

## COMPLICATIONS IN DENTAL IMPLANTS: A REVIEW

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### ABSTRACT:

Since a Medline and an extensive hand research were performed in English language publications beginning in 1981, the phenomenal evolution of dental implant prosthesis has attracted many concerns leading to a debate. Despite the widespread implementation and acceptance of this treatment modality, there is a paucity of available scientific data identifying types and frequency of complications, as well as risk factors associated with implant complications. This was subsequently stated by Avivi Arber and Zarb, who concluded that "Extensive long-term implant studies are needed to determine which specific criteria comprise optimal functional and esthetic results with minimum risk of morbidity." Complications and failures are part and parcel of any clinical discipline, as science never provides 100% results. Despite the long-term predictability of implants, however, biologic, technical and esthetic complications do occur in some percentage of cases.

Keywords: Function, Esthetics, Risk, Failure.



### INTRODUCTION:

If one considers "success" as the outcome without any adverse effects or problems, "implant success" should be defined as any implant-retained restoration in which (1) The original treatment plan is performed as intended without complications, (2) All implants that placed remain stable and functioning without problems, (3) Periimplant hard and soft tissues are healthy, and (4) Both the patient and the treating clinician(s) are pleased with the results. When strict criteria are used, implant success (i.e; absence of complications) is projected to be only about 61%.<sup>[1]</sup> "Implant survival," on the other hand, is simply defined as any implant that remains in place at the time of evaluation, regardless of any untoward signs,

symptoms, or history of problems. Clearly, there is a difference between implants that are present and functioning under an implant-retained restorations and implants that are present but not connected to any restoration (not functioning). These latter implants are sometimes referred to as "sleepers" and should not be considered successful merely because they are present and remain osseointegrated. Rather, these sleeper implants should be included in the discussion as "surviving" but counted as "failures" because they failed to fulfill the originally intended treatment.<sup>[2]</sup>

A review of articles identified through the Medline research from 1981 to 2007, focus on publications, that contain clinical data regarding success, failure and complications in dental implants the complications were

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divided into following categories- surgical, implant loss, bone loss, periimplant soft tissue, mechanical, and esthetics & phonetics. The raw data combined from multiple studies and means calculated to identify trends noted in the incidence of complications.<sup>[3]</sup>

The most complications (those with >15% incidence) were loosening of overdenture mechanism (33%), implant loss in irradiated maxillae (25%), hemorrhage related complications (24%), resin veneer fracture with FPD (22%), implant loss with maxillary overdentures (21%), overdentures needing to be relined (19%), implant loss in type IV bone (16%) and overdenture clip attachment fracture (16%).

The key to minimize implant-related complications is to understand the causes and plan cases so that known implant complications and failures associated with endosseous dental implants and the retained prosthetic appliances are avoided or minimized. As dental implant is spreading its feather at a rapid pace, we are the prosthodontists at cross roads, to analyze its various pros and cons.<sup>[4]</sup>

## CLASSIFICATION OF DENTAL IMPLANT COMPLICATOINS:

### I) SURGICAL COMPLICATIONS

#### (A) Hemorrhagic complications

(a) According to type of injury to blood vessels:

- Transection
- Laceration (Fig 1)

- Contusion
- Spasm
- Arterio-venous fistula.

(b) Post-operative complications in subperiosteal implants.

-Short term complications-: Incision line opening. (Fig 2)

-Intermediate complications-: Swelling of lateral mandible.

-Long term complications-:

- (i) Posterior bone loss. (Fig 3)
- (ii) Tenderness and/or swelling.
- (iii) Purulent exudates.

(c) During Maxillary sinus lift and sinus graft surgery

Membrane Perforation (Fig 4)

Short term complications

- Bleeding from nose
- Intra oral swelling in region of access window

Long term complications

- -Oro antral fistulae (Fig 5)
- -Allergic rhinitis
- -Cyst arising in maxillae

(d) Iliac crest grafting complications

- Neurological problems arising out of injury to lateral femoral cutaneous nerve.

**(B) Neuro sensory Disturbances**

- Anaesthesia
- Paresthesia
- Dys-esthesia

**(C) Mandibular fracture (Fig 6)**

**(D) Air-embolism Occurrence**

**(E) Adjacent Tooth Devitalisation/Damage (Fig 7)**

**(F) Implant Displacement into Mandibular Canal. (Fig 8)**

**(G) Singultus/hiccups**

1. Involvement of CNS:- Due to neoplasms, hydrocephalus, ventriculoperitoneal  
a. shunts and multiple sclerosis
2. Involvement of PNS:- Irritation of vagus nerve along its course
3. Other causes:- Toxic, Metabolic, Pharmacologic.

**II) SYSTEMIC COMPLICATIONS**

1. Effect of Irradiation
2. Complications in Diabetic Population
3. Chemotherapy Complications due to cytotoxic drugs

**III) BIOLOGICAL/PERIODONTAL COMPLICATIONS**

**1) Inflammation and Proliferation of periimplant soft tissues:** Inflammation in periimplant soft tissues has been found to be similar to the inflammatory response in

gingival and other periodontal tissues. Not surprisingly, the clinical appearance is similar as well. Inflamed peri-implant tissues demonstrate the same erythema, edema, and swelling around teeth. Occasionally, however, the reaction of periimplant soft tissues to bacterial accumulation is profound, almost unusual, with a dramatic inflammatory proliferation.(Fig 9)

This type of lesion is somewhat characteristic around implants and is indicative of either a loose-fitting implant to abutment connection or trapped excess cement that remains buried within the soft tissue space or "pocket." The precipitating local factor ultimately becomes infected with bacterial pathogens, leading to mucosal hypertrophy or proliferation and possible abscess formation. Correction of precipitating factors (e.g; loose connection, excess cement) quickly and effectively resolves the lesion. Another type of lesion resulting from a loose abutment connection is the fistula. Again, correcting the etiologic factor quickly resolves the fistula [5, 6].

**2) Dehiscence and Recession :** It occurs when support for those tissues is lacking or has been lost. Recession is a common finding after implant restoration and should be anticipated especially when soft tissues are thin and not well supported. This problem is particularly disconcerting in anterior esthetic areas. Patients with a high smile line or high esthetic demands will consider such recession as a failure.

The anatomy and soft tissue support around implants is different than that around teeth. Specifically, periodontal

tissues have the distinct advantage of soft tissue support from circumferential and transeptal connective tissue fibers that insert into the cementum above the level of crestal bone. In absence of inflammation, these fibers support periodontal soft tissues far above the level the crest of bone. As a result, gingival margins and interdental papillae are supported and maintained around teeth even when the periodontal tissues are very thin. Periimplant soft tissues, on the other hand, are entirely dependent on surrounding bone for support. Soft tissue thickness accounts for some soft tissue height, but there are no supra-crestal inserting connective tissue fibers to aid in soft tissue support around an implant. Therefore, soft tissue height around implants typically does not exceed about 3 to 4 mm, and bone loss around implants often leads to recession [7]. (Fig 10)

### 3) Periimplant mucositis/ Periimplantitis:

A periodontitis like process, periimplantitis, can affect dental implants, and because untreated periodontitis may ultimately lead to loss of natural teeth, similarly, periimplantitis can result into loss of implants. Substantial evidence supports bacterial plaque as the primary etiologic factor in loss of both teeth and implants. Clinical findings include marked gingival inflammation, deep pocket formation, and progressive bone loss. The term periimplantitis is used to describe the bone loss around an implant. This may be stress induced, bacteria induced or combination of both. Early crestal bone loss around implant, beyond the abutment connection is seldom caused by bacteria. It is usually

the result of stress factors too great for the immature, incompletely mineralized bone implant interface. Surprisingly, stress induced bone loss occurs without bacteria is the primary cause of periimplantitis and subsequent implant failure. However, once the bone loss from stress or bacteria deepens the sulcular device and decreases the oxygen tension, anaerobic bacteria may become the primary promoter of the continued bone loss [8, 9].

Periimplant mucositis: It's a term used to describe reversible inflammatory reactions in the mucosa adjacent to an implant. Early microbial colonization on titanium implants followed the same patterns as that on teeth. The lesions in the gingival and in the periimplant mucosa increase in size in a similar manner during the 3 weeks of experiments. In other words, in a given individual, encapsulating plaque associated lesions. [8]

“Periimplantitis”-: It is defined as an inflammatory process affecting the tissues around an osseointegrated implant in function, resulting in loss of supporting bone. [9]

## IV) PROSTHETIC COMPLICATIONS

### 1. Mechanical/technical complications (In order of frequency)

- a. Resin veneer fracture of fixed partial dentures
- b. Overdenture loss of retention /adjustment
- c. Need for overdenture relines

- d. Overdenture clip/attachment fracture
- e. Porcelain veneer fracture of fixed dentures
- f. Overdenture fracture
- g. Acrylic resin base fracture
- h. Prosthetic screw loosening
- i. Abutment screw loosening
- j. Prosthesis screw fracture
- k. Metal framework fractures
- l. Abutment screw fractures
- m. Implant fractures

## 2. Prosthetic Complications due to bone loss

## 3. Complications in fixed detachable prostheses

### SCREW LOOSENING AND FRACTURE

Technical or mechanical complications occur when the strength of materials is no longer able to resist the forces that are being applied. As materials fatigue, they begin to stretch and bend; ultimately, depending on the applied forces, they will fracture (Fig 12). Material failures, in turn, lead to prosthetic complications such as loose, broken, and failed restorations.

The most common complications reported in literature is loosening or fracture of abutment and occlusal screws. Some authors found that the rate of abutment screw loosening or fracture exceeds that of occlusal screws, but the frequency of

problems with occlusal screws was also high. The prosthesis-retaining (occlusal) screw is intended to be the weak point of the implant/abutment/prosthesis assembly. Some believe that this “weak link” is a design feature that allows failure of less critical occlusal screw before the abutment or implant is stressed to failure [10,11,12]

### ABUTMENT SCREW FRACTURE-

Component fractures usually present as mobility of the prosthesis, and the patient seeks prosthodontic instead of surgical evaluation. Of particular concern is abutment screw fracture, which can be a serious problem. (Fig 13)

If the abutment screw breaks at the O-ring, a common occurrence, the remainder can easily be retrieved. However, if the fractured abutment screwed is buried within the internal threads of fixture, it may be unretrievable. The osseointegrated fixture may be destined for non-use and buried beneath the mucosa. A fixed tissue-integrated prosthesis may need to be changed to a tissue bar with an over-denture as a final restoration.

### IMPLANT FRACTURE:

The ultimate mechanical failure is implant fracture because it results in loss of implant and possibly the prosthesis. Furthermore, removal of a fractured implant will create a large osseous defect. Factors such as fatigue of implant materials and weakness in prosthetic design or dimension are the usual causes of implant fractures (Fig14). Balshi listed three

categories of causes that may explain implant fractures;

- (1) Design and material
- (2) Non passive fit of prosthetic framework
- (3) Physiologic or biomechanical overload.

Patients with bruxism seem to be at higher risk for such events and therefore need to be screened and informed accordingly. <sup>[13]</sup>

#### **FRAMEWORK FRACTURE:**

Framework fractures occur because of (1) inadequate thickness of the metal framework or (2) poor solder joints (Fig 15). The fractured framework will produce slight mobility of the prosthesis, cause excessive lateral forces on abutments and may be accompanied with a fractured abutment screw. To minimize the buccolingual width of the prosthesis and neutral space required for the gold cylinders, it is common to thin the framework to make it as small as possible. Adequate metal must be provided to support each cylinder with additional thickness of metal distal to the terminal fixture.

Metal commonly used for a tissue-integrated prosthesis are alloys of silver palladium, which are strong, light in weight, and cast well into gold cylinders. The high melting point of silver palladium alloys challenges even the experienced technician. A one-piece casting is preferred over solder casting.

## **V) ESTHETIC AND PHONETICS COMPLICATIONS**

### **Esthetic complications:**

High smile line with short lip

- High esthetic demand
- Exposure of metal abutment due to lack of hard and soft tissue support.
- Un-esthetic profile due to implant placement too apical, buccal and/or interproximal.

Esthetic complications arise when expectations are not met. Patient satisfaction with the esthetic outcome of implant prosthesis will vary from patient to patient depending on a number of factors. As mentioned earlier, the risk for esthetic complications is increased for patients with high esthetic expectations and less-than-optimal patient related factors (e.g; bone quantity and quality). In addition to the actual appearance of the final restoration, individual perceptions and desires will be more or less accepting of the results. Esthetic complications result from poor implant placement and deficiencies in existing anatomy of the edentulous sites that were reconstructed with implants. (Fig 16)

Implant placement in the esthetic zone requires precise three-dimensional tissue reconstruction and ideal implant placement. This reconstructive procedure enables the restorative dentist to develop a natural emergence profile of the implant

crown. If the amount of available bone does not allow for ideal implant placement, and, if the implant is placed too apical, buccal or interproximal, a prosthetic profile will be developed with unesthetic dimensions. The same is true if a bone reconstruction procedure shows a compromised result and the implant is still placed, but in an inappropriate position.

### **Phonetic complications:**

Implant prostheses that are fabricated with unusual palatal contours (e.g; restricted or narrow palatal space) or that have spaces under and around the superstructure can create phonetic problems for the patient. This is particularly problematic when the full-arch, implant-supported, fixed restorations are fabricated for patients who have a severely atrophied maxilla. These patients are probably best served with an implant-assisted maxillary overdenture.

Numerous authors have addressed the audible speech changes present with initial placement of maxillary complete denture. Emphasis has been placed on correct positioning of anterior teeth, proper placement of premolars and molars, and proper lingual and palatal contour of the denture base. Palatograms have been used to assess changes in lingual denture base contours.

Treating a patient for implant reconstruction involves converting a maxillary complete denture into a patient with a fixed-tissue-integrated prosthesis. The elimination of the palatal denture base and the addition of new contours representing the thickness of gold cylinder

and surrounding the metal framework often present new speech complications. Excessive air flow beneath the metal framework, excessive saliva, and alteration of tongue function are reasons for these speech changes.

Minimizing speech problems involves planning the spacing of fixtures more than 7 mm apart to allow for ridge contact of the metal framework between fixtures and ridge lip of the acrylic resin flange. With minimum ridge resorption, modified abutments with a cemented porcelain-fused-to-metal restoration will generally satisfy esthetic and speech expectations. Speech problems usually related to the amount of ridge resorption; the greater the ridge resorption, the greater the probability of speech difficulty. Some speech adaptation can be expected during earlier use. [14]

### **VI) ALLERGIC REACTIONS RELATED TO IMPLANTS:**

Allergy is a type of unpleasant reaction of human body to any kind of foreign material placed upon it. It varies from person to person and is different in different situations.

Allergies caused by metals have been increasing. The number of patients visiting dentists with the chief complaint of metal allergy has also been increasing, and following conclusions can be made: [15]

**(1)** The most common five elements acting on patients are Hg, Co, Ni, Cr, and Pd.

**(2)** The most frequently used elements of dental restoration metal materials are Zn,

Ag, Cu, Au, and Pd, and the alloy is Au-Ag-Pd alloy.

(3) The highest tendency of coincidence between allergen and intraoral metals were observed among Co-Cr-Ni alloys and Pd, Ni and Cr elements.

(4) In case of palmoplantar pustulosis, allergen metals tends to be the same as intraoral metal elements.

### CONCLUSION:

Probably the most common dental implant complication is iatrogenic. Be it infection, implant overload or periodontal considerations, it needs proper diagnosis and meticulous planning. The human mouth is cesspool and even with the greatest care to avoid contamination, the tissues around a newly inserted dental implant can become infected.

Another possible dental implant complication is overload. Until the bone heals around dental implant, the biting pressures should be reduced to protect the supporting bone while it builds up.

It has been hypothesized among implant practitioners that dental implant failure rate is higher in the maxilla than in the mandible. With the area of lowest failure rate being the anterior mandible and highest being the posterior maxilla.

The most commonly observed complications are inflammatory (10.2%), followed by prosthetic (2.7%) and operative (1.0%). However the silver lining is that, most of the implants (62%) associated with complications don't fail.

Multivariate Cox proportional hazards regression identified smoking, 1-stage implants, use of reconstructive procedures, and placement of implants as risk factors for complications.

As stated above hemorrhage related complications are most common among all. However, it remains for short term. Commonest among these is, incision line opening. This may occur mostly in smokers. Neurosensory disturbance may occur (7%) in some cases during surgical procedures. But it is normally transitory in nature, normal sensation likely to return within 1 year of implant surgery. Mandibular fracture is very rare (0.3%) during implant surgery.

Implant loss occurs mostly in maxillary overdentures (19%), as compared to maxillary fixed complete denture about 10%. The least amount of implant loss occurs in maxillary and mandibular single crowns (3%). Implant loss before implant placement is generally lesser than after implant placement. Implant loss in implant of more than 10mm length seems to be more successful than that of lesser length.

Systemic causes like smoking, radiation therapy, un-controlled diabetics, uncontrolled hypertension, and HIV-sero positive status have adverse impact on implant viability. Though it appears that osteoporosis, scleroderma, chemotherapy may have some effect on implant success, it is yet to be proven clinically.

Periodontal complications include fenestration and dehiscence (7%), gingivitis (6%), and fistulas (1%). Periimplantitis also



occurs which seems to need meticulous oral hygiene.

Mechanical/prosthetic complications include overdenture loss of retention/adjustment in 30% of cases. Esthetic veneer fracture followed suit constituting 22% of it. Implant fracture occurs rarely (1%).

Esthetics and phonetics complications do occur during implant placement. These may be avoided by taking precautionary measures. At times patient may try to manipulate the prosthesis as well as surgical sites due to compulsive behaviour. These patient related factors pose a threat even to implant even if the clinician does everything within rules.

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**FIGURES:**

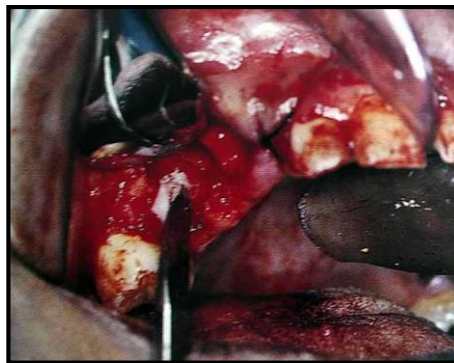


Figure 1: Arterial hemorrhage and its management.



Figure 2: Opening of the incisal lines.



Figure 3: Bone loss after insertion of the implant.

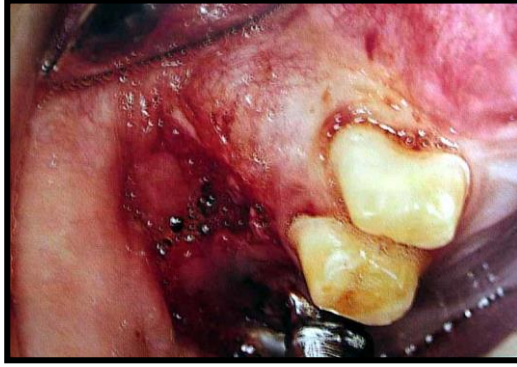


Figure 4: Membrane perforation during sinus graft surgery

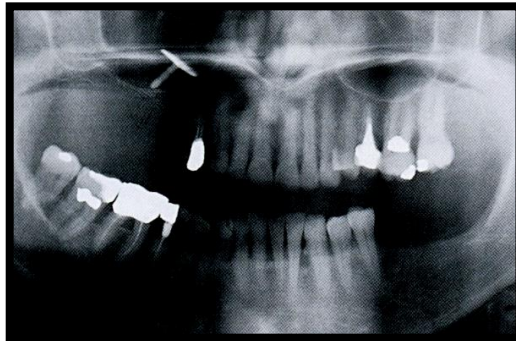


Figure 5 : Perforation of maxillary sinus

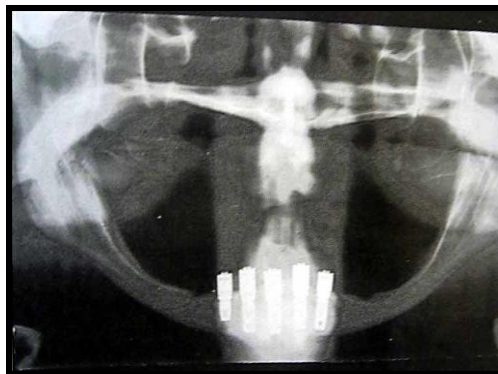


Figure 6 : Mandibular fracture after implant placement



Figure 7: Adjacent Tooth Devitalization/Damage

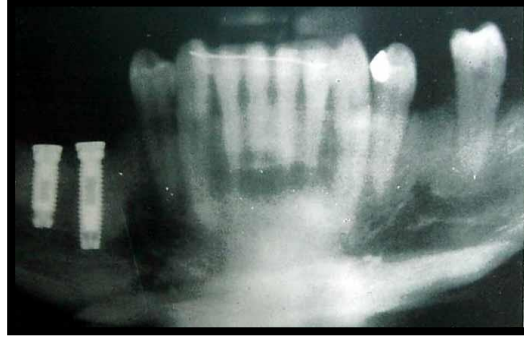


Figure 8 : Violation of mandibular canal after implant placement.

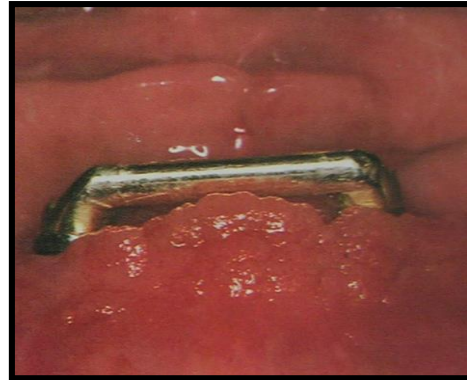


Figure 9 : Gingival inflammation and proliferation evident after implant placement.

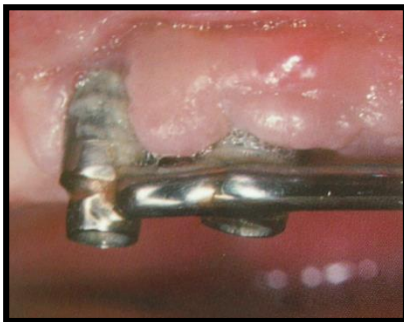


Figure 10: Dehiscence and recession seen after implant placement



Figure 11: Inflammatory Reaction of Mucosa

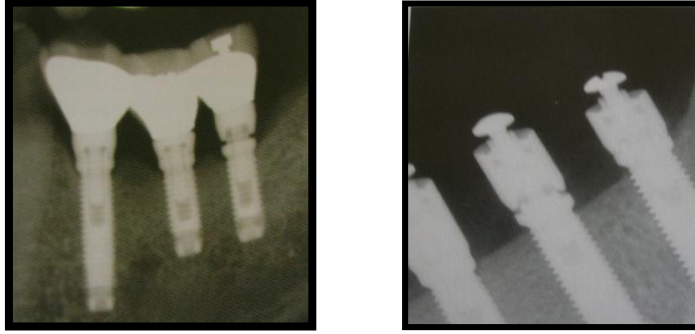


Figure 12: Abutment screw loosening.

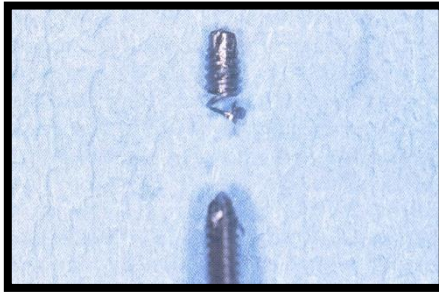


Figure 13: Fractured prosthesis retaining screw

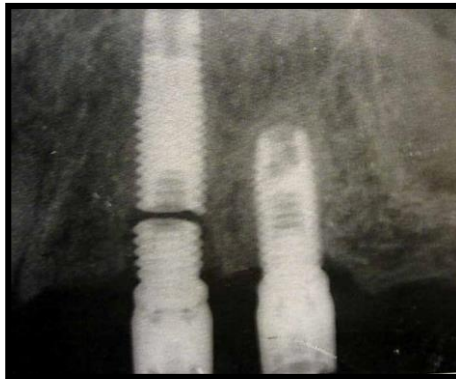


Figure 14: Implant Fracture

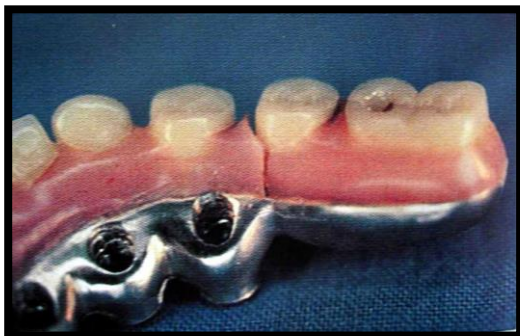


Figure 15: Framework fracture



Figure16: Esthetic Complications after implant placement.