according to the shape of the ridge (morphology) and the bone quality. This is vital for the surgical approach.

6.15. If the prognosis of teeth is deemed hopeless due to periodontal, endodontic or non-restorability factors, then the amount of future ridge collapse needs to be estimated. In this case, it is extremely important to identify the tissue biotype and the underlining missing bone, which will help determine the prognosis and steps necessary to preserve or rebuild the desired soft and hard tissue architecture after tooth loss.

6.16. Thick tissue is much more forgiving, easier to manipulate and provides a more predictable aesthetic outcome, as compared to thin tissue, which is more likely to shrink.

6.17. Deciding when to extract a tooth is easy when it is hopeless, but sometimes attempts to save teeth that are broken down with a questionable prognosis is not simple.

6.18. In order to preserve the alveolar bone for implants, sacrificing teeth (early extraction) requires a change of thinking as compared to previous philosophical treatment decisions.

7. **RECOMMENDATION THREE:** OCCLUSION ANALYSIS

7.1. Patients with occlusal wear type defects due to clenching or bruxism should be identified. The para-functional habits will greatly affect the outcome and longevity of the type of reconstruction planned.

7.2. The opposing occlusion along with the type of restorative materials selected for the final prosthesis will affect the ability of the bone implant interface to withstand the occlusal load.

7.3. In Periodontally compromised patient, loss of teeth without replacement leads to lack of posterior support. This often causes an unstable occlusal scheme with mesial drifting of posterior teeth and flaring of anterior teeth with a loss of vertical dimension.

7.4. A full examination includes not only the mobility of remaining teeth, but also the occlusal scheme and guidance in lateral and protrusive movements. Over-eruption of any teeth will cause occlusal interferences and decrease the inter-occlusal space necessary for implant restorative components.

7.5. Lack of restorative space is a major contributor to mechanical failure of implant restorations. Mounted diagnostic casts are used to evaluate the occlusion, the edentulous space ridge relationship to the adjacent teeth and the opposing dentition. The amount of vertical and horizontal overlap as well as the restorative space available is extremely important.

8. **RECOMMENDATION FOUR:** CARIES AND ENDODONTICALLY INVOLVED DENTITION

8.1. The endodontic integrity and vitality of remaining dentition must be established.

8.2. Any pathological changes, such as periapical lesions and existing root canals that are incomplete need to be evaluated. Any teeth with a poor endodontic

prognosis should have a thorough risk assessment completed by a specialist, so as not to jeopardise future implant sites.

9. **RECOMMENDATION FIVE:** PROSTHODONTIC/RESTORATIVE

9.1. The integrity of all existing restorations should be evaluated. This must include margin integrity of fillings and crowns and soft tissue response to sub-gingival placement.

9.2. Teeth with biologic width violation, that will require surgical crown lengthening, will affect the future level of the osseous crest at sites adjacent to implants.

9.3. In the aesthetic zone, it is important to anticipate the future gingival contours of the teeth adjacent to the implant site. Teeth that are fractured or not predictably restorable, or have compromised support will be given a poor or hopeless prognosis. The strategic value of each tooth needs to be determined prior to removal. Often in complex cases, even teeth with a poor prognosis can be kept in the initial phases to support a fixed interim prosthesis or preserve the vertical occlusal dimension, while implant healing progresses. This phased approach of sequential extraction will help manage the complex case, sometimes through long periods while development and healing of implant sites is progressing.

10. **RECOMMENDATION SIX:** ORTHODONTIC

10.1. Analysis of the restorative space is important regarding future tooth restoration size, but it is equally important to analyse the position and angulation of the roots in the alveolar bone.

10.2. Drifting and tipping of remaining teeth will often present problems with space mesially-distally.

10.3. The orthodontist needs to be given clear requirements when opening or closing spaces in regards to root positions.

10.4. Taking radiographs during treatment will give useful information to the treating team, prior to appliance removal and completion of treatment.

10.5. It is always preferable in aesthetic cases to complete the orthodontic care prior to implant placement.

10.6. In cases of missing posterior teeth, provisional interim implants can be placed to help the orthodontist establish anchorage.

10.7. The final implants should only be placed posteriorly, if the orthodontic wax-up of the final result allows for correct positioning, without compromising the end result.

11. RECOMMENDATION SEVEN: RADIOLOGICAL EXAMINATION

11.1. The preliminary exam will include an Orthopantomogram (OPG), and if necessary a set of periapical and bitewing radiographs as indicated.

11.2. A Cone Beam Computed Tomography (CBCT) or a 3-D computerized tomography (CT) scan imaging should be considered for cases where osseous depth and width are in question, particularly in relation to vital structures such as ID Nerve canal, impacted teeth and the Maxillary sinus.

11.3. Once the patient has had the initial consultation and accepted the proposed options of treatment, a cast can be a template for a diagnostic wax-up of the final proposed treatment and to fabricate a surgical guide.

11.4. The surgical needs can be identified and the most predictable options can be presented to the patient prior to the start of treatment. The goals of the final reconstruction, whether fixed or removable, can be determined.

11.5. The treatment expectations can be presented to the patient, with realistic steps of what can and cannot be accomplished. Only then can the treatment plan in a phased approach, be determined by all the treating doctors on the team.

11.6. All financial obligations (if any), treatment consent as well as aesthetic goals are established prior to taking any further steps.

11.7. Occasionally, when questionable teeth are still present, it may be beneficial to have a CBCT prior to removing teeth. This can help make treatment decisions regarding surgical options and of timing of implant placement.

12. RECOMMENDATION EIGHT: PRE-SURGICAL PLANNING

12.1. Viewing the CBCT images, which have the cross-sectional reformatted images of the bone quantity and quality at each desired implant site, allows the surgeon to develop the surgical plan.

12.2. In complex fully edentulous cases, whether fixed or removable reconstruction will be the best outcome can be determined. The surgeon can then modify the radiographic guide to be used as a surgical guide on the day of surgery.

12.3. Recent developments in Computer-Aided Design & Computer-Aided Manufacturing (CAD-CAM) technology allow the team to perform pre-surgical planning on a virtual model and then transfer this information to a clinical surgical guide to assist accurate placement of implants.

12.4. The hard tissue classification by Lekholm and Zarb defined quantity and quality of the edentulous ridge.

12.4.1. Quality

Type 1	Almost the entire jaw is composed of homogenous compact bone.
Type 2	A thick layer of compact bone surrounds a core of dense trabecular bone
Type 3	A thin layer of cortical bone surrounds a core of dense trabecular bone of favourable strength.
Type 4	A thin layer of cortical bone surrounds a core of low-density trabecular bone.

12.4.2. Quantity: Ridge shape a–e. Shape 'a' represents no bone resorption, while 'e' represents advanced ridge resorption. The pattern of resorption in the anterior maxilla advances posteriorly and superiorly, which greatly affects the aesthetic zone and lip support. The pattern of resorption of the posterior ridges greatly affects the occlusion and horizontal overlap of the dentition.

12.4.3. Anterior maxilla: Vertical resorption of the ridge will affect the aesthetic result in partially edentulous cases. In fully edentulous cases

the amount of loss might limit treatment to removable overdentures, these are things that to be considered for patient education.

12.4.4. Options for surgical correction include Onlay bone grafting, Guided Bone Regeneration by means of a Matrix and Distraction osteogenesis.

12.4.5. The onlay block graft requires an autogenous block of bone be taken from either intra-oral sites (Ramus or chin) or extra-oral site (iliac crest or calvaria). The greater the defect, the more bone is required. Analysis of the dimensions required will dictate which donor site is preferable. Extra-oral sites require general anaesthesia and increase the risk for greater co-morbidity, but nevertheless, sometimes necessary. Intraoral block grafts are better suited for partially edentulous situations with minimal bone loss. The block of cortical cancellous bone is carefully adapted to the recipient site and fixated with screws to stabilise the graft in the duration of healing. Building vertical height is the least predictable of all the grafting options particularly in the mandible, and when possible to avoid, it is recommended to do so.

13. **RECOMMENDATION NINE:** SURGICAL PREPARATION OF THE IMPLANT SITE

13.1. Distraction Osteogenesis

13.1.1. Distraction Osteogenesis allows the existing bone to be transferred to a more coronal position after surgical osteotomy cuts and placement of a device that is activated daily in the mouth.

13.1.2. After several weeks of movement, the bone is left to mature for a few months prior to implant placement.

13.2. Posterior maxilla:

13.2.1. The posterior maxilla has historically always been the most challenging site to achieve success. The most common site for tooth loss in the periodontally compromised patient is the maxillary molars because of furcation involvement.

13.2.2. Due to a combination of periodontal bone loss and sinus proximity, limited bone height is usually available for implants. The bone is also usually soft (type 3 or 4), which makes initial stabilization difficult to achieve.

13.3. The Sinus Lift procedure:

13.3.1. Reported by Boyne et al. showed that it is possible to open the maxillary sinus through the lateral wall, elevate the sinus membrane and pack bone-grafting material into the space, either autogenous or synthetic.

13.3.2. Autogenous bone has always been the most predictable option that has set the gold standard; nevertheless, excellent synthetic options do exist.

13.3.3. Intra-oral bone can be harvested from the chin, ramus or tuberosity areas. It is more predictable to perform the sinus lift graft, and then wait 5-6 months for healing prior to implant placement.

13.3.4. If at least five (5) millimetres of bone height is available, simultaneous implant placement with sinus lift and bone grafting is possible, with less predictability.

13.3.5. If 6-8 mm of height is available, then placement of the implants with an osteotome technique (internal sinus elevation) for increasing the length of implant is possible.

13.3.6. It is recommended to perform drilling initially 2-3 millimetres short of the sinus floor.

13.3.7. The osteotome is placed into the osteotomy site and the sinus floor is in-fractured, thereby raising the membrane and creating space for the graft or creation of a tent with the implant at its peak and while the membrane is protected by means of a resorbable membrane or similar material.

13.3.8. If opted for bone grafting, bone graft material can then be pushed into the preparation site prior to placing the implant. This technique is popular, because it seems less invasive as compared to the sinus lift via the lateral wall technique, but it requires careful patient selection.

13.3.9. It is a technique sensitive procedure, good for single tooth replacement, but with less predictability, due to the greater potential for sinus membrane perforation.

13.4. Posterior mandible:

13.4.1. The inferior alveolar nerve needs to be visualised (at least by means of radiographs) in order not to cause nerve injury.

13.4.2. It often limits implant placement to short wide implants. Alternative options are the nerve transposition procedure, which has a high comorbidity and rate of nerve damage, or distal cantilevering of the prosthesis of implants placed mesial to the foramina.

13.4.3. Distraction osteogenesis can also be used if inter-arch space is not challenging.

13.5. Anterior maxilla:

13.5.1. The pattern of resorption usually creates knife-edge ridges or ridges that are too thin due to concavities. The anterior incisal foramen is sometimes large and can restrict implant placement in the maxillary central positions.

13.5.2. Knife-edge ridges are best treated with veneer grafts using an intraoral block of cortical-cancellous autogenous bone stabilised with fixation screws. Unlike onlay grafts, these veneer grafts are more predictable.

13.5.3. Concavity defects can be treated with block grafts. An intra-oral block harvested from the ramus can be ground, or a scraping device can harvest scrapings off the ramus cortical plate, which can then be mixed with synthetic material and patient blood to create a grafting material.

13.5.4. A resorbable or non-resorbable membrane is then fixated with pins over the graft material. A titanium re-enforced membrane can be used if space making is desired.

13.5.5. Narrow ridges in the maxilla can also be treated by spreading the bone with osteotomes or a more aggressive approach, the Split-Ridge technique, which widens the existing bone with simultaneous implant placement.

13.6. Anterior and posterior mandible:

13.6.1. Block grafts with fixation screws- Guided Bone Regeneration (GBR) as described above are possible. Determining the depth of the vestibule and the ability to advance the flap for graft coverage without any tension, this is the key to achieve success.

13.6.2. Tooth or teeth need to be removed:

a. If the tooth or teeth need to be removed, then ask the following questions:

I. Is the tooth in the aesthetic zone?

II. Type of tissue biotype?

III. Thin scalloped or thick flat.

IV. Amount of bone loss due to periodontal disease or endodontic failure.

V. How predictable is the stability of the future gingival architecture?

13.6.3. There are several timing options to consider:

a. Extract and wait several months prior to implant placement. Orthodontic forced eruption to move the gingival complex and crestal bone into a more favourable position prior to extraction.

b. Extract and proceed with socket preservation methods or bone graft the socket to help preserve soft tissue contours and minimise collapse of the ridge, if the buccal plate is thin or has a slight dehiscence.

c. Extract and place implant immediately into socket (single rooted teeth and buccal plate is thick and intact). Two stage buried. One stage with healing abutment or customised healing abutment. Immediate load implant with provisional restoration.

d. Extract and wait two to three months, then bone graft (Intra-oral block or GBR). After five to six months healing, place the implant.

14. **RECOMMENDATION TEN:** SURGICAL COMPLICATIONS

14.1. In order to minimize post-surgical complications, careful planning of the flap design, and gentle soft tissue manipulation is required.

14.2. Control of bleeding, along with releasing incisions that allow for flap advancement and closure without tension are mandatory.

14.3. Failure to maintain flap coverage due to sloughing or opening of the incision line will lead to delayed healing with compromised results. Smoking affects both hard and soft tissue healing and has been shown to be the greatest risk factor.

14.4. The medically compromised patient (e.g. Diabetes Mellitus, Autoimmune disease, patients on long term steroids, Bisphosphonates, radiation treatment etc.) needs special attention, but is not always contra-indicated to receive Implant treatment.

14.5. Logical and ethical decisions need to be made with the patient and their treating physicians.

15. **RECOMMENDATION ELEVEN:** SPECIAL CONSIDERATIONS

15.1. Surgical Recommendations for Bone Level Implants' Placement

15.1.1. The implant should be at least 1.5 millimetre away from the adjacent teeth.

15.1.2. The implant should be at least 3 millimetres away from the adjacent implant.

15.1.3. A wide platform implant should be selected for molar teeth, above 4.5 millimetres diameter.

15.1.4. When the Mesio-distal space is 14 millimetres, it is required two of regular diameter implants to be placed.

15.1.5. Regular diameter implants are considered as 3.5-4.1 millimetres diameter.

15.1.6. Wide diameter implants are considered as 4.5 millimetres diameter and more.

15.1.7. Standard regular length is considered nine (9) millimetres to eleven (11) millimetres.

15.1.8. When three implants are planned in the posterior quadrant (Premolar molar sites), a total space of 23 millimetres mesio- distal is required.

15.1.9. When mesio-distal space is less than twenty-three (23) millimetres, two (2) implants should be placed if possible by using wide diameter body.

15.1.10. When a molar restoration is planned, wide diameter implants need to be placed 2.5 millimetres away from the adjacent teeth to allow a wider emergence profile of the implant supported crown.

15.1.11. At least 6 mm thickness of the bony ridge is required for a Regular diameter implant (3.5-4.1 millimetres diameter).

15.1.12. At least seven (7) millimetres thickness of the bony ridge is required for a wide diameter implant (4.5 millimetres diameter and more).

15.1.13. Using wide diameter implants allows a better emergence profile for the implants restoration in case of replacing molars, maxillary premolars and maxillary central incisors and canines.

15.1.14. In posterior maxilla, where bone quality is less dense bone; it is in favour to place one implant for each tooth.

15.1.15. When three implants are placed in posterior regions, it is advised to offset them in a tripod effect.

15.1.16. When the patient is a bruxer, it is favourable to have additional implants for load distribution.

15.1.17. Narrow diameter implants are considered platforms from 2.75 millimetres to 3.4 millimetres diameters.

15.1.18. Narrow diameter implants are recommended to replace lower Incisors, Upper lateral Incisors and in narrow bucco-palatal and mesio-distal spaces.

15.1.19. Narrow diameter implants are not recommended in posterior occlusal load bearing areas.

15.2. Surgical consideration for Subcrest Level Implants' Placement

15.2.1. The implant should be at least 1.5 millimetres away from the adjacent teeth.

15.2.2. The implant should be at least two (2) millimetres away from the adjacent implant.

15.2.3. When the mesio-distal space is fourteen (14) millimetres, it is required two (2) of regular diameter implants to be placed.

15.2.4. Regular diameter implants are considered as 3.5 millimetre diameter.

15.2.5. Wide diameter implants are considered as 4.5 millimetre diameter and more.

15.2.6. Standard regular length is considered 8 millimetres to 9.5 millimetres.

15.2.7. When a molar restoration is planned, implants need to be placed three (3) millimetres subcrestally to allow a wider mesio-distally emergence profile implant supported crown.

15.2.8. At least 6 mm thickness of the bony ridge is required for a Regular diameter implant (3.5 millimetre diameter).

15.2.9. At least seven (7) millimetres thickness of the bony ridge is required for a wide diameter implant (4.5 millimetre diameter and more).

15.2.10. Using wide diameter implants to replace molars, maxillary premolars and maxillary central incisors and canines allows a better emergence profile for the implants' restoration in case the bony ridge dimension will be appropriate.

15.2.11. In posterior maxilla, where less dense bone is found. It is in favour to replace one implant for each tooth.

15.2.12. When three implants are placed in posterior regions, it is advised to offset them in a tripod effect.

15.2.13. When the patient is a bruxer, it is favourable to have additional implants for load distribution.

15.2.14. Subcrestal implant can be placed 1-3 millimetres subcrestally (under the bone level).

B. GUIDELINES FOR TREATMENT PLANNING AND PROSTHESIS OF DENTAL IMPLANTS

1. BACKGROUND

Implant treatment is a multi-disciplinary dental service, which requires proper diagnosis and treatment planning following systematic approach and guideline to develop higher rates of success. Implant treatment is a patient-centered rather than dentist-centered service, accordingly, it's very important to develop an implant treatment guideline to standardize the treatment process and eliminate miscommunication among patients, laboratories, and treating dentists. This document presents a step-by-step guideline for implant treatment along with the adjunct information needed to help clinicians avoid complications that may be caused by missing crucial steps of the diagnostic, surgical, and prosthetic implant procedures.

2. SCOPE

2.1. Plan for and restore dental implants.

2.2. Standardized implant treatment.

3. PURPOSE

3.1. To increase the awareness among implant licensed professionals regarding the prosthetic approach to plan for and restore dental implants.

3.2. To reduce failure and complications associated with implant treatment.

3.3. Ensure that all prosthetic patients who are eligible to have dental implants receive the same quality of management.

4. APPLICABILITY

4.1. DHA licensed Dentist and Dental specialist privileged for dental implantology except for Dental Radiology and Forensic Dentistry licensing categories.

4.2. DHA licensed Prosthodontists.

5. RECOMMENDATION ONE: OUTLINE OF IMPLANT TREATMENT GUIDELINE

5.1. Perform initial consultation and comprehensive examination.

5.2. Order required diagnostic investigations.

5.3. Assess risk factors and contraindications of implant treatment.

5.4. Analyse data and develop a treatment plan.

5.5. Present the case to the patient and obtain a detailed informed consent.

5.6. Place implants following surgical guidelines to simple and complex cases requiring extra surgical preparation.

5.7. Restore implants following biomechanics and prosthetic guidelines for simple and complex cases.

5.8. Implement a solid follow-up plan for the implants and the prosthesis.

6. RECOMMENDATION TWO: INITIAL CONSULTATION AND COMPREHENSIVE EXAMINATION

6.1. Medical and medication history.

6.2. Dental history with adequate periodontal charting.

6.3. Soft tissue evaluation including adequacy of keratinized mucosa and height of muscle attachment.

6.4. Extra-oral examination including TMJ, muscle tone, lip support, smile line, and facial symmetry.

6.5. Clinical evaluation of the remaining dentition, present restoration and old prosthesis.

7. RECOMMENDATION THREE: DIAGNOSTIC INVESTIGATIONS

7.1. Radiographs:

7.1.1. Periapical radiographs.

7.1.2. Panoramic radiograph.

7.1.3. Cone-beam computerized tomography (CBCT) may be required for certain cases.

7.1.4. Bone densitometry may be required in cases with suspiciousness to have osteopenia, osteoporosis, and other bone metabolism disorders.

7.2. Prosthetic investigations:

7.2.1. Mounted diagnostic cast.

7.2.2. Diagnostic wax-up.

7.2.3. Face-bow transfer if required.

7.2.4. Selection of shade, shape, and size of teeth.

8. RECOMMENDATION FOUR: RISK FACTORS OF IMPLANT TREATMENT

8.1. General risk factors:

8.1.1. Age (very young and very old)

8.1.2. Compromised medical condition

8.1.3. Compromised psychological condition

8.1.4. High aesthetic demands

8.1.5. Tobacco and alcohol use

8.1.6. Temporomandibular disorders

8.1.7. Periodontal disease

8.1.8. Occlusal trauma

8.1.9. Limited mouth opening: a minimum of 40 mm mouth opening is required to allow accessibility for placing and restoring posterior implants

8.1.10. Poor oral hygiene

8.1.11. Low bone density

8.1.12. Bone defects

8.1.13. Narrow alveolar ridge

8.1.14. Excessive or inadequate vertical restorative space

8.1.15. Excessive or inadequate horizontal restorative space

8.1.16. Acute lesions

8.1.17. Chronic lesions distant form the implant zone.

8.2. Aesthetic risk factors:

8.2.1. Gingival smile line

8.2.2. Thin and/or scalloped gingiva

8.2.3. Crestal bone height deficiency

8.2.4. Reduced height of keratinized gingiva

8.2.5. Long and thin papilla between adjacent teeth

8.2.6. Triangular tooth form

8.2.7. Position of interdental contact point relative to the crestal bone level (distance of < 5mm represents less of a risk than distance > 5mm)

8.2.8. Amount of interdental contact (a small area of contact represents a higher risk than a large area of contact)

8.2.9. Absence of bony papilla (septum) between 2 implants.

8.3. Functional risk factors:

8.3.1. Bruxism

8.3.2. Clenching

8.3.3. Tongue thrusting

8.3.4. Macroglossia

8.3.5. Compromised position of the implant.

8.4. Occlusal risk factors:

8.4.1. Unfavourable distribution of load

8.4.2. Wide occlusal table

8.4.3. Interferences in lateral excursion

8.4.4. Non-axial loading

8.4.5. Occlusal scheme

8.4.6. Excessive occlusal forces

8.4.7. Occlusion of the opposing arch.

8.5. Biomechanical risk factors:

8.5.1. Fewer number of implants

8.5.2. Small implant diameter

8.5.3. Short implants

8.5.4. Rigid connection between implant and natural teeth

8.5.5. Unsplinted implant crown

8.5.6. Improper implant design

8.5.7. Uncontrolled use of cantilever in regards to anteroposterior length

8.5.8. Improper prosthesis/implant height ratio

8.5.9. Unsatisfactory primary implant stability

8.5.10. Lack of passive fit of the prosthesis

8.5.11. Immediate loading.

9. **RECOMMENDATION FIVE:** CONTRAINDICATIONS OF IMPLANT TREATMENT

9.1. Absolute contraindications:

9.1.1. Recent myocardial infractions

9.1.2. Cerebrovascular accident

9.1.3. Valvular prosthesis surgery

9.1.4. Bleeding disorders

9.1.5. Drug abuse

9.1.6. Psychiatric illness

9.1.7. Intravenous bisphosphonate use

9.1.8. Terminal illness

9.1.9. Tumoricidal radiation to implant site.

9.1.10. Unrealistic expectations

9.1.11. Inability to prosthodontically restore the implants

9.1.12. Collagen and bone disease

9.1.13. Immunosuppressive disorders

9.1.14. Hyperactive involuntary muscle movement

9.1.15. Patient younger than sixteen (16) years of age.

9.2. Relative contraindications:

9.2.1. Blood dyscrasia

9.2.2. Pulmonary problems

9.2.3. Anticoagulant therapy

9.2.4. Psychiatric or psychogenic disorders

9.2.5. Mental retardation

9.2.6. Chemotherapy

9.2.7. Tobacco use

9.2.8. Osteoporosis

9.2.9. Uncontrolled diabetes mellitus

9.2.10. Human immunodeficiency virus (HIV)

9.2.11. Hypothyroidism

9.2.12. Immunosuppression therapy

9.2.13. Positive interleukin-1 genotype

9.2.14. Lupus

9.2.15. Renal insufficiency

9.2.16. Scleroderma

9.2.17. Pregnancy

9.2.18. Elderly patients

9.2.19. Cervicofacial irradiation.

10. RECOMMENDATION SIX: ANALYZE DATA AND DEVELOP A TREATMENT PLAN

10.1. Prosthetic options:

10.1.1. Implant-supported prosthesis which include:

a. Single crown

b. Fixed partial denture

c. Hybrid prosthesis.

10.1.2. Implant-retained overdenture which may be retained by:

a. Single standing implants (ball/locator attachment)

b. Bar attachment

10.2. Loading conditions:

10.2.1. Immediate occlusal loading: Immediate occlusal loading within two weeks of implant insertion.

10.2.2. Early occlusal loading: Occlusal load to an implant prosthesis between 2 weeks and three (3) months after implant placement. The actual time may use the number of weeks in parentheses (i.e. early [5 weeks] occlusal loading).

10.2.3. Non-functional immediate restoration: An implant prosthesis in a partially edentulous patient delivered within two (2) weeks of implant insertion with no direct occlusal load.

10.2.4. Non-functional early restoration: An implant restoration delivered to a partially edentulous patient between two (2) weeks and three (3) months after implant insertion.

10.2.5. Delayed occlusal loading:

a. Two-stage delayed occlusal loading: The soft tissue covers the implant after initial placement. A second stage surgery after three (3) months exposes the implant to the oral environment, after which the implant is loaded.

b. One-stage delayed occlusal loading: The implant is positioned slightly above the soft tissue during the initial implant placement. The implant is restored into the occlusal load after more than three (3) months.

11. **RECOMMENDATION SEVEN:** CASE PRESENTATION AND INFORMED CONSENT

11.1. Case presentation:

11.1.1. Present treatment options using diagnostic wax-up and available tools

11.1.2. Discuss limitation and risk factors

11.1.3. Provide estimate of treatment duration

11.1.4. Present provisional prosthesis options

11.1.5. Discuss maintenance requirements

11.1.6. Inform the patient of possible complications

11.1.7. Explain fees and financial options if applicable.

11.2. Informed Consent: When the patient accepts the treatment, he/she should sign an informed consent and be provided with per operative and postoperative instructions and prescription for any required medications.

12. RECOMMENDATION EIGHT: RESTORE IMPLANTS FOLLOWING BIOMECHANICS AND PROSTHETIC GUIDELINES FOR SIMPLE AND COMPLEX CASES

12.1. Vertical space considerations:

12.1.1. Vertical space requirement for fixed prosthesis:

a. Single-unit fixed prosthesis:

i. In treatment planning a single-unit fixed prosthesis to replace a posterior tooth, the minimum vertical space needed for a cement-retained crown is 9 mm from the crestal bone to the occlusal plane of the opposing dentition or 6 mm from the soft tissue to the occlusal plane.

ii. For an anterior crown, the space required is 1-2 mm greater to accommodate the longer abutment necessary for proper retention of the crown.

b. Multi-unit fixed prosthesis:

i. Space required vary according to the material to be used. If the space is less than 15 mm, porcelain is the restorative material of choice. If the space is greater than 15 mm, hybrid prosthesis is considered.

c. Crown/implant ratio:

i. The ratio of the crown to the implant should be taken into consideration in the fabrication of a fixed implant-supported prosthesis, otherwise a vertical cantilever forces can be induced which will compromise the osseointegrated implants.

12.1.2. Vertical space requirement for removable prosthesis:

a. Bar-retained overdenture:

i. It requires a minimum of 17 mm of crown height space depending on the type of attachment used.

b. Ball- or Locator-retained overdenture:

i. It requires a minimum of 14 mm of crown height space depending on the type of attachment used.

12.2. Horizontal space considerations:

12.2.1. Implant-to-implant space requirement:

a. A minimum of 3 mm should be available between the adjacent implants.

b. To calculate the ideal implant-to-implant space:

i. Width of the implant crown = $\frac{\text{Width of crown 1}}{2} + \frac{\text{width of crown 2}}{2}$

c. Implant-to-natural tooth space requirement:

i. Width of the implant crown = $\frac{\text{Width of crown}}{2}$

13. **RECOMMENDATION NINE:** BUCCOLINGUAL POSITIONING AND ANGULATION OF THE IMPLANT

    13.1. Implants distribute occlusal load best when the forces are applied along the long axis of the implant body. When placed in the posterior region, the centre of the implant should correspond to the central fossa of the planned implant restoration.

    13.2. In the anterior region, the buccolingual position of the implant depends on the type of the prosthesis planned. For a screw-retained implant prosthesis, the position of the centre of the implant is under the cingulum of the future crown, while for a cement-retained crown, the centre of the implant is placed under the incisal edge.

14. **RECOMMENDATION TEN:** IMPLEMENT A SOLID FOLLOW-UP PLAN FOR THE IMPLANTS AND THE PROSTHESIS

    14.1. A solid follow-up plan for the implants and the prosthesis should be implemented including regular check-up appointments and hygiene instructions. Everyone in the team should be familiar with the hygiene guideline and be a part of educating and motivating the patient; albeit the primary responsibility will fall on the hygienist, dentist and dental assistant.

15. **RECOMMENDATION ELEVEN:** COMPLICATIONS AND FAILURE OF IMPLANT PROSTHESIS

    15.1. Complications resulting from biomechanical overloading:

15.1.1. Prosthetic failure in dental implants resulted from biomechanical overloading, off-axis loading, may result from poor implant angulation or position, inadequate posterior support, inadequate surrounding bone, or parafunctional habits like bruxism.

15.1.2. Overloading and the consequence failure is manifested by:

a. Restoration fracture

b. Retaining screw fracture

c. Abutment fracture

d. Implant body fracture

e. Osseous destruction

f. Cement failure

g. Plaque accumulation under ridge lap pontics.

15.2. Complications resulting from improper depth of implant placement:

15.2.1. Complications associated with placing deep implant:

a. Bone loss around the implant neck

b. Increased crown height

c. Increased occlusal forces

d. Increased sulcus depth

e. Compromised aesthetics

f. Difficulty seating prosthetic component

g. Difficulty removing excess cement.

15.2.2. Complications associated with placing shallow implant:

a. Exposure of the cover screw during healing

b. Aesthetic complication

c. Decreased crown height

d. Exposure of the abutment

e. Exposure of the implant body.

16. RECOMMENDATION TWELVE: HEALTH SCALE FOR DENTAL IMPLANTS

16.1. Success (Optimum Health)

16.1.1. No pain or tenderness upon function

16.1.2. Zero mobility

16.1.3. Two (2) mm radiographic bone loss from initial surgery.

16.1.4. No exudates history.

16.2. Satisfactory Survival

16.2.1. No pain on function

16.2.2. Zero mobility

16.2.3. Two to four (2–4) mm radiographic bone loss

16.2.4. No exudates history.

16.3. Compromised Survival

16.3.1. May have sensitivity on function

16.3.2. No mobility

16.3.3. Radiographic bone loss 4 mm (less than 1/2 of implant body)

16.3.4. Probing depth seven (7) mm

16.3.5. May have exudates history.

16.4. Failure (Clinical or Absolute Failure)

16.4.1. Pain on function

16.4.2. Mobility

16.4.3. Radiographic bone loss 1/2 length of implant

16.4.4. Uncontrolled exudates

16.4.5. No longer in mouth.

KEY PERFORMANCE INDICATORS (KPIs)

1. Patient Happiness: Overall Assessment	
DHA Pillar	Patient Happiness
Indicator Name	Overall Assessment
Measure Type	Outcome
Data Source	Survey data
Measure Description	People who had a very favorable overall assessment of the facility during measurement period
Measure Denominator	All survey respondents who meet inclusion criteria
Measure Numerator	Survey respondent whose overall assessment of the facility was very high - patients with the highest possible score (scale has 2-7 options) or the two highest options (scale has 8+ options)
Measure Inclusion Criteria	Total number of valid responses to surveys that ask a patient to give their overall assessment of a facility
Measure Exclusion Criteria	None
Source	DHA
International Benchmark	None: Dubai facility surveys are not sufficiently uniform to allow benchmarking
Higher is Better	Yes
Risk Adjust This Measure	No

2. Patient Happiness: Recommendation to Others	
DHA Pillar	Patient Happiness
Indicator Name	Recommendation to Others
Measure Type	Outcome
Data Source	Survey data
Measure Description	Percentage of patients who were very likely to recommend the facility to other people during measurement period
Measure Denominator	All survey respondents who meet inclusion criteria
Measure Numerator	Survey respondent whose recommendation was very high - patients with the highest possible score (scale has 2-7 options) or the two highest options (scale has 8+ options)
Measure Inclusion Criteria	Total number of valid responses to surveys that ask whether the patient would recommend the facility to others
Measure Exclusion Criteria	None
Source	DHA
International Benchmark	None: Dubai facility surveys are not sufficiently uniform to allow benchmarking
Higher is Better	Yes
Risk Adjust This Measure	No

3. Patient Happiness: Doctors Made Sure Patient Understood All Information	
DHA Pillar	Patient Happiness
Indicator Name	Doctors Made Sure Patient Understood All Information
Measure Type	Outcome
Data Source	Survey data
Measure Description	Percentage of patients who answered favorably ('yes') that doctors made sure he/she understood all information
Measure Denominator	All survey respondents who met inclusion criteria
Measure Numerator	Survey respondent indicated 'yes,' doctors made sure that the patient understood all information
Measure Inclusion Criteria	Valid response to the survey question ('yes' or 'no')
Measure Exclusion Criteria	None
Source	DHA
International Benchmark	None: Dubai facility surveys are not sufficiently uniform to allow benchmarking
Higher is Better	Yes
Risk Adjust This Measure	No

4. Patient Safety: Rate of Medication Error	
DHA Pillar	Patient Safety
Indicator Name	Rate of Medication Error
Measure Type	Outcome
Data Source	Internal facility records, reports, or survey data
Measure Description	Rate of prescriptions per 100,000 with a dispensing error during measurement period
Measure Denominator	Number of medication prescriptions during measurement period
Measure Numerator	Number of prescriptions in which a medication error occurs (e.g. dispensing error, prescribing error, administering and preparing error, patient compliance error, vaccine error, administering a medicine for a known allergy patient, dose-related adverse drug reaction)
Measure Inclusion Criteria	All filled prescriptions
Measure Exclusion Criteria	Unsafe condition and near miss incident, adverse drug reactions
Source	TEC required measures http://apps.who.int/iris/bitstream/10665/252274/1/9789241511643-eng.pdf
International Benchmark	2.28 Per 100,000 (in the U.S.) Source: https://www.nationwidechildrens.org/newsroom/news-releases/2017/07/study-finds-rate-of-medication-errors-resulting-in-serious-medical-outcomes-rising . One medication error occurs for every five doses given in US hospitals and 1-2% of patients admitted to US hospitals are harmed by medication errors. Source: http://stateclaims.ie/wp-content/uploads/2017/11/Medication-Incidents-Report-2016.pdf
Higher is Better	No
Risk Adjust This Measure	No

5. Patient Safety: Rate of Medical Error	
DHA Pillar	Patient Safety
Indicator Name	Rate of Medical Error
Measure Type	Outcome
Data Source	Internal facility records, reports, or survey data
Measure Description	Rate of medical errors (errors in diagnosis, medication, surgery, equipment use, lab findings interpretation) per 100,000 patients in measurement period
Measure Denominator	All qualifying patients in measurement period
Measure Numerator	Medical errors as defined through proven reports (e-medical systems) during measurement period
Measure Inclusion Criteria	All patients with at least one medical encounter in measurement year
Measure Exclusion Criteria	None
Source	TEC required measures http://apps.who.int/iris/bitstream/10665/252274/1/9789241511643-eng.pdf
International Benchmark	To be discussed with DHA
Higher is Better	No
Risk Adjust This Measure	No

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