Review Article

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A NEW CONCEPT OF MANAGEMENT OF INTRACANAL SEPARATED INSTRUMENT BY ELECTROCHEMICAL DISSOLUTION: A REVIEW

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ABSTRACT:

The ideal goal of modern dentistry is to restore the patient to normal contour, function, comfort, esthetics, speech and health.A major challenge for prosthodontists is the management of edentulous state and the constant desire of patient for fixed prosthesis. Though the science of restoration of missing teeth is as old as 300 BC with the Egyptians employing a variety of methods to secure the prosthetic teeth, the successful replacement of lost natural teeth by dental implant is a major advance in dentistry. What makes implant dentistry unique is the ability to achieve the ideal goal regardless of the atrophy, disease or injury of the stomatognathic system. However, the more teeth a patient is missing, the more challenging this task becomes. As a result of continued research, diagnostic tools, treatment planning, implant designs; materials, and techniques, predictable success is now a reality for the rehabilitation of many challenging clinical situations.

Keywords: Implant osseointigration, Implant success, Implant failure, Implant survival.

INTRODUCTION:

Dental implants are an ideal option for people in good general oral health who have lost a tooth or teeth for the rehabilitation of many challenging clinical situations.[1] Dental implants are biocompatible metal anchors surgically positioned in the jaw bone to support an artificial crown where natural teeth are missing.

In 1969, Branemark et al published landmark research, and documented the successful Osseointegration of endosseous titanium implants. Since then, these methods for surgical placement of dental implants have had a profound influence on the practice of dentistry.

A successful implant is defined as an osseointegrated dental implant that is successfully restored and contributing to the functional success of a dental restorative treatment or one that could be used for such purposes. An implant failure is defined as a dental implant that is not fulfilling this criterion. Early failure refers to an implant that fails to osseointegrate before second-stage

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surgery or uncovering of the implant.Late failure refers to loss of osseointegration or mechanical failure of an implant after second-stage surgery. Most research on the success of dental implants concentrates on the first few years after placement. Research to date suggests that when implants do fail, they tend to do so soon after placement, and the likelihood of failure decreases from the time of implantation through 5 years post surgery.

Implant treatment has a high success rate that has been rated as high as 95 to 99%,[2]despite high success rate with endosseous titanium implants, failures unavoidably occur. At early stage, lack of primary stability, surgical trauma, peri operative contamination and occlusal overload seem to be the most important causes of implant failure.[3]The microbiological component plays an important role in encouraging and facilitating implant infection during implant placement, and also later when the implant is in function in the mouth, which is a septic medium.[4]

Many causes have been studied on the subject of implant failures. Implant failure can occur at any time during treatment and subsequently when the implant is in function. Implant placement is contraindicated in many cases because the failure rate increases sharply, sometimes jeopardising oral health and even the patient's general state of health. If there is no contraindication for undergoing the treatment, studies of implant failure reveal two main causes of failure: infection and occlusal overload, The first is associated with the phase prior to placing the implant in situ, in direct relation with surgery, and the second is associated with implant function following prosthodontic rehabilitation. The latter also involves an infectious component that is encouraged by microfractures in the bone and the appearance of peri-implant pockets, with a clear infectious component.[5]We should neither fear nor embrace failure.

CLASSIFICATION OF IMPLANTS

Dental implants may be classified under four categories: [6]

A - Depending on the placement within the tissues

B - Depending on the materials used

C - Depending on their reaction with bone

D - Depending on the treatment options

a - depending on the placement within the tissues -

1. Endosseous
2. Subperiosteal
3. Transosteal

b - depending on the materials used –

1.metallic implants – Titanium, Titanium alloy, Cobalt Chromium.

2.non- metallic implants – Ceramics, Carbon etc.

c - depending on their reaction with bone –

1.bioactive implants – Hydroxyapatite

2.bio-inert implants – metals

d - depending on the treatment options

Misch in 1989 reported five prosthetic options of implants, of the five the first three are fixed prosthesis that may be partial or complete replacements, which in turn may be cemented or screw retained. The fixed prosthesis are classified based on the amount of hard and soft tissue structures that are to be replaced. The remaining two are removable prosthesis that are classified based on the support derived.

FP- 1: Fixed prosthesis

Replaces only the crown; looks like a natural tooth.

FP- 2: Fixed prosthesis

Replaces the crown and a portion of the root; crown contour appears normal in the

occlusal half but is elongated or hypercontoured in the gingival half.

FP- 3: Fixed prosthesis

Replaces missing crowns and gingival color and portion of the edentulous site;prosthesis most often uses denture teeth and acrylic gingival, but may be made of porcelain, or metal.

RP-4: Removable prosthesis

Overdenture supported completely by implant.

RP-5: Removable prosthesis

Overdenture supported by both soft tissue and implant.

SUCCESS CRITERIA FOR DENTAL IMPLANTS

On 5th October,2007, a Pisa, Italy Consensus Conference modified the James–Misch Health Scale and approved 4 clinical category that contain conditions of implant success, survival, and failure.

Survival conditions for implants may have 2 different categories:[7]

a)satisfactory survival: Implant with less than ideal conditions, yet does not require clinical management

b)compromised survival : Implants with less than ideal conditions, which require clinical treatment to reduce the risk of implant failure.

Health scale given by International Congress of Oral Implantologists pisa based on clinical evaluation is as-

i. success (optimum health) -

a) No pain or tenderness upon function

b) No mobility

c) 2 mm radiographic bone loss from initial surgery

d) No exudates history

ii. satisfactory survival –

a) No pain on function

b) N0 mobility

c) 2–4 mm radiographic bone loss

d) No exudates history

iii. compromised survival –

a) May have sensitivity on function

b) No mobility

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

d) Probing depth 7 mm

e) May have exudates history

iv. failure (clinical or absolute failure) any of following:

a) Pain on function

b) Mobility

c) Radiographic bone loss 1/2 length of implant

d) Uncontrolled exudate

e) No longer in mouth

REVISED CRITERIA FOR IMPLANT SUCCESS

ALBERKTSON, ZARB, WASHINGTON, AND ERICKSON-

I. Individual unattached implant that is immobile when tested clinically.

II. Radiograph that does not demonstrate evidence of peri-implant radiolucency.

III. Bone loss that is less than 0.2 mm annually after the implant's first year of service.

IV. Individual implant performance that is characterized by an absence of persistent and/or irreversible signs and symptoms of pain, infections, necropathies, paraesthesia, or violation of the mandibular canal.

In content of criteria mentioned, a success rate of 85% at the end of a 5-year observation period and 80% at the end of 10-year observation as a minimum criterion for success.[8]

Further, in 1998 ***Esposito et al***[8][9] have listed out the following various criteria for success which were agreed upon at the 1st European Workshop on Periodontology.

- Absence of mobility
- An average radiographic marginal bone loss of less than 1.5 mm during the first year of function
- Less than 0.2 mm annually thereafter

- ✠ Absence of pain/parasthesia

CLASSIFICATION OF IMPLANT FAILURE

I. ***Esposito et al*** [8][9] classified implants according to the Osseointegration Concept:

   - Biological
   - Mechanical
   - Iatrogenic
   - Inadequate patient education

biological –A biological failure can be defined as the inadequacy of the host tissue to establish or to maintain osseointegration, It is of two types:

- ***Early or primary (before loading):*** failure to establish osseointegration.
- ***Late and secondary (after loading):*** failure to maintain the achieved osseointegration.

mechanical –

- Fracture of implants, connecting screws, bridge frameworks, coating etc.

iatrogenic –can be defined as one characterized by a stable and osseointegrated implant, but due to malpositioning,

- Nerve damages, wrong alignment of implants, etc.

inadequate patient adaptation – Phonetical, esthetical, psychological problems, etc.

PROSTHETIC FACTORS IN IMPLANT FAILURE

Once the initial healing period has occurred, osseointegration then depends on proper prosthetic design, regular hygiene and maintenance of the implant and the prosthesis.[1]

a - forces on implants –

Implants and implant components tolerate vertical forces well but not lateral bending forces. It is demonstrated that bending elevate stress to implant and bone and should be minimized whenever possible. In designing the cantilever length of an edentulous fixed bridge in the mandible, for instance one looks at a number of factors. The length of the implants, the quality of the bone, the number of implants, the opposing occlusion and the occlusal habits of the patient are all important but perhaps the most important is the anterior and the posterior spread of the implants.

When a patient has occlusion on the cantilevered portion of the edentulous fixed bridge although the forces are vertical in nature, a fulcrum line is established through the distal most implants. This is identical to the situation in which a patient has occlusion on the distal extension bases of a distal extension removable partial denture. With an implant supported fixed bridge, the cantilever suction is compressed

towards the tissue, whereas the bridge anterior to the distal most implant has tension occlusally. Bending results through the fulcrum line that passes through the distal most implant.[10]

b - geometric load factors –

Increased bending exerted on implants has been identified and the term bending overload has been proposed as a major risk factor for implant and implant component failure.

The number and position of implants define the geometric support capacity for the prosthesis. Geometric load factors that can compromise the support and result in increased bending overload include –

1. Fewer than three implants.
2. Implants connected to teeth
3. Implants in a line
4. Cantilever extension
5. Occlusal plane beyond the implant support in buccal or lingual cantilevering and
6. Extensive crown: implant ratio.

Most complications occurred on the two implant restorations in which bending overload was present. The inline arrangement led to loose screws, broken screws, increased bone loss and implant failure. Overloading of an implant may lead to marginal bone resorption. Once bone resorption exceeds three threads the weaker portion of the implant below the abutment screw engagement is exposed and an increase in overload of the implant occur. The type of bone loss seen in this situation is described as " cupping ". This cupping pattern is a rounded radiographic appearance of bone loss rather than a more horizontal or vertical straight line bone loss.This unique bone loss develops during this period on which the fracture occurs and is a reaction to percolation to inflammatory infiltrate from repeated micro-opening of initial fatigue cracks. When this type of bone loss is noted one should be suspicious that fracture has occurred or is occurring and any potential reason for overload should be examined. To avoid this overloading it is recommended to place three implants when a three unit restoration is planned. Three implants are the treatment of choice. This simple example is that of a stool. If one stool has two legs, there is no resistance to bending, the stool with three legs contains the tripod effect with its resistance to bending. This tripod effect is so advantageous in the implants restoration that sometimes three implants are planned when only two teeth are to be placed. The bending moment on a three implant restoration can be reduced 20% to 60%. If there is an offset between the implants of 2 to 3 mm.Thus in order to maximize the chance for success and minimize the chances for complications and failure, the placement of three implants for the establishment of a tripod effect is a sound approach for replacing three or

more and sometimes two or more teeth in a partially edentulous patient. In area of poor quality of bone we often go beyond the tripod whenever possible. In other words when replacing four teeth in the posterior maxilla four implants actually is recommended if possible.[1]

c - crown implant ratio -

Crown implant ratio varies for totally edentulous patient from that of the partially edentulous. Lateral forces on a restoration with a large crown implant ratio are much better tolerated in a full arch restoration and are not tolerated well or at all in a partial edentulous patient with the same ratio. When a unilateral implant restoration is to be fabricated in a partially edentulous patient who has undergone significant resorption in the area, rebuilding the missing tissues with augmentation procedures should be considered the treatment of choices before placing and restoring implants.

d - occlusal design -

Besides the placement of three implants for a tripod support system there are other considerations for minimizing the potentially damaging bending forces. Narrow occlusal tables minimize bending by preventing the forces from being too far beyond the fulcrum line. For instances, the further facial and buccal cusps are placed on a mandibular implant restoration, the further they are cantilevered from the fulcrum line and more bending is introduced. Although it is important to place the centric contacts directly over the implants, often eliminating tooth to tooth contacts on the mandibular buccal cusps. Tooth to tooth contacts are not necessary to apply forces. Thus, the narrower the occlusal table or the closer the buccal cusps are to the buccal seating surface of the restoration, the smaller the bending moments are when those buccal cusp function.

Lateral forces on an implant restoration introduce bending moments, therefore it is important to establish centric contact over the implants but not lateral contacts. The remaining natural teeth should provide the lateral guidance if only two implants are present the occlusal design should include narrow occlusal tables, have centric contacts only, centralize the centric contact over the implants as much as possible and keep the cuspal inclination as flat as possible.In order to centralize the centric contacts as directly over the implants as possible to minimize bending in a posterior mandibular implant restoration one can design a lingulized occlusion in which the maxillary lingual cusps contact the mandibular central fossa with no mandibular buccal cusp contacts.

It is also important to note that even when a nice tripod is established, attempts still should be made to minimize bending. The occlusal table should be designed in a relatively narrow manner. The centric contacts should be located as directly over the implants as possible the cuspal indentions should be relatively flat and if the remaining

natural teeth can provide the lateral guidance then the implants restoration should provide only centric contacts. One occlusal load factor that perhaps by itself should prevent the consideration of implant treatment is bruxism. It is difficult, if not impossible, ever to control the occlusal forces of these patients or to maintain a constant occlusal scheme that could be protective of the implant restoration.[1]

e- strategic extraction-

When planning implants in a certain area to replace missing teeth, one always considers carefully the condition of the adjacent remaining teeth. By strategically extracting the compromised adjacent tooth, not only does one eliminate the potential for more dental treatment in the near future but one also improves the support design of the implant restoration by placing more implants and providing on the tripod effect on occasion, the extraction of a tooth does not necessarily depends on the health of the tooth but rather on the overall rehabilitation provided.

f - tooth implant connection-

Two problems of connecting implants to teeth have been documented. First of a rigid structure like implant is connected to a non-rigid structure (tooth) the more mobile of the two may act like a cantilever and result in the application of increased load to the rigid structure. Second if a non-rigid connector is used there is a tendency for the teeth to intrude with this intrusion there is a much greater risk of bending overload because any potential support by the natural tooth is lost. Certainly there have been numerous connection design such as rigid attachments, non-rigid attachments and telescopic copings, but due to the differences in the support system it is still recommended to avoid the potential load factor risk if at all possible.

The best solution is to design the implant restoration to be fully implant supported and to place an adequate number of implants in the proper positions. Connecting an implant to a natural tooth to help the implant is not practical because any implant that needs the help of natural tooth probably should be removed.[1]

CONCLUSION:

Implant Failures that do occur may be related to patient variables, design and manufacturing of implants compositional structure of implants, certain design feature, skills of the restorative and surgical members of the team and so on. Starting knowledge of the surgical and prosthetic possibilities for each of the team providers is of great benefit in treatment and towards prevention. When an implant fails, a tailor made treatment plan should be provided to each patient according to all relevant variables. Patients should be informed regarding all possible treatment modalities after implant failure and give their consent to the most appropriate

treatment option for them. The first 2 years after implant placement appear to be the most critical in determining whether any implant will be successful. The use of osseointegrated implants as a foundation for the prosthetic replacement of missing teeth has become widespread in the last decade.

Owing to the remarkable success of dental implants, there has been growing interest in identifying the factors associated with implant failure. The majority of the past and current literature implicates smoking as one of the prominent risk factors affecting the success rate of dental implants. Smoking also has a strong influence on the complication rates of implants: it causes significantly more marginal bone loss after implant placement, it increases the incidence of peri-implantitis and affects the success rates of bone grafts. The failure rate of implants placed in grafted maxillary sinuses of smokers is again more than twice that seen in nonsmokers. Use of oral bisphosphonate at the time of implant placement was associated with dental implant failure. Specifically, the odds of reporting use of bisphosphonates among women with implant failure were almost three times greater than among their counterparts without implant failure. While the association between oral bisphosphonate use and dental implant failure did not vary by implant length, there was evidence that this association may be stronger in the maxilla than in the mandible. Systemic diseases also limits the application of dental implant therapy. An increased knowledge of the underlying disease process has improved the management of patients suffering from bone metabolism abnormalities, diabetes mellitus, xerostomia, and ectodermal dysplasias etc and helps to reduce failure rates in dental implant therapy.

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