Review Article

Newer proposed classification of periimplant defects: A critical update

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ARTICLE INFO

Article history:

Received 23 September 2016

Accepted 17 January 2017

Available online 7 February 2017

Keywords:

Peri-implantitis

Pocket depth

APF (Apically positioned flap)

GBR Guided bone regeneration

ABWG- Autogenous bone wedge grafting

ABSTRACT

The term peri-implantitis is used to describe a destructive inflammatory process affecting the soft and hard tissues around osseointegrated implants, leads to the formation of a peri-implant pocket and loss of supporting bone. Predisposing factors are Poor Plaque Control, inflammation, infection, Smoking, Diabetes and Occlusal Overload. It is diagnosed on the basis of clinical and radiographic interpretation and still no definite criteria have been proposed for the diagnosis and treatment of peri-implantitis. However treatment can be both conservative and surgical. The cumulative interceptive supportive therapy protocol serves as good guide for the treatment of the peri-implantitis. There is lack of a standard classification system to differentiate the various degrees of peri-implantitis, which produces dilemma in evaluating the stages clinical and radiological status, treatment and its outcome. Many classification has been proposed in medical literature with their pros and cons but still there is lack of standard classification system of implant defects and definite treatment protocol according to the same. The classification should be easy to use, clearly understandable and help in communication by clinicians of different speciality. This review aimed to introduce a classification system based on added clinical, and detailed radiological parameters with prognosis and staged treatment algorithms.

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1. Introduction

The dental implants are the one of the greatest revolution in the restoration of the patient's function, esthetics and long-term survival for partially/fully edentulous conditions in dentistry. In spite of their high predictability and success rates, biological complications do occur. The term peri-implant mucositis and peri-implantitis which affects the dental implants are analogous to the terms gingivitis and periodontitis which affects the periodontium of natural teeth. Peri-implant mucositis is a disease in

which the presence of inflammation of soft tissues surrounding a dental implant, without the signs of supporting bone loss following initial bone remodeling during healing where as Peri-implantitis is an inflammatory phenomenon, including soft tissue inflammation and progressive loss of supporting bone around an implant. These definitions are worldwide accepted, but still there is dilemma regarding diagnostic criteria. The diagnosis can be made simultaneously clinically and radiologically. The signs and symptom of peri-implantitis includes typical saucer shaped destruction of the crestal bone vertically as radiologic finding and osseointegration of the apical part of the fixture. Formation of a peri-implant pocket. Bleeding with or without suppuration on gentle probing (<0.25 N). Mucosal swelling and hyperplasia. Generally asymptomatic but pain can be associated with an acute infection. An average of crestal bone loss of 0.9–1.6 mm is noted during the first post-surgical year and then a yearly loss of 0.02–0.15 mm is observed.¹

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Treatment of peri-implantitis, can be both conservative as well as surgical therapies. Conservative therapy includes medication and manual treatment with curettes, ultrasonic and air polishing systems, advance techniques such as laser-supported and photo-dynamic therapy. The surgical treatments methods are resective or regenerative procedures with bone grafting and flap surgery.

Mombelli developed the Cumulative Interceptive Supportive Therapy (CIST) protocol for maintenance of the dental implant and management of peri-implantitis. Parameters like infection, bleeding, suppuration (pus), pocket depth on probing, radiolucency on X-ray are considered into the protocol.² Treatment modalities for treatment of peri-implantitis includes Initially debridement, irrigation of pocket with disinfectant and supplementing antibiotic cover to reduce any active inflammation. Chlorhexidine 0.2% is very much effective in the reduction of pocket depths, increased tissue implant adhesion and general reduction of inflammation. Systemic and local antibiotic applications with Amoxicillin, Metronidazole, Doxycycline, Tetracycline, Minocycline hydrochloride, Ciprofloxacin can significantly reduced pocket depths. Detoxification procedures to decontaminate affected implant surfaces are air-powder abrasion, saline wash, citric-acid application and peroxide treatment, Photodynamic therapy using the Er:YAG, Helbo laser for decontaminating the implant and bone both. Reflection of the full thickness mucoperiosteal flap up to the edge of the intact bone followed by Surgical curettage of all granulation tissue and cleaning of the titanium surface with plastic curette and a titanium brush. Regenerative treatment using autogenous bone graft to stabilize the soft tissue and to prevent the formation of new pockets. Advanced novel therapy includes De-epithelisation of the pocket with the diode laser.

There are numbers of classification of peri-implant defects quoted in medical literature but still there is lack of standard classification system of implant defects highlighting degrees of peri-implantitis, clinical and radiological condition, treatment, outcome and prognosis. The review highlights various classifications for dental peri implant defects or periimplantitis and an attempt is made to propose a classification of implant defects.

2. Discussion

Branemark in 1952 described titanium as a biocompatible material that “fuses” to bone and till date titanium is the gold standard material for of implants globally. Osseointegrated dental implants are predictable treatment option for replacement of missing teeth, around the world. Success rates of more than 90% and predictability of dental implants is well published in literature, but still complications and failures occurs. There are number of classifications of periimplant defects quoted in medical literature with their Pros and cons but till date there is no uniformly accepted classification. Various system of classification proposed in literature described below.

Schwarz et al.³ classified peri implant defect depending on the configuration of the bony defect as:

Class I defect – Intraosseous

Class II defect – Supra-alveolar in the crestal implant insertion area.

This Classification informs about only two classes. No clinical and radiological interpretation is evident.

Spiekermann⁴ characterized peri-implant defect into the type of bone resorption pattern into 5 category.

Class I – Horizontal,

Class II – Hey-shaped

Class III a – Funnel shaped

Class III b – Gap-like

Class IV – Horizontal-circular form

This classification describes 5 different patterns of bone resorption around implant. No clinical criteria and treatment protocol for each class is given in it.

Another system of classification exists amount of bone loss with shaped of defect associated⁵

Class 1: Slight horizontal bone loss with minimal peri-implant defects

Class 2: Moderate horizontal bone loss with isolated vertical defects

Class 3: Moderate to advanced horizontal bone loss with broad, circular bony defects.

Class 4: Advanced horizontal bone loss with broad, circumferential vertical defects, as well as loss of the oral and/or vestibular bony wall

This classification reveals horizontal bony defect along with other types of bony defects around implant. No clinical picture, treatment modality and prognosis is highlighted.

A new classification of bone defects adjacent to dental implants highlighting the defect anatomy in the progression of the regenerative process⁶

(1) **CLOSED DEFECTS** – It is characterized by the maintenance of intact surrounding bone walls.

(2) **OPEN DEFECTS** – it is the one which lack one or more bone walls.

The classification could be a useful tool for planning the correct regenerative procedure for each type of defect but classification lacks clinical and radiological assessment statistically.

Peri-implantitis is classified into⁷:

2.1. Early Peri-implantitis

PD $\geq$ 4 mm, Bleeding and/or suppuration on probing, Bone loss <25% of the implant length.

2.2. Moderate Peri-implantitis

PD $\geq$ 6 mm, Bleeding and/or suppuration on probing, Bone loss ranging from 25% to 50% of the implant length.

2.3. Advanced Peri-implantitis

PD $\geq$ 8 mm, Bleeding and/or suppuration on probing, Bone loss >50% of the implant length.

(Atleast two aspect of implant with evidence of Bleeding and/or suppuration. Bone loss was measured on most recently radiograph taken and compare with radiograph taken at the time of prothetic loading).

This classification provides a standarised method about clinical and radiographic status of implant but it does not share any information of information related to management of periimplantitis and prognosis.

Combined Classification of peri-implant mucositis and peri-implantitis⁸

Staging	Definition
Stage A	Probing Depth 4 mm and Bleeding on probing and/or suppuration, with no signs of loss of supporting bone following initial bone remodeling during healing
Stage B	Probing Depth >4 mm and Bleeding on probing and/or suppuration, with no signs of loss of supporting bone following initial bone remodeling during healing

Staging	Definition
Stage I	Bleeding on probing and/or suppuration and bone loss ≤ 3 mm beyond biological bone remodeling
Stage II	Bleeding on probing and/or suppuration and bone loss > 3 mm and < 5 mm beyond biological bone remodeling
Stage III	Bleeding on probing and/or suppuration and bone loss ≥ 5 mm beyond biological bone remodeling
Stage IV	Bleeding on probing and/or suppuration and bone loss $\geq 50\%$ of the implant length beyond biological bone remodeling

This is combined (peri-implant mucositis and peri-implantitis) classification giving valuable information for clinical status of implant. However lacks prognosis and treatment criteria.

Lang NP et al classification included treatment part in its classification.⁹

Stage	Result	Therapy
	Pocket depth (PD) < 3 mm, no plaque or bleeding	No therapy required
A	PD < 3 mm, plaque and/or bleeding on probing	Mechanical cleansing and polishing, oral hygienic maintenance instructions
B	PD 4–5 mm, radiologically no bone loss	Mechanical cleansing and polishing, oral hygienic maintenance instructions plus local anti-infective therapy (e.g. Chlorhexidine)
C	PD > 5 mm, radiologically bone loss < 2 mm	Mechanical cleansing and polishing, microbiological test, local and systemic antibiotic therapy
D	PD > 5 mm, radiologically bone loss > 2 mm	Resective or regenerative surgery

This is a good classification which provides clinical radiological information and therapeutic part but still insufficient detail about type of bony defect and prognosis.

Zhang L et al demonstrated classification of peri-implant bone defects (PIBDs) on the basis of their Panoramic radiographic shapes in patients with lower implant-supported overdentures. They are broadly classified into decreasing order of occurrence.¹⁰

1. Saucer-shaped defects
2. Wedge-shaped defects
3. Flat defects
4. Undercut defects
5. Slit-like defects

This classification is given for lower implant-supported overdentures cases only and focus on different shapes and patterns of bony defects exclusively. Lacks clinical and detailed radiographic interpretations.

2.4. Retrograde implantitis

A clinically symptomatic periapical lesion that develops with in the first few after implant insertion while the coronal portion of the implant sustains a normal bone to the implant interface.¹¹

Class I – Mild – Extends $< 25\%$ of the implant length from implant apex.

Class II – Moderate – Extends 25–50% of the implant length from implant apex.

Class III – Severe – $> 50\%$ of the implant length from implant apex.

It is a good classification of retrograde implantitis. None of the classifications described have mentioned any point about this.

Passi D (2016): Newer Proposed Classification
BMP classification of Implant Defects

STAGE	Bleeding on Probing	Probing Depth	Bone loss (%) of implant length	Mobility	Proposed Treatment & Prognosis
STAGE 1	–	2–3 mm	10–25%	No mobility	No treatment. Oral hygienic instructions Prognosis is good
STAGE 2	+	4–6 mm	25–50% Vertical Horizontal combination	Grade 1	vertical defect < 2 –4 mm- GBR, osteoplasty Horizontal Defect $< 1/2$ of implant height – APF, GBR, osteoplasty Combination Defect: Bone augmentation and GBR. Prognosis is fair.
STAGE 3	+	6–8 mm	$> 50\%$ Vertical Horizontal combination	Grade 2	vertical defect 2–4 mm-GBR,ABWG Horizontal Defect $> 1/2$ of implant height – GBR and Augmentation. Combination Defect: Implant removal. Questionable Prognosis
STAGE 4	+	> 8 mm	$> 50\%$	Grade 3	Implant removal Poor prognosis

APF- Apically positioned flap, GBR- Guided bone regeneration, ABWG- Autogenous bone wedge grafting.

This classification uses menomics B (Bleeding, Bone loss), M (Mobility), P (Probing depth, Proposed treatment and Prognosis). Hence the name BMP classification of implant defects is given. This classification describes clinical parameters and soft tissue conditions like bleeding on probing, extent of probing depth and mobility of implant. It includes radiographic parameters like Bone loss (in percentage) of implant length and type/orientation of implant defect. It also includes stage wise management of defect and its prognosis. The main limitation of the classification that it lacks to include any etiological factors like bacterial or trauma and is bit complex and lengthy to read. Also this classification does not include any relations of implant to adjacent natural teeth.

3. Conclusion

The proposed classification allows both clinical and radiographic interpretation of implant defects and can serve as easy, reproducible and good guideline for treatment planning and prognosis.

Conflict of interest

None Declared.

Source of support

Nil.

References

1. Adell R, Lekholm U, Rockler B, Brånemark PI, Lindhe J, Eriksson B, Sbordone L. Marginal tissue reaction at osseointegrated titanium fixtures (1): a 3-year longitudinal prospective study. *Int J Oral Maxillofac Surg.* 1986;15:39–52.
2. Mombelli A, Lang NP. The diagnosis and treatment of periimplantitis. *Periodontology.* 1998;17:63–76.
3. F. Schwarz, N. Sahm, J. Becker, Aktuelle Aspekte zur Therapie periimplantärer Entzündungen. *Quintessenz* 2008, 59:00.
4. Spiekermann H: *Implantologie*. Stuttgart: Thieme; 1984.
5. Nishimura K, Itoh T, Takaki K, Hosokawa R, Natio T, Yokota M. Periodontal parameters of osseointegrated dental implants. A 4-year controlled follow-up study. *Clin Oral Implants Res.* 1997;8:272–278.
6. Vanden Bogaerde L. A proposal for the classification of bony defects adjacent to dental implants. *Int J Periodontics Restorative Dent.* 2004;24:264–271.
7. Stuart F, Paul F. A proposed classification for peri-implantitis. *Int J Periodontics Restorative Dent.* 2012;32:533–540.
8. Ata-Ali1 Javier, Ata-Ali Fadi, Bagan Leticia. A classification proposal for peri-implant mucositis and peri-implantitis: a critical update. *The Open Dentistry Journal.* 2015;9:393–395.
9. Lang NP, Berglundh T, Heitz-Mayfield LJ, Pjetursson BE, Salvi GE, Sanz M. Consensus statements and recommended clinical procedures regarding implant survival and complications. *Int J Oral Maxillofac Implants.* 2004;19 (Suppl):150–154.
10. Zhang L, Geraets W, Zhou Y, Wu W, Wismeijer D. A new classification of peri-implant bone morphology: a radiographic study of patients with lower implant-supported mandibular overdentures. *Clin Oral Implants Res.* 2014;25 (August (8)):905–909.
11. Shah Rucha, Thomas Raison, Tarun kumar AB, Singh Mehta Dhoom. A radiographic classification of retrograde periimplantitis. *J Contemp Dent Pract.* 2016;17(4):313–321.