Review Article

# Diagnosis for dental implant

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**A B S T R A C T**

Various factor have been discussed in the literatures that facilitate clinical assessment for dental implant selection and placement with consequent hard and soft tissue enhancement around the implant prosthesis. The sequential process of clinical examination, laboratory tests, radiographic analysis, diagnostic protocols of casts, wax ups. Along with the treatment needs and desires of the patient have to be factored in for the overall diagnosis and prognosis of implant therapy. A step-by-step methodology has been created to help the implant practitioner with a checklist that aims to create the optimal plan for each case. [1]

## 1. Introduction

Dental implants are one of the options available to replace missing teeth [2] in the recent years, dental implant design has improved to such an extent that mere integration with the bone is no longer considered as the only success criteria for the implants. It is expected that successful implant treatment restores normal function, esthetics, comfort and speech in a patient.(misch ce. 1999.) [3]

A good dental and medical history is the beginning of any dental treatment planning. The dental history will help in identifying the cause of tooth loss and the reasons why the patient is seeking replacement. If the patient has lost his teeth due to periodontal disease, there is a risk that the patient will develop peri-implantitis, unless his oral hygiene and other underlying causes for periodontal disease are not corrected. The micro-flora associated with failing implants has been found to be identical to those in chronic adult periodontitis.[zablotsky mh. 1998).

The procedures of patient selection, treatment planning, implant selection, placement and prosthetic management

are technically demanding. Meticulous attention to detail is needed for optimal success. As implant options have proliferated and esthetic expectations have risen, the task of selecting appropriate implant for each site has become increasingly important. [4]

The success of any surgical implant procedure depends on careful selection and preparation of the patient. Imaging is an irrefutable part of preoperative implant assessment to determine feasibility of fixture installment. It is one of the most accurate means by which the clinician can assess the morphologic features of the proposed fixture site, select implant of appropriate size and evaluate the fixture periodically after its placement. [1,5]

The assessment includes

1. Appraisal of proposed implant site,
2. Determination of bone quantity and quality,
3. Assessing inclination of alveolar process,
4. Location of adjacent anatomic structures,
5. Detect existing pathology

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## 2. Initial Consultation

The initial consultation is the first assessment process thus allowing for the completion and reviewing of medical and dental history questioners and preliminary evaluation of patient, emotionally and psychologically. In gathering the patient's history in which the patient's profile is recorded in which age, sex, occupation status is noted down. Then the chief complaint is recorded in the patient's words.

While taking the medical history special attention should be given to whether the patient has the ability to physically and emotionally sustain all the procedures that may be required in the implant therapy including surgery, a variety of anesthetics, pain control drugs and prosthetic rehabilitation. History of uncontrolled medical conditions like diabetes, hypertension, and record of drug allergies, and information on any drugs patient may be consuming should be noted down

Past dental condition with a history of periodontal disease, caries, trauma, change in occlusion or smile, any oral pathology or smoking habits should be noted down. If there is a history of change in occlusion then minor changes from missing tooth, major occlusion discrepancies or changes in tm joint should be examined and recorded. The consultation appointment allows an opportunity to get to know the patient and can also be utilized as a screening process of patients in whom the clinician establishes whether he can fulfill the patient's expectations and establish a long-term successful relationship.(mills. Edward j, 2002).[2]

Comprehensive diagnostic examination. The patient's initial signs are documented like blood pressure, pulse and respiration and pertinent aspects of medical history is further investigated by screening radiographs. Including panoramic and a full set of periapical x-rays are taken.

Medical history; The medical history is an essential part of the diagnostic process and may have a direct bearing on the treatment plan and prognosis.[3] The medical history usually completed in the first visit, it becomes an important factor in establishing rapport and gaining confidence. Leading questions concerning past medical experience may reveal the patients level of pain tolerance, and further astute questioning will also reveal factors such as adaptability to change.

Health information; Anatomical abnormalities This may include severly resorbed alveolar ridges, congenital deformities like diminutive maxilla or mandible, undercut, tori, exoestosis, enlarge tongue and salivary gland. Age Patient under 18 may not be candidates for implant replacement because their dental arches are not fully developed.

Systemic illness; These may reflected in poor tissue tone, low pain threshold, slow healing, sensivity to pressure, tissue fragility and xerostomia.

Physical limitation; Such limitation may result from accident, facial burns, malignances or congenital defects.

### 2.1. Extraoral examination

Extraoral examination allows for evaluation of facial symmetry, skeleton profile, facial contours, and patient's speech, etc.

### 2.2. Intraoral examination

Intraoral examination is visual as well as palpation process. Intraoral soft tissue is examined for any pathology. Evaluation of tongue and para functional habits should be examined along with lateral and frontal tongue thrust and factors of force. Muscle attachment on buccal or lingual aspect of natural teeth or implant site should be evaluated.

#### 2.2.1. Bone evaluation

Usual method of doing this is by means of radiographs. The types of radiographs used depends on number of implants to be placed, location in jaws. Another method less used is palpation.

Intraoral palpation can be used to evaluate the following:

1. Sharpness of crest, it often indicates the presence of knife edge ridges
2. Depth of vestibule

Ridge relationship: plays an important role in determining the type of prosthesis that can be fabricated and occlusion plays an important role in manner in which forces are directed to implants at bone implant interface. The best observation of this relationship is accomplished from mounted diagnostic casts to the articulator.

### 2.3. Periodontal evaluation

Periodontal evaluation includes periodontal charting, periodontal disease, classification and documentation of the location of quantity of keratinized attached gingiva. Bone loss, i.e. Vertical or horizontal defect should be carefully mapped on the chart any gingival recession on maxillary or mandibular teeth should be examined. Oral prophylaxes of patient should be inspected for plaque or calculus. The patient should be radiographically and clinically evaluated with a comprehensive periodontal examination.

1. Intra oral and extra oral photographs should be taken pre-operatively, intra-operatively and post operatively
2. Diagnostic study models are helpful in treatment planning an projecting goals to the patient pre-operatively. They also aid in this retrospective analysis of the progress of therapy.
3. Pre-operative radiographic analysis is one of the most critical aspects of the clinical evaluation

## 2.4. Bony anatomy of implant site and its evaluation

The skeletal profile has both esthetics as well as well-functional ramifications. The patient should be evaluated aesthetically while inspecting the edentulous arch. Skeletal profile classification relating the maxilla and the maxillary arch to the mandible and the mandibular arch is done with visual inspection mounted study models and by cephalometric radiographs. Mounted study models can assist in properly evaluating the arch form as well as inter arch relationship. The arch geometry impacts the position of dental implants., thus impacting the way the implants relate to each other in an anteroposterior direction In a V shaped arch would land more easy to place implants with a great anterior posterior ratio than a u-shaped arch or an arch with straight anterior ridge.

## 2.5. Smile analysis

All aspects of patient's smile should be analyzed and the patient's esthetics, expectations should be documented preoperated digital photographs can be utilized to evaluate and document the pretreatment smile. (chee w 2006) the maxillary anterior teeth should show when the patient smiles. The anterior arrangement of teeth including teeth sizes as well as the positions in the arch should be documented.

While analyzing the smile, the implantologist should look for any spaces, length of clinical crowns any recessions flaring teeth, attrition and shade of the teeth preoperative and check the feasibility of creating the golden proportions of a pleasing smile postoperative.

## 3. Occlusion

The patient should be examined for the changes in occlusion due to the missing teeth. There may be premature contacts or major occlusal discrepancies due to trauma to occlusion. The patient's existing occlusion should be evaluated. In conjunction with the development of the treatment plan it is also necessary to create a diagnostic wax-up to determine spatial relationship (mesial, distal, buccal, and lingual) as well as the alignment and parallelism of the implants to be placed. In the edentulous space the tooth or teeth are fabricated using a base plate The diagnostic wax-up is duplicated into a stone model and a surgical template is fabricated to assist the surgeon in proper alignment, parallelism and direction of implants. The cuspid relationship as well as posterior tooth contact in centric as well as eccentric relationship should be documented. (chee w and jivraj s. 2006.)

## 3.1. Temporomandibular joint

The temporomandibular joint's movement should be thoroughly examined. Alteration in mandibular movement may be indicative of temporomandibular joint arthropathy and neuromuscular imbalance of the head and neck.

## 3.2. Plain film radiography

It is still the most widely used modality for pre and postoperative implant assessment. Both periapical and occlusal radiographs are known to provide the best image details with minimal geometric distortion of all the available modalities. (frederiksen nl. 1995).

## 3.3. Periapical radiograph

Provide detailed information regarding the dimensions in length and height of available bone in small sections.they are indicated for single tooth replacement, but it is difficult to locate the inferior alveolar canal in the first molar region and correct positioning of film is difficult in edentulous region. They do not give information regarding the buccolingual dimension and this modality is limited by its 2d nature.[2]

## 3.4. Occlusal radiograph

Usually used in conjunction with the periapical radiographs and they show the buccolingual width between the extremes of buccal and lingual cortical plates.

## 3.5. Disadvantages

1. It fails to show the medial and lateral extent of cortical bone delineating the alveolar process as it displays only the extremes of the cortical plate.
2. This modality is limited by its 2d nature.

## 3.6. Panoramic radiograph

They display image slices through the jaws by producing a single image of the maxilla and mandible and their supporting structures in a frontal plane they display anatomic structures like nasal cavity, maxillary sinus, inferior alveolar canal and mental foramen and indicated when multiple implant placements are planned.

## 3.7. Disadvantages

The resolution is lesser when compared to intraoral radiograph.

1. A 10-20% image magnification occurs, which is non uniform. This magnification is undesirable for both implant selection and implant site assessments.
2. Geometric distortion and overlapping of images of teeth can occur.
3. Overlapping of anterior region by vertebral column occurs.(reiskin ab. 1998).

### 3.8. Cephalometric radiograph

It displays an image of the skull and facial bones in the mid-saggital plane.

1. It provides more accurately the information on inclination, height and width of alveolar bone at the midline, when compared to panoramic radiographs.(frederiksen nl.1995).

It provides information regarding the relationship of the jaws when image is taken with teeth in occlusion. Position and relationship of mental foramen, nasal fossa and maxillary sinus to the adjacent structures can be assessed.

### 3.9. Disadvantages

1. 6-15% image magnification occurs which leads to measurement errors of implant site.
2. Image resolution is less when compared to intraoral radiographs (potter bj, shrout mk 1997.

### 3.10. Digital radiography

It was first introduced in 1987 and became popular very soon. In this modality, the conventional film has been replaced by a 'charged couple device' (ccd).

1. It allows rapid acquisition of images.
2. Postacquisition enhancement is possible.
3. Ease of storage, retrieval and transmission of images to remote site from the database. (vandre rh, 1995).

## 4. Disadvantages

1. Digital radiography lacks the resolution of film radiography.
2. It has a much smaller active image area ($17 \times 26$ mm) when compared to iopa film ($32 \times 41$ mm).
3. There are very few studies on the use of this technique for presurgical site evaluation.

### 4.1. Computed tomography

Considering the new age tool, it blends the concept of thin layer radiography (tomography) with computer synthesis of image. It was first applied successfully in implantology in the 1980s. In computed tomography (ct), multiple thin axial slices at small distances are obtained through the jaws and data is reformatted with special software package to produce cross-sectional, panoramic and 3d images.

The ct always images entire arch, and normally is not used for single tooth replacements.

1. It can determine bone density in any region of the jaw.
2. The 3d image helps in accurately locating the vital structures.
3. Operator has an access to full range of contrasts.

4. It automatically calculates bone height and width in a specified region.
5. The information provided is a life size image, which is highly desirable for ease of measurements.(brookssl 1993).

### 4.2. Disadvantages

It is an expensive modality.

1. An expert radiologist required to interpret the image.
2. High radiation dosage when compared to conventional radiographic technique.
3. Patient's head position must remain constant throughout the entire imaging process of about 15-20 min.

### 4.3. Recent advances in computed tomography

1. Cone beam ct is a relatively newer modality. It uses a conical beam and reconstructs the image in any direction using special software. It gives all the information of a ct but, at 1/8th the radiation dose.
2. Microtomograph, another modification of ct is especially useful in acquiring serial sections of bone-implant interface. (senner 2003).
3. Multislice helical ct offers higher accuracy of images when compared to ct.[5]

### 4.4. Periodontal treatment phase

The periodontal treatment phase is directed towards obtaining optimal health for the patient's periodontium as well as potential implant sites. The patients with periodoniitis. Root planning and scaling indicated. Osseous surgery may be indicated for deeper osseous defects. Mucogingival surgery can be done during the initial periodontal phase to obtain adequate attached keratinized gingiva. Esthetic periodontal surgery can be performed to enhance tissue contours. In an atrophied maxilla a soft tissue graft is considered following itmplant insertion.

### 4.5. Edentulous ridge

The edentulous area present in the patient's mouth is further evaluated. Classification of is described by misch and judy describing edentulous ridge as division—a bone is greater than 5 mm in width and over 10 mm in length. It is adequate in all dimensions and root form implants are usually the implant of choice. Division-b bone is between 2.5 mm and 5 mm in width. A division c ridge is and either lacking in height (c-h) or have inadequate width (c-w) to place a root form implant. The division-d ridge is severely atrophied and is the most challenging to restore prosthetically.

*4.5.1. Implant dentistry: a multidisciplinary approach*

Dental implants are one of the options available to replace missing teeth. The long-term success of any dental implant treatment is influenced by several factors including patient factors, preventative measures used by the patient, esthetics, surgical factors, periodontal factors, restorative factors and mechanical factors of the implant system. Dental implants are placed and restored by specialists as well as general dental practitioners with differing levels of training in dental implantology. Therefore, it becomes very important for the main clinician in charge of the implant patient to be aware of the multidisciplinary approach that is required to ensure long-term implant success. [3]

## 5. Conclusion

Long-term success of dental implant treatment is dependent on good case selection, detailed patient assessment and implementation of a multidisciplinary approach

## 6. Source of Funding

None.

## 7. Conflict of Interest

None.

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