Journal Homepage: -www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI:10.21474/IJAR01/19797
DOI URL: http://dx.doi.org/10.21474/IJAR01/19797

RESEARCH ARTICLE

COMPLICATIONS IN IMPLANT DENTISTRY

Dr. Kumar Kartikey[1] and Dr. Payal Sarkar[2]

1. Post Graduate Student, Department of Periodontology, Divya Jyoti College of Dental Sciences & Research, Ghaziabad, Uttar Pradesh, India.
2. Pediatric Dentist, MDS, Department of Pediatric& Preventive Dentistry, Divya Jyoti College of Dental Sciences & Research, Ghaziabad, Uttar Pradesh, India.

Manuscript Info

Manuscript History
Received: 30 August 2024
Final Accepted: 30 September 2024
Published: October 2024

Key words:-
Dental Implants, Osseointegration, Biological Complications

Abstract

In dentistry, quest for newer techniques are never ending. One such newer technique is Dental Implant which has been introduced to obtain maximum benefits for good clinical performance.Dental implants made of titanium with threads are inserted into the bone during a surgical procedure.After a healing period, the implant is osseointegrated and ready for loading and function as a dental unit. Biological complications, such as biofilm-induced inflammatory bone loss, that affect osseo-integrated dental implants have become more prevalent with the increasing number of implant carriers, which is a challenge in clinical practice.Dental Implants is a promising technique for replacement of lost tooth structure, however it comes with some complications that can be overruled only when dentists have proper knowledge about it. Thus this article discuss about various complications associated with Dental Implants.

Introduction:-

Tooth structure can be lost due to decaying, trauma, pathologic exfoliation or due to poor oral hygiene, they need to be replaced with prosthesis for proper functioning of the oral cavity.Dental implants are currently a standard treatment for replacing missing teeth and titanium implants are also used to anchor orthopaedic and facial prosthesis. Dental implants made of titanium with threads are inserted into the bone during a surgical procedure.[1]

Osseo-Integration–

The term osseointegration was introduced by **Per-Ingvar Brånemark**in **1977.**[2,3]**According to GPT-8**osseo-integration is defined as**" the apparent direct attachment or connection of osseous tissue to an inert, alloplastic material without intervening connective tissue"**[2]

Biological complications, such as biofilm-induced inflammatory bone loss, that affect osseo-integrated dental implants have become more prevalent with the increasing number of implant carriers, which is a challenge in clinical practice. Clinical experiences and implant survival studies from 15 years of treatingpatients with osseointegrated dental implants showed that 89% of implants in the maxillary bone were stable and 100% of implants in the mandible were stable after 5 to 9 years.[4]Studies have also documented the association of complications with surgical implant procedures and prosthetic rehabilitation. Management of complications can be challenging and often requires a combination of surgical and prosthetic approaches.

Corresponding Author:-Dr. Kumar Kartikey
Address**:-**Post Graduate Student, Department of Periodontology, Divya Jyoti College of Dental Sciences & Research, Ghaziabad, Uttar Pradesh, India.

Discussion:-

Dental implant complications can be classified as follows -:

Classification

- **Early-stage complications**

1)Infection2)Edema 3)Ecchymoses and haematomas 4)Emphysema 5)Bleeding 6)Flap dehiscence 7)Sensory disorders

- **Late complications**

1)Perforation of the mucoperiosteum 2)Maxillary sinusitis 3)Mandibular fractures 4)Failed osseointegration 5)Bony defects 6)Periapical implant lesion

- **Complications in Implantology can be sub divided into following headings-**

1)Soft Tissue Complication **2**) Hard Tissue Complication**3**) Surgical Complication**4**)Mechanical Complication

Soft Tissue Complications

Three types of soft tissue complications may develop around dental implants and represent an everyday clinical challenge, namely, **lack of attached mucosa, volume deficiency, and peri-implant mucosal recession.** A deficient band of attached tissue around implants is associated with more plaque deposition, mucosal inflammation (assessed by bleeding on probing), occurrence of soft tissue recession. Soft tissue volume refers to the vertical and horizontal thickness of the peri-implant tissues and is valuable for the build up of a biologic width around implants. Peri-implant bone undergoes a remodeling process to allow enough space for the peri-implant soft tissue to be reformed.

Peri- Implantitis–

Peri-implantitis is defined as a pathological condition characterised by inflammation in the peri-implant mucosa/connective tissue and progressive loss of the supporting bone around a dental implant.[5]Bleeding and/or suppuration on probing, increasing probing depths and/or recession of the mucosal margin are clinical signs of peri-implantitis, along with radiographic bone loss compared to past examinations. Condition involve biofilm-induced inflammation in the soft tissue that subsequently triggers a host response, with possible tissue degradation(FIG-1).

Fig. 1:-Soft Tissue Inflammation Caused Due To Peri-Implantitis.

Below are the factors discussed in brief responsible for inflammatory responses

1) Poor plaque control and lack of regular supportive therapy

Plaque contains periodontal pathogens responsible for the degradation of periodontal hard and soft tissue causing inflammatory responses resulting in increased probing depth, bleeding on probing and loss marginal bone.In the "keystone hypothesis", Porphyromonasgingivalis, as an opportunistic dysbiotic pathogen, both over-activates and undermines the inflammatory response and increases pro-inflammatory cytokine signalling, inducing tissue degradation, which may progress to peri-implant disease with aggressive tissue degradation.(FIG-2)

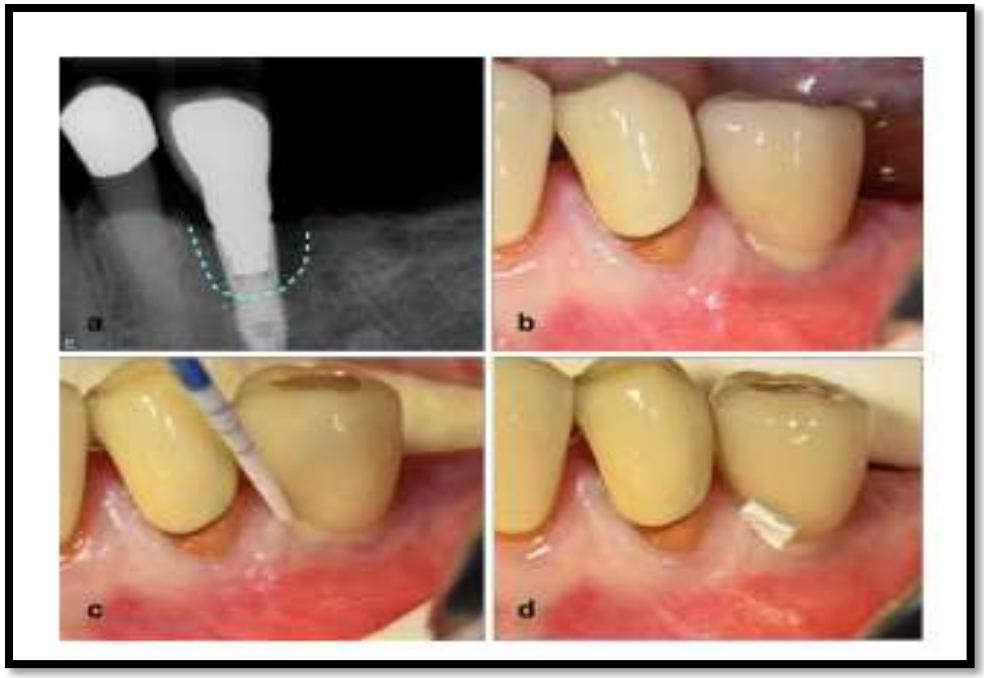

Fig. 2:- (A)BONE LOSS IN PERI-IMPLANTITIS (B) INFLAMMATORY PERI-IMPLANT LESION WITH PUS (C) COLLECTION OF BACTERIAL SAMPLES (D) PICF SAMPLING.

2) History of Periodontitis -There is strong evidence from longitudinal and cross-sectional studies that a history of periodontitis constitutes a risk factor for peri-implantitis.
3)Smoking-The evidence for smoking as a risk factor is inconclusive, although smoking is strongly associated with periodontitis, marginal bone loss and tooth loss. One 10-year cohort study reported that peri-implantitis developed for 28% of all implants in smokers, while the corresponding incidence was 6% of all implants in non-smokers.
4)Systemic Conditions- Diabetes in patients with uncontrolled blood sugar levels has been identified as a risk factor for periodontitis.
5)Keratinised Mucosa- Compared to sites with a keratinised mucosa of greater than 2 mm, sites with a keratinised mucosa of less than 2 mm are associated with plaque accumulation followed by peri-implant inflammation in the soft tissue, but no change in marginal bone level has been verified.
6)Undesirable host bed state for implantation 1) PREVIOUS IRRADIATION 2) RIDGE HEIGHT RESORPTION 3) OSTEOPOROSIS

- As stated by **Misch 1999[6],** the bones with D1 and D2 bone densities shows good initial stability and better osseointegration. **The critical time/ temperature - bone tissue necrosis - 47° for one minute.**
- **Recommendations by Erickson R.A[7]**1)Slow speed 2)Graded series 3) Adequate cooling 4)Avoid Overheating 5) Bone cutting speed of less than 2000 rpm. 6) Tapping at a speed of 15 rpm with irrigation 7) Using sharp drills. The optimal torque threshold – 35 N/cm.

Buccal Soft Tissue Recession –
Peri-implant soft tissue recession can be a major esthetic complication, when occurring in the anterior maxilla. The ones that depict the greater negative impact on the stability of the peri-implant mucosa when they are not present are the quality of the mucosa (the presence of attached mucosa), adjacent teeth attatchment level, and mucosal thickness. When looked at the esthetic point of view, the gray color of the titanium implant and the implant components may result into a major problem when exposed and clinically evident as a result of peri-implant mucosal recession.

Mucogingival Defects Around Implants –
The etiology includes **Chu and Tarnow2013[8]**1)Poor implant spatial placement 2)Horizontal biologic width creation 3)Incorrect abutment contour 4)Excessive implant diameter 5)Thin biotype

Treatment –
A connective tissue graft with a coronally advanced flap may be used to correct recession on the buccal mucosa. In cases where an immediate implant must be placed in thin biotype situations, a technique combining subepithelial connective tissue graft and immediate implant placement and provisionalization is recommended to gain a more predictable soft tissue contour **Kan, Rungcharassaeng, and Lozada, 2005.** [9]

Hard Tissue Complications
Poor Bone Quality-
Studies show that the greatest implant failure is in areas of the softest bone, especially in the maxilla **Misch, 2008.**[10] Studies have found that the highest risk factor for implant failure is in type 4 bone found in the maxilla **Goiato et al 2014**.[11]Possible causes of poor quality of the bone are as follows: 1)Older patients with osteoporosis 2)Denture patients with maxillary resorption.

Surgical Complications
- **Malposition of the Implant in the Esthetic Area**can lead to compromised esthetics.Gaining a papilla between two adjacent implants than a natural tooth and an implant is more difficult. It is not recommended to place a central and lateral implant adjacent to one another.

Fig.3:-An Implant Placed Less Than 1.5mm from The Adjacent Surface Has Lost Bone on that Surface. The Patient's Poor Oral Hygiene Has Also Likely Contributed to the Bone Loss.

Apicocoronally the implant should be placed 1mm apical to the cementoenamel junction of the adjacent tooth in patients who do not have gingival recession or 3mm apical to the final buccal gingival margin of the implant restoration. Recession may occur if the implant is placed too deep and disruption of the gingival harmony. Esthetic parameters (e.g, height of upper smile line, lower lip line, occlusal plane orientation, dental and facial symmetry and esthetics of contralateral tooth). **Phonetic problems** may result when the implant prosthesis is made with unusual palatal contours due to malpositioning of the implant **Klokkevold**2006.[10]

- **Retained Root Tips in the Implant Location** A retained root tip can lead to infection and peri - implantitis**Al - Faraje 2011**[10] or even implant failure. However, unintentional placement of dental implants into retained root fragments did not cause any clinical problems or histological signs of inflammation. A retained root tip or fragments may also result in poor bone healing, resulting in a fibrous - osseous defect.
- **Mandibular Nerve Injury**Injury to the IAN can result in partial or complete paresthesia, analgesia, anesthesia or in rare cases dysesthesia, to the structures it innervates.
- **Sinus/Nasal Floor Perforation** Perforation of the maxillary sinus and nasal floor occur, usually secondary to poor planning or surgical technique. The degree of perforation indicates the treatment in both cases. In case of perforation occurs with the pilot drill and often shortening the length of the subsequent osteotomies to avoid damage to the underlying membraneis sufficient. Larger perforations may be treated via internal sinus lifts or placing collagen membrane at the apex of the osteotomy.

- **Fracture of the Mandible** Fractures can occur in less dense or poorly mineralized bone when stress or strain develops as implants are placed. Excess tightening of a screw-type implant can result in micro-fractures in the surrounding bone caused by the strain generated by placing the implant in unhealthy bone.

Mechanical Complications

Mechanical complications are generally followed after biomechanical overloading. Factors contributing to the biomechanical overloading are poor implant position/angulation(cuspal inclination, implant inclination, horizontal offset of the implant and apical offset of the implant), insufficient posterior support i.e missing posterior teeth and inadequate available bone or the presence of the excessive force due to parafunctional habits. **Screw loosening, Screw implant fracture, Fracture of the Framework**could be the complications due to overloading and rigid connection between osseo-integrated implant and sebsequent framework.

The Success Criteria (Alberktsson et al 1986)[12]- 1)The individual unattached implant should be immobile when tested clinically. 2) The radiographic study must not depict any evidence of radiolucency. 3) After first year of implant loading the vertical bone loss around the fixtures should be less than 0.2mm per year. 4) The implant should not show any signs of pain, infection, neuropathies, parasthesia, violation of mandible canals and sinus drainage.

Nonsurgical therapies

For peri-implantitis lesions, including mechanical debridement, laser and/or photodynamic therapy, and adjunctive local antimicrobial or systemic antibiotic treatment, may lead to an improved clinical state, but these approaches are often insufficient to achieve resolution of the periimplantitis lesion**Mombelli and Lang 1992**.[13]

Fig4:-NitiPeri-Implant Brush Used To Improve Surface Decontamination.

Reconstructive or Regenerative Interventions

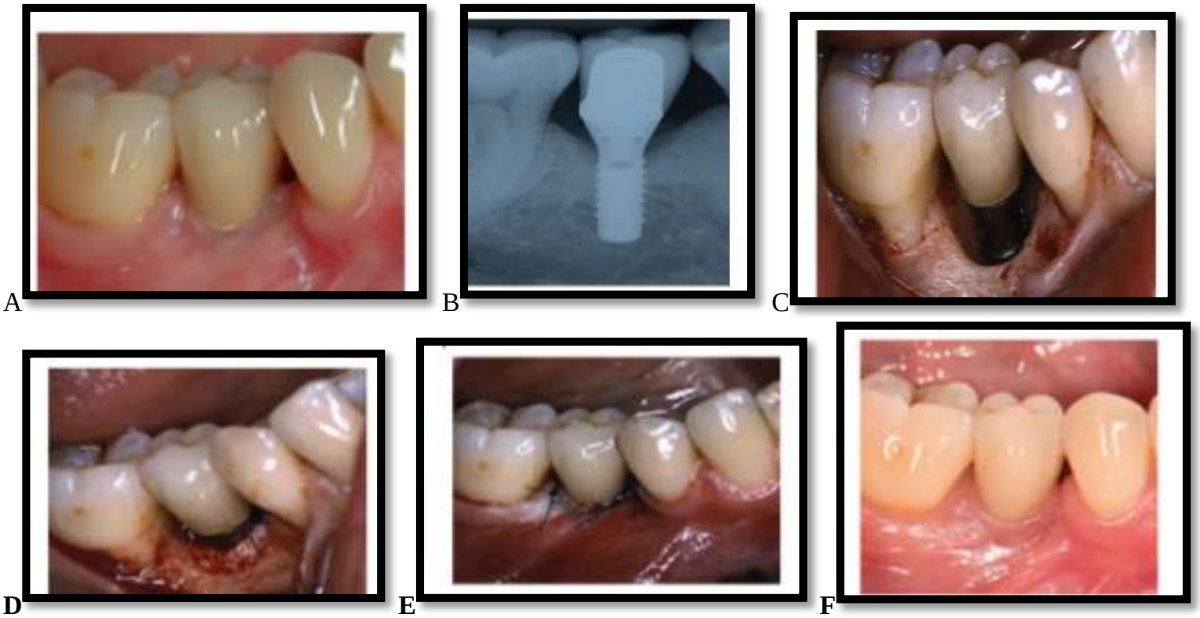

Fig.5:-(a) 3 years following delivery of the cemented restoration mucosal inflammation is visible around implant 45 (b) Radiograph showing the crater shaped bony defect. Excess cement had previously been removed (C) the crater shaped bony defect is visible following mucoperiosteal flap elevation following removal of granulation tissue implant surface decontamination is performed (d) Deproteinized bovine bone mineral granules were applied into the

defect around implant 45 (e) Transmucosal healing of implant 45 following flap adaptation and suturing (F) Clinical situation of implant 45 ten years after regenerative therapy. Healthy peri implant tissue is visible.

Explantation–
The most radical treatment is to remove the implant completely. This approach might be the only option when no other methods seem to work, and the inflammatory process continues, with progression of bone loss around the implant.

Effects of antibiotics in the treatment of peri-implantitis–
The rationale for using adjunctive antibiotics in the treatment of peri-implantitis is to achieve infection control.

Adjunctive local antibiotic treatment-
As an adjunct to nonsurgical mechanical debridement for peri-implantitis, locally distributed antibiotics, such as minocycline-containing microspheres or a slowrelease doxycycline-containing preparation, were evaluated in RCTs, with clinical benefits up to 12 months.

Adjunctive systemic antibiotic treatment –
In addition to surgical treatment combined with systemic antibiotics, metronidazole and amoxicillin were proposed for the treatment of periimplantitis.

Conclusion:-

To conclude, the new concept in implant therapy are considering all biologic and biomechanical factors, in conjunction with continuous training and improvement of their surgical skills to control and prevent implant complications. It is strongly recommended to avoid use of the many different implant systems without indepth knowledge of the surgical and prosthetic armamentarium or thoughtful evaluation of each individual system. Only when the experience level is high should clinicians treat complex cases and patients with medically compromised conditions. The biologic and mechanical concepts must be done by well - trained&equiped clinicians, who use well - tested available implant systems giving evidence based solutions.

References:-

1. Adell R, Lekholm U, Rockler BR, Brånemark PI (1981) A 15-year study of osseointegrated implants in the treatment of the edentulous jaw Int J Oral Surg1981 Jan 1;10(6):387-416.
2. Dr. Abhishek Sharma, Dr. Ramandeep Singh, Dr. Sonali Sharma, Dr. ShivangiSahi, Dr. Vishal Thakur, Priyanka Jamwal (2020) A review on Factors affecting osseointegration in dental implants. Int J Appl Dent Sci 2020;6(3):745-748.
3. Brånemark PI, Adell R, Breine U, Hansson BO, Lindström J, Ohlsson A (1969) Intra-osseous anchorage of dental prostheses I Experimental studies Scand J PlastReconstrSurg 1969;3(2):81-100.
4. Linder L ,Albrektsson T, Branemark PI, Hansson HA, Ivarsson B, Jonsson U et al(1983)Electron microscopic analysis of the bone-titanium interface ActaOrthopaedicaScandinavica 1983 Jan 1;54(1):45-52.
5. Renvert S, Persson GR, Pirih FQ, Camargo PM (2018) Peri-implant health, peri-implant mucositis, and peri-implantitis: Case definitions and diagnostic considerations J Clin Periodontol 2018 Jun;45:S278-85.
6. Misch, Carl E, Zhimin Qu, and Martha W, Bidez (1999) "Mechanical properties of trabecular bone in the human mandible: implications for dental implant treatment planning and surgical placement" **J Oral MaxillofacSurg** 57 6 (1999): 700-706.
7. Ericsson I, Berglundh T, Marinello C, Liljenberg B, Lindhe J (1992)Long-standing plaque and gingivitis at implants and teeth in the dog Clin Oral Implants Res 1992 Sep;3(3):99-103.
8. Chu SJ, Tarnow DP (2013) Managing esthetic challenges with anterior implants Part 1: midfacial recession defects from etiology to resolution CompendContinEducDent 2013 Oct 1;34(7):26-31.
9. Kan JY, Rungcharassaeng K, Lozada JL (2005) Bilaminar subepithelial connective tissue grafts for immediate implant placement and provisionalization in the esthetic zone J Calif Dent Assoc2005 Nov 1;33(11):865-71.
10. Termeie DA, Nelson DW (2016) Implant complications Avoiding and Treating Dental Complications: Best Practices in Dentistry 2016 Jun 13:144.
11. Goiato MC, Dos Santos DM, Santiago JJ, Moreno A, Pellizzer EP (2014) Longevity of dental implants in type IV bone: a systematic review Int J Oral Maxillofac Surg. 2014 Sep 1;43(9):1108-16.

12. Albrektsson T, Zarb G, Worthington P, Eriksson AR(1986) The long-term efficacy of currently used dental implants: a review and proposed criteria of success Int J Oral Maxillofac Implants 1986 Summer;1(1):11-25.
13. Mombelli A, Lang NP (1992) Antimicrobial treatment of peri-implant infections Clin Oral Implants Res 1992 Dec;3(4):162-8.