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# Peri-implantitis and Practical Management: A Review

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## ABSTRACT

At present, with an increasing number of implants placed, peri-implant diseases are also increasing. The inclusion of peri-implant disease in the latest classification of periodontal disease shows the global significance of the disease in addition to periodontal disease. Management for peri-implantitis is more complicated and similar to periodontitis, and bone loss is irreversible. Numerous studies throughout the decades were conducted using various techniques investigating the best method in treating peri-implantitis. Therefore, this article will explore the latest evidence for peri-implantitis and its management.

**Keywords:** *Dental implants; non-surgical therapy; peri-implantitis; surgical management*

## INTRODUCTION

In the current Classification of Periodontal and Peri-implant Disease and Condition (Caton *et al.*, 2018), the peri-implant disease has been included to ensure a uniform understanding of the disease globally. Peri-implant mucositis is a reversible inflammatory change of the peri-implant soft tissue without bone loss. Peri-implantitis is evidenced by inflammatory changes around osseointegrated implants in function, affecting the mucosa and resulting in the loss of supporting bone around the implant, indicated by  $\geq 6$  mm probing depth in conjunction with profuse bleeding and

suppuration. A diagnosis of peri-implantitis is also made when evidence of radiographic bone loss around the implant is noted (Renvert *et al.*, 2018).

One of the most critical factors for the long-term success of dental implants is the maintenance of healthy peri-implant tissues. Therefore, all underlying dental diseases must be treated or stabilised before implant therapy can commence. This maintenance is of great importance when dealing with patients susceptible to periodontal disease because this group of patients has an increased susceptibility to peri-implantitis (Karoussis *et al.*, 2004). On top of that,

recent evidence showed potential leachable elements from implant fixture in the body (Mat-Baharin *et al.*, 2020). The titanium particles have been identified in the peri-implant tissues of peri-implantitis patients (Berryman *et al.*, 2020). Although more clinical studies are needed, this will ignite the thought of taking extra care when dealing with implant patients. Hence, one of the most critical factors for the long-term success of dental implants is the maintenance of healthy peri-implant tissues and early detection of disease. Although the prevalence of peri-implantitis has been reported in several studies to vary from approximately 10% to 12.8%, it is a significant problem for the whole dental team today and in the foreseeable future (Mombelli *et al.*, 2012; Rakic *et al.*, 2018). This review is aimed to explore current evidence in the management of peri-implantitis.

### Diagnostic Indicators

One must be methodical when monitoring peri-implant tissues at review appointments to spot the early signs of peri-implantitis. Other than early disease detection, frequent follow-up and regular assessment enable the clinician to modify oral hygiene practices of the patient; if the disease is detected, it can be managed at an initial stage. Clinical assessment should detect plaque accumulation, bleeding on probing (POB), increase in probing depth (PD), swelling and suppuration, mobility and radiographic bone loss detection (Daly & McCracken, 2019).

Probing around implant area is essential to detect early sign of disease. It was shown that probing around healthy peri-implant tissue does not cause damage to the mucosal seal and can be done routinely (Etter *et al.*, 2002). Histologically, it was shown that when probing at peri-implant tissues, the tip of probe's position was located coronal to the apical cell of junctional epithelium and cause lateral compression of the peri-implant mucosa (Ericsson & Lindhe, 1993). This contributes to a deeper probe penetration at peri-implant area compared to tooth.

It is well noted that peri-implant tissues are different from periodontium where there is a parallel attachment of the junctional epithelium around the implant surface. Hence, there is less resistance when probing around the implant (Ericsson & Lindhe, 1993; Chai *et al.*, 2016). This kind of attachment may result in deeper peri-implant probing depths compared with probing around natural teeth. Therefore, a light force must be used (0.25 N) to avoid tissue trauma when probing peri-implant tissues.

Peri-implant probing depths of implants placed in sites excluding the aesthetic zone range between 2 mm and 4 mm under healthy conditions. In the aesthetic zone where the implant is usually placed deep, the probing depths are more profound than usual. Therefore, the initial baseline values must be recorded should there be any change at a later date. The soft tissue margin in relation to a fixed landmark, such as the abutment–implant junction should be included, to note any possible changes from the previous record (Salvi & Lang, 2004).

Other factors need to be considered when performing peri-implant probing depth, such as gingival phenotype, depth of margin placement and prosthetic contour; a probing depth of 5 mm and more is an indicator of peri-implantitis (Daly & McCracken, 2019). Therefore, other clinical parameters should be considered whenever the peri-implant probing depth is more than 5 mm. The presence of bone loss surrounding the implant fixture is one of the preeminent characteristics of peri-implantitis (Renvert *et al.*, 2018).

A baseline radiograph must be established to record the bone levels at the time of the prosthesis placement. It is preferably obtained with a standardised film holder, and the radiograph should clearly show the implant reference point with distinct visualisation of the implant thread (Renvert *et al.*, 2018). Long cone radiographs obtained annually for the first three years of the implant in function are reasonable. After

that, the indications for further radiographs should be made following methodological clinical assessment. Most implant systems show a small amount of marginal bone loss within the first year of function (Albrektsson *et al.*, 1986).

The Implant Disease Risk Assessment was introduced as a guide to identifying the risk of developing implant disease (Heitz-Mayfield *et al.*, 2020). Eight parameters were suggested to be included in assessing the risk of peri-implant disease in a patient. They include:

1. History of periodontitis
2. Bleeding on probing
3. Number of teeth/implant with probing depth of 5 mm or more
4. Bone loss/age of a patient
5. Periodontitis susceptibility
6. Compliance with supportive care
7. Distance of restorative margin to the bone crest
8. Prosthesis-related factor

Amongst the parameters listed, periodontitis susceptibility includes established periodontal disease risk factors such as smoking and diabetes mellitus. A meta-analysis showed a significant relationship between smoking and osseointegrated implant failure (Hinode *et al.*, 2006). For risk of implant failure amongst patients with diabetes mellitus, no significant difference in implant failure was found between healthy and diabetic subjects. However, another meta-analysis revealed that healthy patients show lower marginal loss than patients with diabetes (Moraschini *et al.*, 2016). Given that the Implant Disease Risk Assessment

tool is newly introduced, further validation is needed. Nonetheless, it can be a valuable tool to recognise patients with a high risk of peri-implant disease. Any clinical changes around dental implants must be monitored and acted upon promptly.

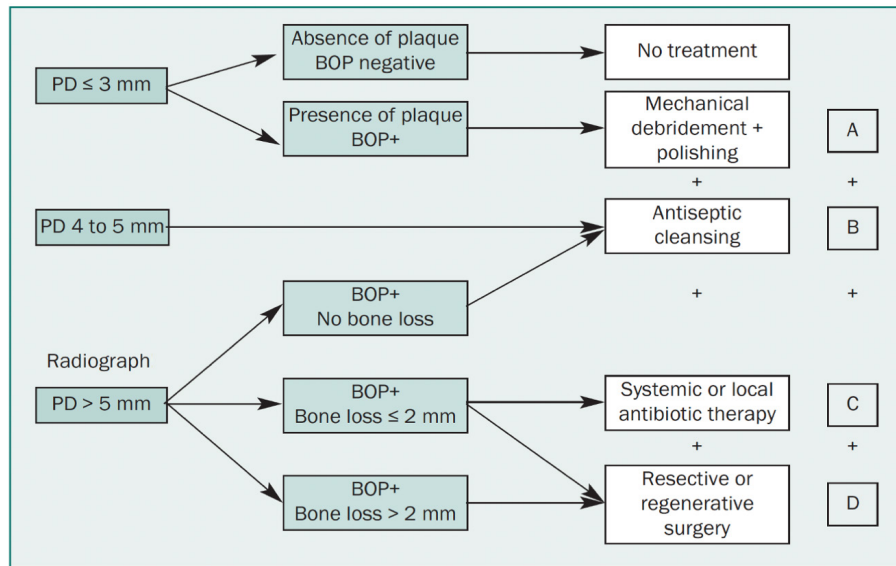
### Progressive Bone Loss

If there is evidence of ongoing bone loss, then the cause must be ascertained. The causes of progressive bone loss in the dental implant are as follows:

1. Occlusal overload
2. Bacteria-induced inflammation

Any occlusal overloading needs to be corrected, but it is beyond the scope of this article.

Bacteria-induced inflammation is initially treated non-surgically but depends on the initial clinical presentation (Albrektsson *et al.*, 1986). This non-surgical therapy involves the removal of dental plaque with or without the use of locally delivered or systemic adjuncts. Lesions with probing depth of 5 mm or more and bone loss of greater than 2 mm need surgical intervention as recommended by Salvi and Lang (2004). Recent evidence also showed that non-surgical therapy does not provide additional therapeutic value in cases where osseous defect is involved due to the implant fixture thread's appearance and the implant's surface treatment (Mahato *et al.*, 2016). In general, resective or regenerative surgical therapy, or their combination in peri-implantitis cases, yields promising outcomes. When pocketing has been noted, using the Cumulative Interceptive Supportive Therapy (CIST) protocol (Fig. 1) will help treat the majority of peri-implantitis cases (Lang *et al.*, 2004).



**Fig. 1** CIST protocol

Source: Reproduced with permission from Lang *et al.*, 2004

### Surgery of Peri-Implantitis

The aim of surgical therapy in peri-implantitis cases is to increase the cleaning ability of the implant surface and correct the condition of soft and hard peri-implant tissues. Re-osseointegration is the outcome to be gained following the surgical procedure (Figuro *et al.*, 2014).

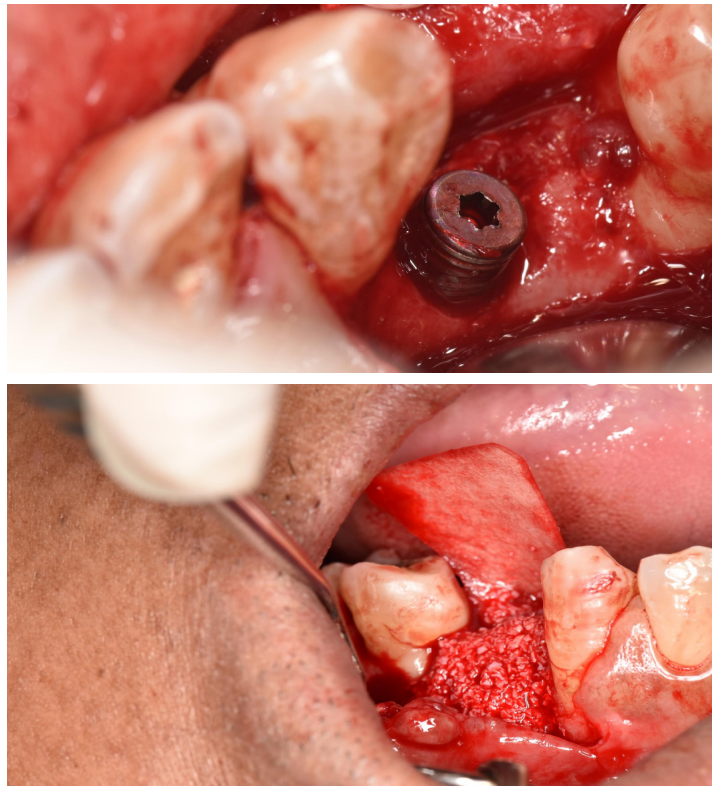
Resective or regenerative surgeries are proposed to treat peri-implantitis depending on the anatomy of the bone defect surrounding the implant. If a site has a suprabony defect or a one-walled defect, resection with osseous surgery and apically repositioned flaps should be performed (Lang *et al.*, 2004).

The main aims of resective surgery are as follows:

1. To eliminate the inflammatory tissues
2. To stop the disease from progressing further

3. To maintain the implant in function with healthy peri-implant tissues
4. To reduce the peri-implant pocket depths
5. To gain a soft tissue morphology that allows cleanability for the patient and leads to healthy peri-implant tissues

For circumferential bony defects with intact bony walls, regenerative surgery with natural bone and collagen membrane showed promising results compared with other types of bone defects (Schwarz *et al.*, 2010). Fig. 2 is an example of peri-implantitis treated with regenerative surgery. Case selection is critical to ensure the success of the treatment offered. A three-dimensional radiograph is beneficial in identifying suitable cases before regenerative surgery because the osseous defect pattern in the peri-implant area is unique and different from periodontitis.



**Fig. 2** Regenerative surgery at peri-implantitis area  
Source: Photos courtesy of Dr. Nik Madihah Nik Azis

In addition to resective or regenerative surgical therapy for peri-implantitis, adjunctive treatment such as surface decontamination is always included due to the difficulty faced in mechanical debridement when cleaning the peri-implant surface compared with the tooth surface. Various tools were introduced, including an oscillating chitosan brush and air-polishing device. Other popular adjunctive materials such as laser and photodynamic therapy were also studied. However, the results were conflicting. Most studies failed to prove the superiority of adjunctive therapy compared with mechanical therapy alone (Rocuzzo *et al.*, 2020).

At present, various techniques have been proposed with the emergence of new technology for surface decontaminations and regenerative material. Although a systematic review concluded that regenerative surgery combined with membrane placement has better outcomes than other methods, the

outcome of the procedures varies (Chan *et al.*, 2014). Therefore, more concrete evidence is needed for the definitive management of peri-implantitis.

### Maintenance Review

Given the unsteady outcome of peri-implantitis treatment, preventing the disease is better than treating it. Following every implant placement, the patient must be called for maintenance review. During the review, a complete intra-oral examination should be conducted to detect early signs of disease. Good oral hygiene must be performed to maintain healthy peri-implant tissues. The use of toothbrushes, either manual or electric, helps reduce the amount of plaque biofilm. Floss, including super floss and interdental brushes, is essential for accessing interproximal surfaces. Oral hygiene for the patient must not be made too complicated, prolonging the time required by using too many oral hygiene aids. Another

aid to help patients become aware of the presence or improvement in reduction of plaque is to disclose the plaque.

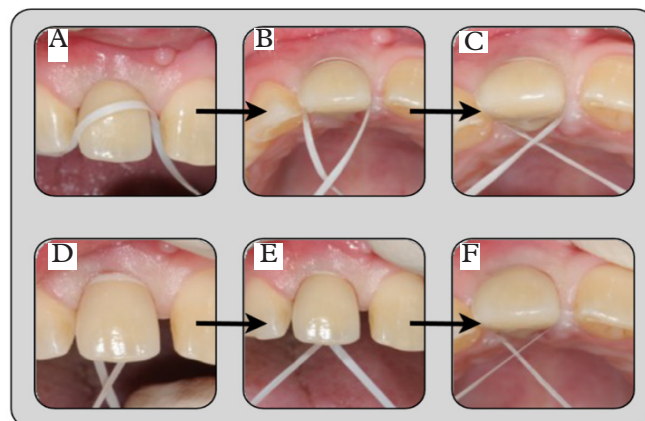
One of the most important things is to observe the patient perform the oral hygiene technique and review the patient two weeks after the final fit of the prosthesis, as they may be heavy-handed and cause damage to the peri-implant tissues. If so, then the technique needs to be modified.

A cross-over flossing technique can be used if the implants are placed in the ideal position in the aesthetic zone (Fig. 3). A poor flossing technique or no flossing at all can lead to subgingival inflammation of the peri-implant tissues, and a correct subgingival flossing technique will result in the formation of epithelialised sulcular tissue down to the implant neck.

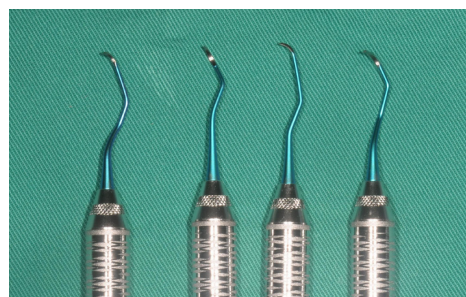
If the implant placement is not in the ideal position, this can lead to difficulty in cleaning as the prosthesis may have a ridge lap profile.

In these cases, modification of oral hygiene is necessary. The use of a tufted brush or super floss is often indicated. In premolar and molar areas, the use of floss is recommended in the case of a single-unit implant; in a fixed-bridge prosthesis, the use of super floss and interdental brushes is indicated.

Calculus formation on dental implants is very similar to that found on teeth. The only difference is that the abutment and porcelain are highly polished; therefore, the calculus is not tenacious. When removing supragingival calculus from the implant crowns, stainless steel scalers must not be used as they will damage the titanium surfaces. Therefore, using the curette and scalers that will not scratch or roughen the treated implant surface such as titanium, carbon fibre or plastic reinforced with graphite is recommended (Fig. 4) (Gulati *et al.*, 2014; Rocuzzo *et al.*, 2020). An ultrasonic scaler is never used on an implant as it will heat the implant and damage the bone that helps integrate the implant.

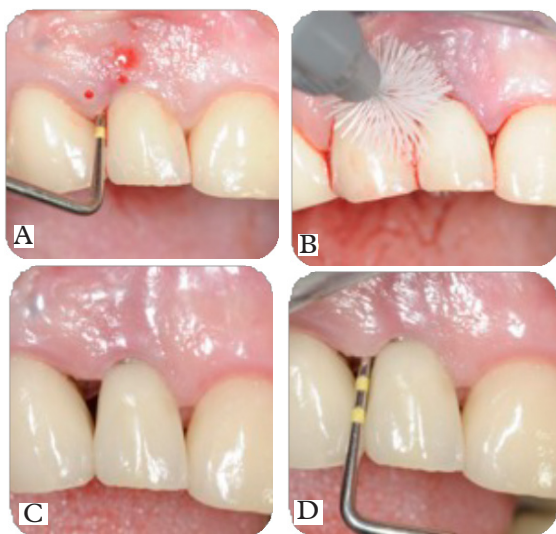


**Fig. 3** Step-by-step cross-over flossing technique for implant of upper right central.



**Fig. 4** Titanium curettes with different working ends for implant maintenance and debridement.

Fig. 5 is an example of an upper right lateral implant with 8 mm pocketing. The site was treated non-surgically with local delivery antimicrobials and with the patient using chlorhexidine gel with the large interdental brush (Fig. 5a–5c). At the 2-week review, the pocketing associated with the upper right lateral implant had reduced to 5 mm with simple non-surgical therapy (Fig. 5d). Any further intervention will need to be reviewed by a dentist who was trained in dental implant.



**Fig. 5** Peri-implant pocketing treated with non-surgical method: (A) 8 mm pocketing implant of upper right lateral; (B) After subgingival curettage of the pocket, the patient was shown how to use a large interdental brush with chlorhexidine gel twice a day; (C) Patient reviewed at two weeks. The inflamed tissues have reduced, exposing the crown margin; (D) Pocketing has been reduced to 5 mm.

## CONCLUSION

Management of peri-implantitis is not straightforward, and the outcome varies depending on various factors. Current evidence showed that surgical therapy should be carried out in treating peri-implantitis. Moreover, regeneration is highly recommended whenever possible. However, more homogenous studies are required to support the current evidence.

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## REFERENCES

- 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*, 1(1): 11–25.
- Berryman Z, Bridger L, Hussaini HM, Rich AM, Atieh M, Tawse-Smith A (2020). Titanium particles: An emerging risk factor for peri-implant bone loss. *Saudi Dent J*, 32(6): 283–292. <https://doi.org/10.1016/j.sdentj.2019.09.008>
- Caton JG, Armitage G, Berglundh T, Chapple ILC, Jepsen S, Kornman KS *et al.* (2018). A new classification scheme for periodontal and peri-implant diseases and conditions – Introduction and key changes from the 1999 classification. *J Clin Periodontol*, 45(Suppl 20): S1–S8. <https://doi.org/10.1111/jcpe.12935>
- Chai WL, Razali M, Ngeow WC (2016). Dimension and structures of biological seal of peri-implant tissues. In: Almasri MA (ed.), *Dental Implantology and Biomaterial*. London: IntechOpen. <https://doi.org/10.5772/63950>
- Chan HL, Lin GH, Suarez F, MacEachern M, Wang HL (2014). Surgical management of peri-implantitis: A systematic review and meta-analysis of treatment outcomes. *J Periodontol*, 85(8): 1027–1041. <https://doi.org/10.1902/jop.2013.130563>
- Daly A, McCracken G (2019). Peri-implant disease part 1: Diagnosis and assessment parameters. *Dent Update*, 46(10): 978–985. <https://doi.org/10.12968/denu.2019.46.10.978>

- Ericsson I, Lindhe J (1993). Probing depth at implants and teeth. An experimental study in the dog. *J Clin Periodontol*, **20**(9): 623–627. <https://doi.org/10.1111/j.1600-051x.1993.tb00706.x>
- Etter TH, Håkanson I, Lang NP, Trejo PM, Caffesse RG (2002). Healing after standardized clinical probing of the perimplant soft tissue seal: A histomorphometric study in dogs. *Clin Oral Implants Res*, **13**(6): 571–580. <https://doi.org/10.1034/j.1600-0501.2002.130601.x>
- Figuero E, Graziani F, Sanz I, Herrera D, Sanz M (2014). Management of peri-implant mucositis and peri-implantitis. *Periodontol 2000*, **66**(1): 255–273. <https://doi.org/10.1111/prd.12049>
- Gulati M, Govila V, Anand V, Anand B (2014). Implant maintenance: A clinical update. *Int Sch Res Notices*, **2014**: 908534. <https://doi.org/10.1155/2014/908534>
- Heitz-Mayfield LJA, Heitz F, Lang NP (2020). Implant Disease Risk Assessment IDRA – A tool for preventing peri-implant disease. *Clin Oral Implants Res*, **31**(4): 397–403. <https://doi.org/10.1111/clr.13585>
- Hinode D, Tanabe S, Yokoyama M, Fujisawa K, Yamauchi E, Miyamoto Y (2006). Influence of smoking on osseointegrated implant failure: A meta-analysis. *Clin Oral Implants Res*, **17**(4): 473–478. <https://doi.org/10.1111/j.1600-0501.2005.01244.x>
- Karoussis IK, Müller S, Salvi GE, Heitz-Mayfield LJ, Brägger U, Lang NP (2004). Association between periodontal and peri-implant conditions: A 10-year prospective study. *Clin Oral Implants Res*, **15**(1): 1–7. <https://doi.org/10.1111/j.1600-0501.2004.00982.x>
- Lang NP, Berglundh T, Heitz-Mayfield LJ, Pjetursson BE, Salvi GE, Sanz M (2004). Consensus statements and recommended clinical procedures regarding implant survival and complications. *Int J Oral Maxillofac Implants*, **19**(Suppl): 150–154.
- Mahato N, Wu X, Wang L (2016). Management of peri-implantitis: A systematic review, 2010–2015. *Springerplus*, **5**: 105. <https://doi.org/10.1186/s40064-016-1735-2>
- Mat-Baharin NH, Razali M, Mohd-Said S, Syarif J, Muchtar A (2020). Influence of alloying elements on cellular response and in-vitro corrosion behavior of titanium-molybdenum-chromium alloys for implant materials. *J Prosthodont Res*, **64**(4): 490–497. <https://doi.org/10.1016/j.jpjor.2020.01.004>
- Mombelli A, Müller N, Cionca N (2012). The epidemiology of peri-implantitis. *Clin Oral Implants Res*, **23**(Suppl 6): 67–76. <https://doi.org/10.1111/j.1600-0501.2012.02541.x>
- Moraschini V, Barboza ES, Peixoto GA (2016). The impact of diabetes on dental implant failure: A systematic review and meta-analysis. *Int J Oral Maxillofac Surg*, **45**(10): 1237–1245. <https://doi.org/10.1016/j.ijom.2016.05.019>
- Rakic M, Galindo-Moreno P, Monje A, Radovanovic S, Wang HL, Cochran D *et al.* (2018). How frequent does peri-implantitis occur? A systematic review and meta-analysis. *Clin Oral Investig*, **22**(4): 1805–1816. <https://doi.org/10.1007/s00784-017-2276-y>
- Renvert S, Persson GR, Pirih FQ, Camargo PM (2018). Peri-implant health, peri-implant mucositis, and peri-implantitis: Case definitions and diagnostic considerations. *J Periodontol*, **89**(Suppl 1): S304–S312. <https://doi.org/10.1002/JPER.17-0588>



Roccuzzo A, De Ry SP, Sculean A, Roccuzzo M, Salvi GE (2020). Current approaches for the non-surgical management of peri-implant diseases. *Curr Oral Health Rep*, 7: 274–282. <https://doi.org/10.1007/s40496-020-00279-x>

Salvi GE, Lang NP (2004). Diagnostic parameters for monitoring peri-implant conditions. *Int J Oral Maxillofac Implants*, 19(Suppl): 116–127.

Schwarz F, Sahm N, Schwarz K, Becker J (2010). Impact of defect configuration on the clinical outcome following surgical regenerative therapy of peri-implantitis. *J Clin Periodontol*, 37(5): 449–455. <https://doi.org/10.1111/j.1600-051X.2010.01540.x>