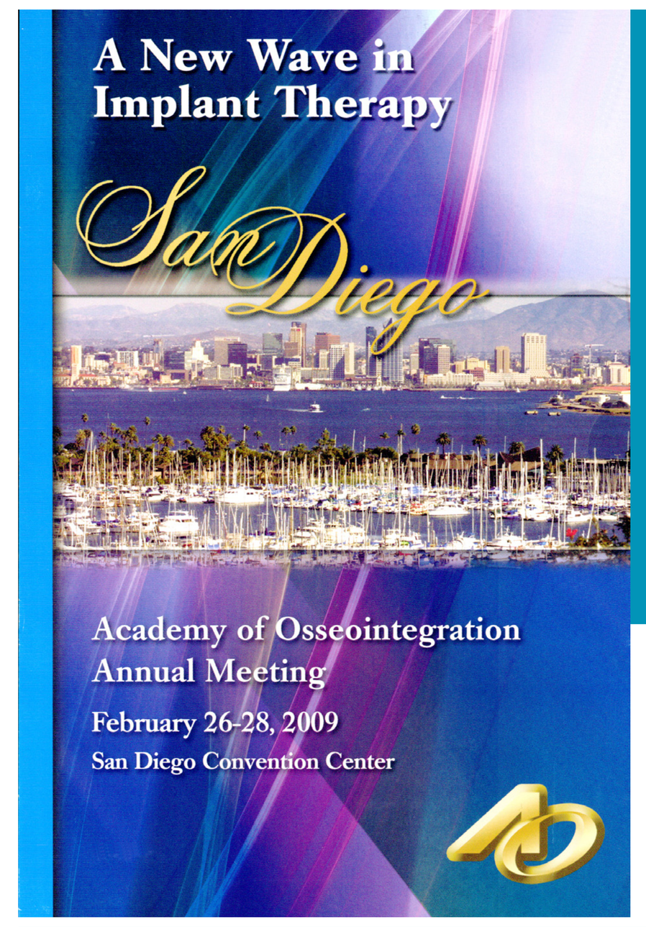

Treatment of Peri-implantitis – A Literature Review

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INTRODUCTION

Peri-implantitis is an inflammatory process affecting the soft and hard tissues surrounding an implant. This disease is associated with loss of supporting bone bleeding on probing and occasionally suppuration. The etiopathogenesis of peri-implantitis is complex and related to a variety of factors that affect the peri-implant environment. Peri-implantitis can influenced by:(1) Patient related factors including systemic diseases (e.g diabetes, osteoporosis) and prior dental history (periodontitis), 2) social factors such as (inadequate oral hygiene, smoking, drug abuse) and 3) parafunctional habits (bruxism & malocclusion). In addition to the above, iatrogenic factors such as faulty restorations, cement left following restoration delivery and loose components can also play a significant role in the development of peri-implantitis.

Although restorations of endosseous implants have demonstrated a very high survival rate(1), one study suggested that over a 5 year period, 0 to 14.4% of dental implants demonstrated peri-implant inflammatory reactions associated with crestal bone loss (2).

Implant failure has been attributed to a variety of causes including: 1) bacterial infection 2) poor surgical technique 3) premature fixture overload (7), 4) faulty or incorrect prosthetic design and/or 5) improper surgical placement (17). In cases where is evidence of progressive infection caused by bacterial plaque and resulting in progressive bone loss of bone around the implant, the etiology is considered to be peri-implantitis.

Many methods of treating peri-implantitis treatment have been documented in the literature. This paper will focus on treatments that address bacterial contamination as the etiologic agent. Therefore methods of implant surface decontamination will be described along with procedures designed to treat the bone loss caused by peri-implantitis (6, 10). These treatments include 1) administration of systemic antibiotics alone, 2) Mechanical debridement with or without systemic antibiotic treatment (38), 3) Mechanical debridement with or without chlorhexidine oral rinses (38), 4) Mechanical debridement combined with LASER decontamination (30,38), 5) Surgical Debridement (32) and more recently, 6) Surgical debridement with guided bone regeneration (GBR) for reparation of bony and soft tissue defects (6, 7, 8). To date, GBR using a bone graft and membrane has had the best success as in demonstrating bone fill of the defects associated with peri-implantitis as described in the literature (6, 9).

The purpose of this literature review was to discuss different treatment modalities for peri-implantitis and the compare of the treatment outcomes.

MATERIALS AND METHODS

Clinical data in this study was obtained from the Implant Database (ID). This data was extracted as de-identified information from the routine treatment of patients at the Ashman Department of Periodontology and Implant Dentistry at the New York University College of Dentistry (NYUCD) Kriser Dental Center. The ID was certified by the Office of Quality Assurance at NYUCD. This study is in compliance with the Health Insurance Portability and Accountability Act (HIPAA) requirements and approved by the University Committee on Activities involving Human Subjects.

This literature review includes a total of 358 articles referring to "peri-implantitis","Peri-implant diseases" (311 articles), " treatment of peri-implantitis" (250 articles), "surgical treatment of peri-implantitis" (218 articles), "re-osseointegration of implants" (188 articles), "microbiology in peri-implantitis" (94 articles), "laser treatment of peri-implantitis" (32 articles), "implant surfaces and peri-implantitis" (50 articles), "peri-implantitis infection" (67 articles).The inclusion criteria for article consideration included:

1. Treatment of peri-implantitis in human clinical studies.
2. Treatment of peri-implantitis in animal clinical studies
3. Re osseointegration of implants
4. Peri-implant diseases
5. Laser treatment of peri-implantitis

RESULTS AND DISCUSSION

Based on this literature review, 39 of the 358 articles were included in this evaluation.

The results of the literature review revealed that although there are a number of studies using different modalities to treat peri-implantitis most of the studies only to have 6 to 12 month follow-up, with one study showing a 24-month follow up. Moreover, only one study showed 5-year post treatment results with a 58 percent success rate.

Pontoriero (21) demonstrated the importance of bacterial plaque accumulation in the development of inflammation around implants (peri-implantitis) and Mombelli (15) showed that, if this condition is left untreated and the surface is not decontaminated, it will lead to peri- implant pocketing, alveolar bone loss, and eventually to implant loss. Because there are biologic differences between teeth and implants, the progression of infection around implants is also different than natural teeth. The inflammatory cell infiltrate around implants was reported to be larger and extend more apical when compared to a corresponding lesion in the gingival tissue around natural teeth (29). In addition, the tissues around implants are more susceptible to plaque associated infections which spread into the alveolar bone (29).

Implant surface bacterial decontamination is essential in treating peri-implantitis infections. Systemic administration of antibiotics has been used in the treatment of peri-implantitis resulting in a reduction of inflammation. However, in a systematic review of treatment Lindhe et al. questioned the use of antibiotics as a sole therapy for treatment (29). Moreover,in one study a 3-month recurrence of peri-implantitis was observed after completion of antibiotic therapy due to bacterial recolonization of the implant surface (14).

Because non-surgical treatment approaches failed to promote the re-osseointegration of the exposed implant sites (37), additional surgical interventions have been used in order to minimize the risk for a re-infection of the peri-implant pocket. Some of the treatment modalities suggested for peri-implantitis are: 1) Sub-mucosal mechanical debridement and antimicrobial minocycline spheres (Arestin), 2) Mechanical ultrasound debridement without antibiotics, 3) Er:YAG laser with mechanical debridement, chlorohexidine, with and without open flap surgery, 4) Antimicrobial therapy with open flap debridement, 5) Access flap surgery and nanocrystaline hydroxyapatite.

Renvert et al. (2006) compared the combination of oral hygiene instructions, mechanical debridement and topical application of minocycline microspheres (Arestin) in peri-implant lesions (with bone loss corresponding to no more than three implant threads) to the combination of oral hygiene instructions, mechanical debridement and 1% chlorhexidine gel application. The results obtained after a follow-up period of 12 months showed that with the Chlorohexidine group, only a limited reduction in bleeding on probing was achieved and the mean peri-implant probing depth (PD) remained unchanged (3.9mm). On the other hand, in the minocycline group, the reduction of bleeding on probing was statistically significantly greater and an improvement in mean peri-implant PD (from 3.9mm to 3.6 mm) was seen. These results suggest that the topical application of chlorhexidine provides limited or no adjunctive clinical improvement when treating shallow peri-implant lesions as compared with using mechanical debridement alone. (33)

Karring et al. (2005) studied the efficacy of sub-mucosal debridement without antibiotics for the therapy of peri-implantitis utilizing an ultrasonic device or carbon fiber curettes. Karring concluded that there was no statistically significant difference reported for the implants treated either by the ultrasonic device or manually scalers from baseline, three, and six months regarding reduction in bleeding on probing and radiographical bone loss. (34)

Schwarz et al. (2005, 2006a) compared the efficacy of the Er:YAG laser with that of the combination of mechanical debridement (using plastic curettes) and antiseptic (0.2% chlorhexidine digluconate) administration for the treatment of peri-implantitis. In both studies the results obtained at 6 months after therapy suggested that the treatment modalities were equally efficacious in significantly improving peri-implant probing pocket depth (PPD) and clinical attachment level (CAL). However, at 12 months, the mean values for both groups of peri-implant PPD and CAL were not statistically significantly different from the corresponding values at baseline. Therefore the results of the Er:YAG laser seems to be limited to a 6-month period, particularly for advanced peri-implantitis lesions. (30)

Leonhardt et al. (2003) evaluated the 5-year outcome of a combined surgical (open flap) and antimicrobial treatment of peri-implantitis in humans. Leonhardt studied the effect of systemic antimicrobial therapy (amoxicillin and metronidazole) together with an open flap procedure and in conjunction with mechanical debridement of the implant surface for decontamination. The treatment was successful in 58% of the implants treated during follow-up for 5 years (26). Smoking was found to be a negative risk factor for treatment success.

Schwarz et al. (2006b) evaluated and compared the efficacy of two bone regenerative procedures for the treatment of moderate intra-bony peri-implantitis lesions that included at a greater than 6mm probing depth and an intrabony component of 3mm as detected on radiographs. The defects were randomly treated either with a surgical debridement and filled with nanocrystalline hydroxyapatite, or surgical debridement and filled with bovine-derived xenograft (Bio-Osss, Geistlich, Wolhusen, Switzerland) combined with a bioresorbable porcine-derived collagen membrane (Bio-Gides, Geistlich, Wolhusen, Switzerland) (31). After two years the study showed that the combination of bovine bone mineral and the collagen membrane seemed to yield greater improvements in clinical parameters showing 0.9 +/- 0.2mm more in PD reduction and 1.0 +/- 0.3 more clinical attachment gain (32).

In this review several modalities have been evaluated as for treatment for peri-implantitis. To date, none of the techniques have been shown to be predictable (Table 1.). At best, a 5-year follow-up study showed a 58% success rate. Moreover, no histological study has reported has reported significant re-osseointegration of a peri-implantitis affected surface. Wetzel 1999 (39).

CONCLUSIONS

The ideal management of peri-implant infections should focus both on infection control of the lesion, detoxification of the implant surface, and regeneration of lost support. Treatment options can be surgical or non-surgical. In this review was concluded that non-surgical treatment of peri-implantitis was unpredictable, while the use of chemical agents such as chlorhexidine had only limited effects on clinical and microbiological parameters. Adjunctive local or systemic antibiotics were shown to reduce bleeding on probing and probing depths in combination with mechanical debridement. Beneficial effects of laser therapy on peri-implantitis have been shown, but this approach needs to be further evaluated. Implant surface bacterial decontamination is the essential in treating peri-implantitis infections. In the studies described, establishing an adequate healthy tissue environment proved to be difficult since inflammation was still present in a significant number of patients. New treatment modalities need to be evaluated using long term randomized-controlled studies to identify predictable and successful treatment of peri-implantitis.

"…implant surface bacterial decontamination is the essential in treating peri-implantitis infections. In the studies described, establishing an adequate healthy tissue environment proved to be difficult since inflammation was still present in a significant number of patients…"

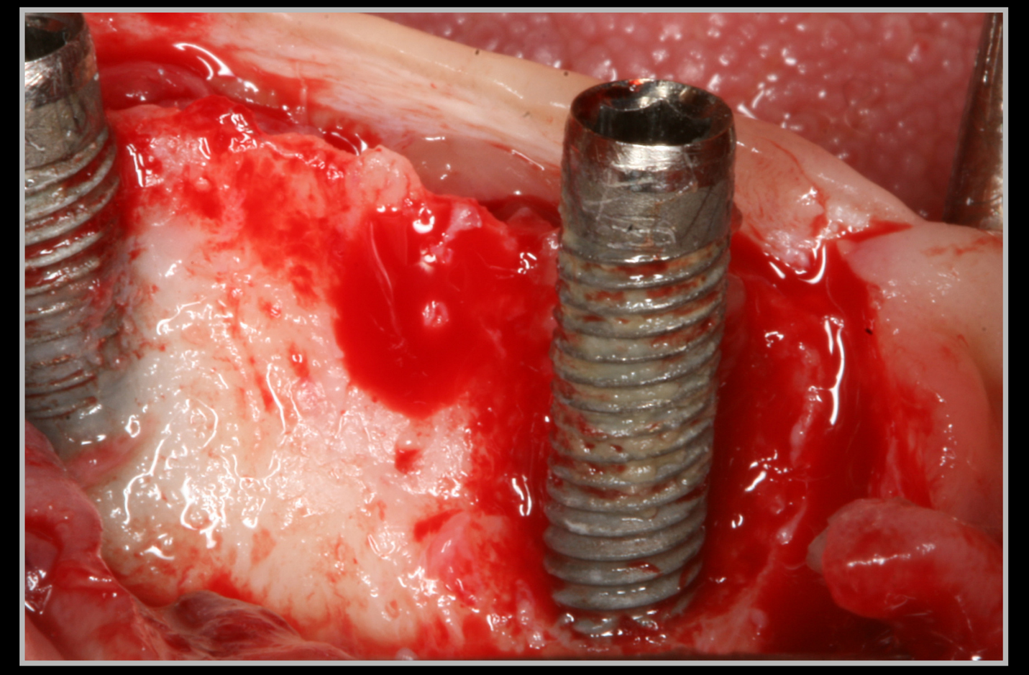
Fig 1a. Peri-implantitis around on internal hex implant

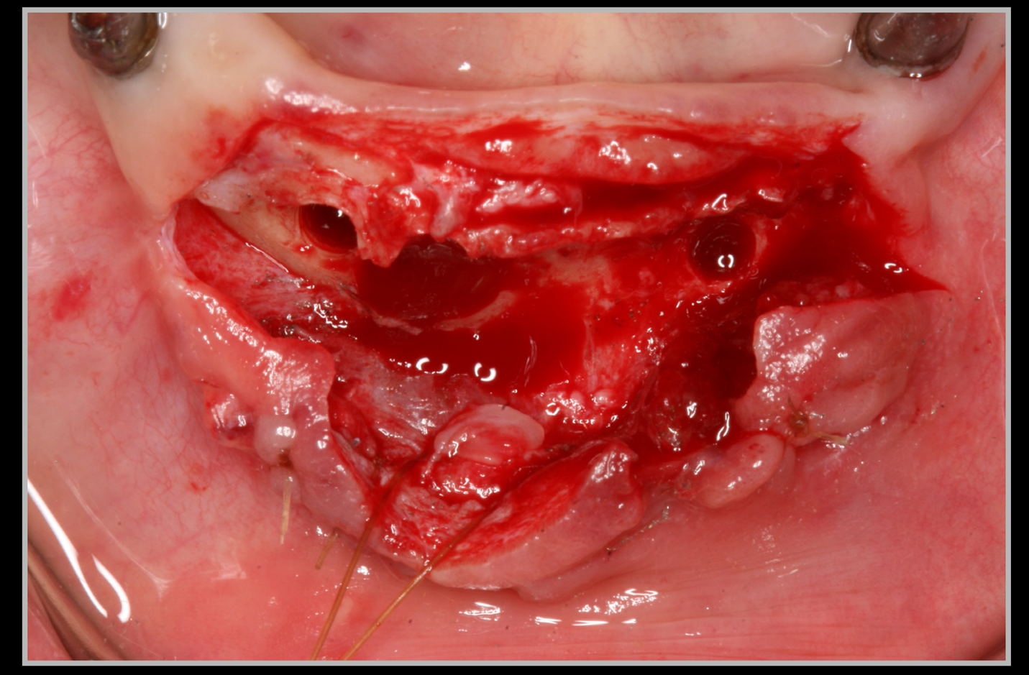
Fig 1b. Implant removal site

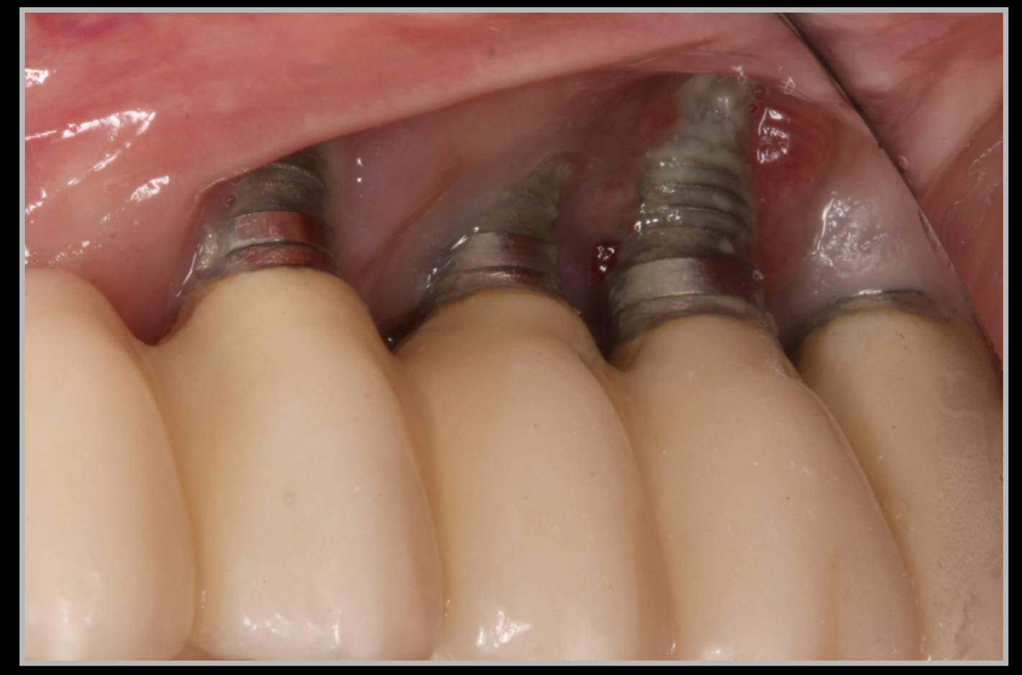
Fig 2a. Peri-implantitis around a RTs implant

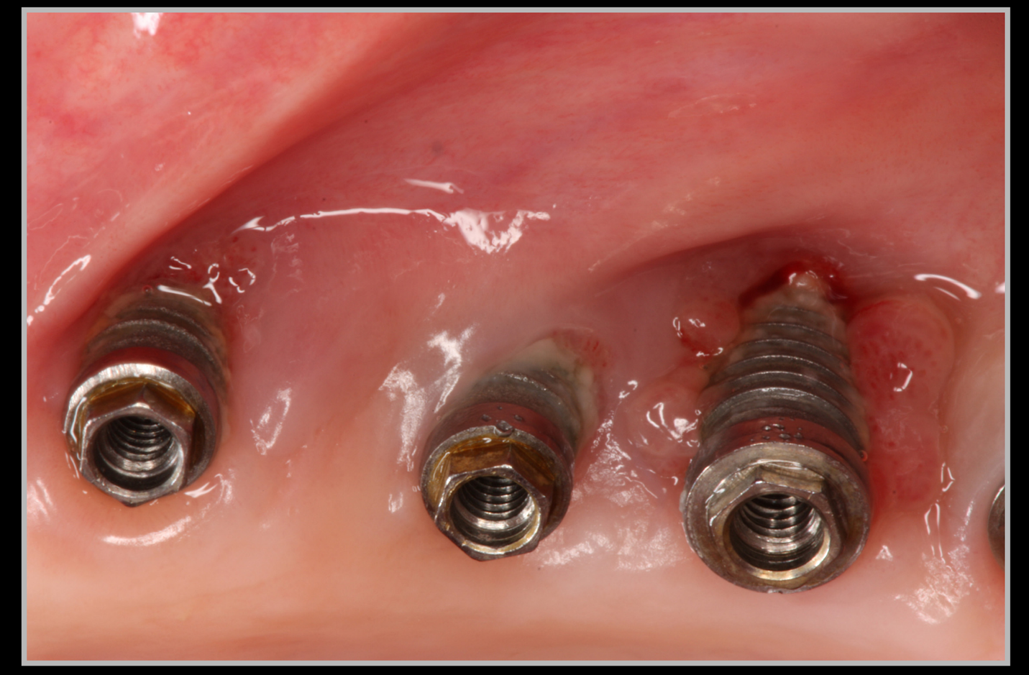
Fig 2b. Peri-implantitis lesions surrounding implants

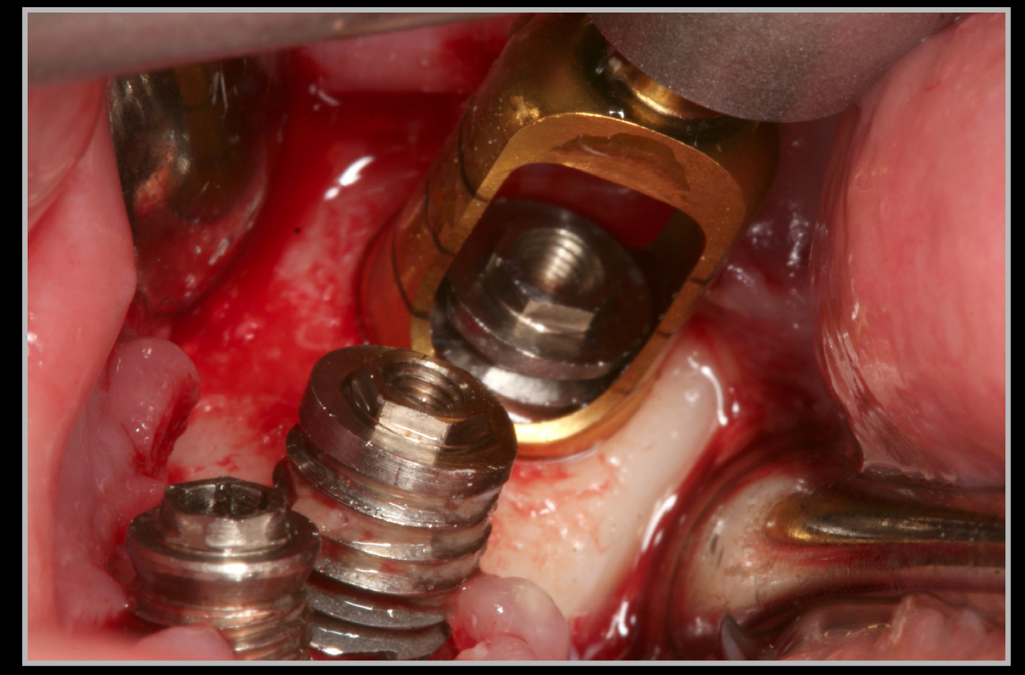
Fig 3a. Peri-implantitis around on external hex

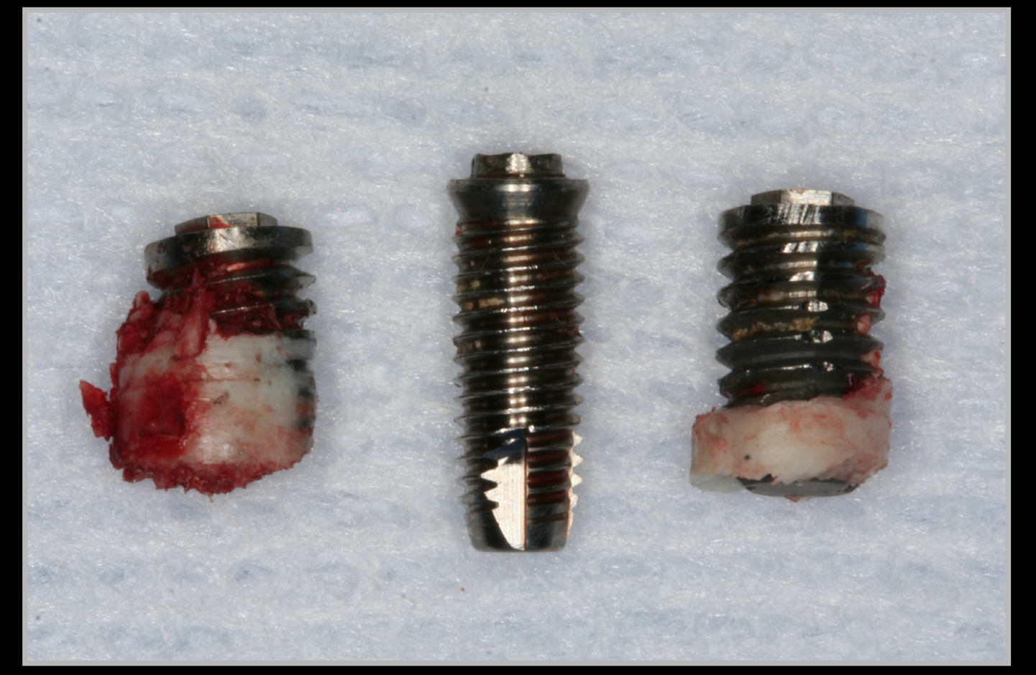
Fig 3b. Removed implants showing extend bone loss

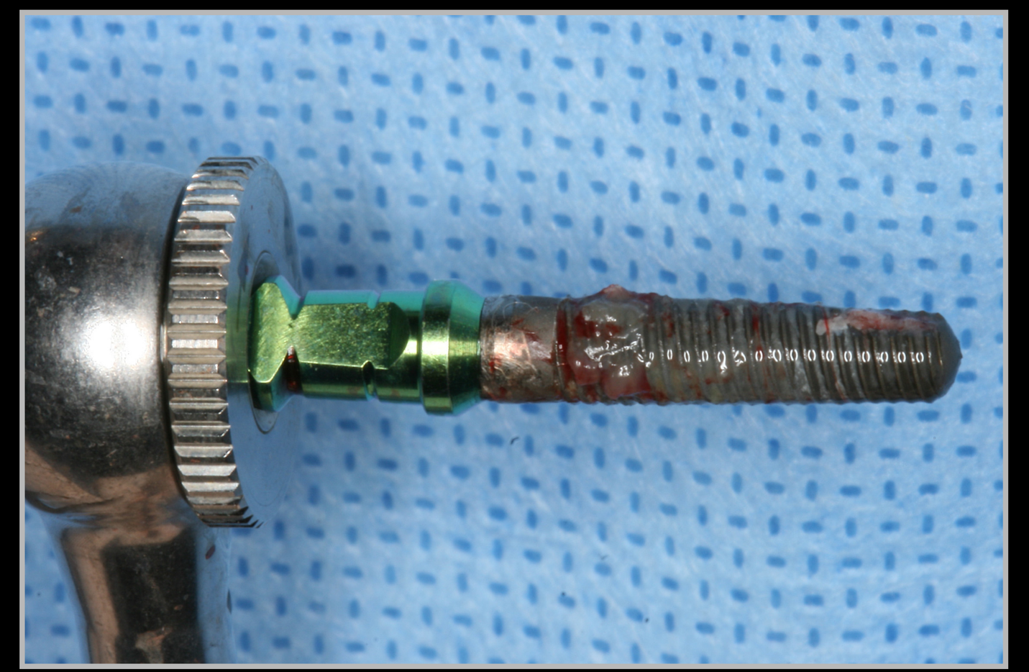
Fig 1c. Implant removal with torque wrench

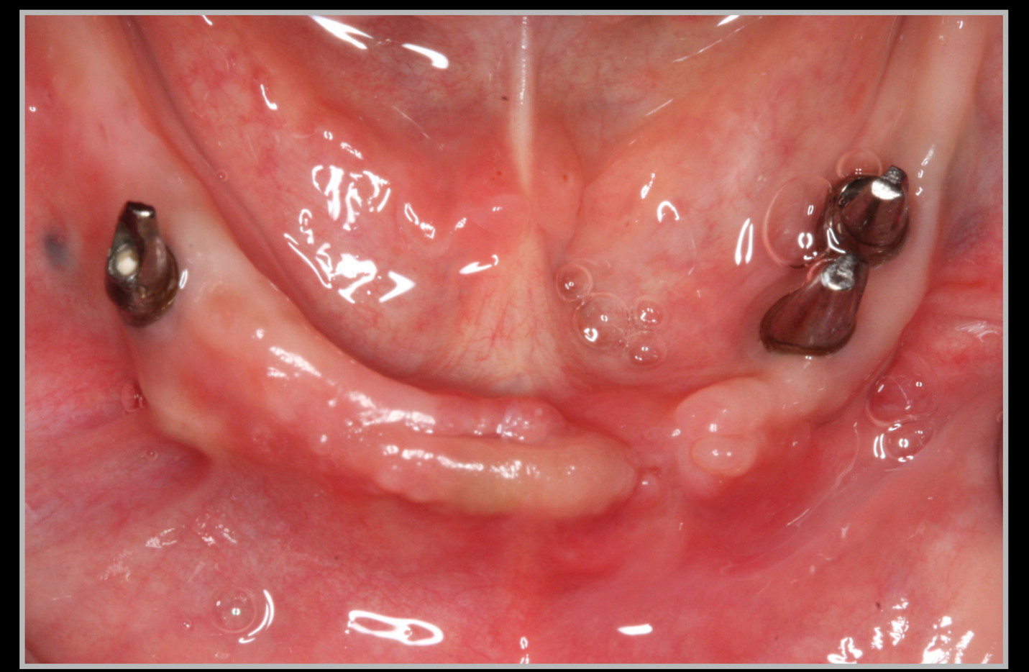
Fig 1d. Healed after implant removal


Fig 2c. Removed implants showing extend of infection

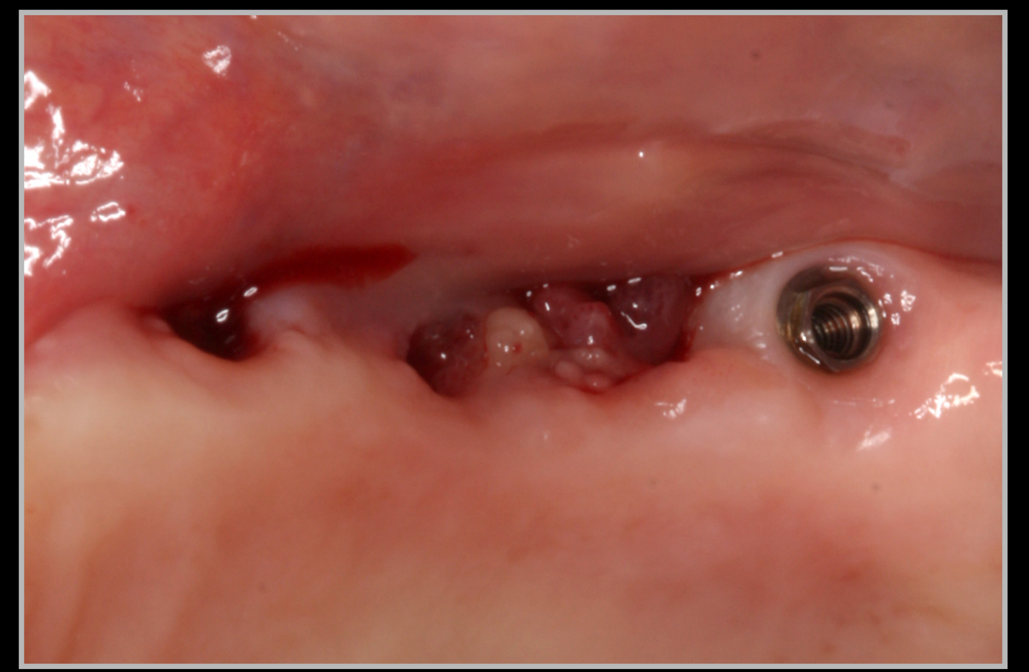
Fig 2d. Site of implant failure due to peri-implantitis

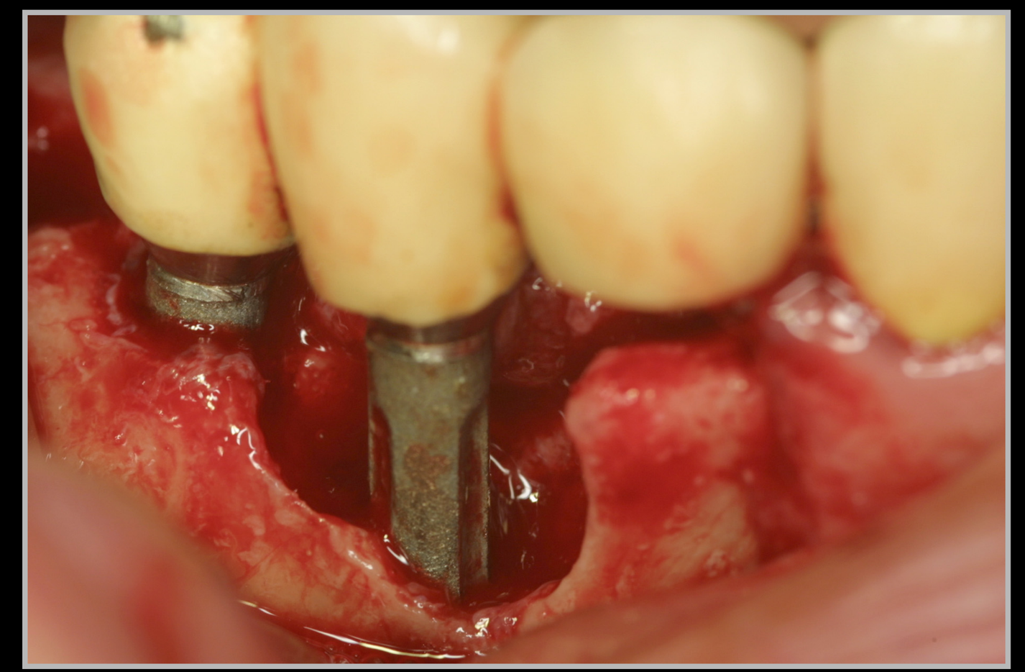
Fig 4a. Peri-implantitis around on press-fit im

Author	Procedures	Patients and implants	Follow-up	Survival rate
Leonhardt, A et al. (2003)	Open flap debridement, Antibiotic: Systemic administration of Amoxicillin and metronidazole	9 patients, 26 implants	6 months, 1 and 5 years	58%
Karring et al. (2005)	Ultrasound debridement, No Antibiotic used	11 patients, 22 implants	6 months	100%
Schwartz et al. (2005) (2006a)	No flap, Er:YAG laser, mechanical debridement, chlorohexidine	20 patients, 32 implants (2005), 20 patients, 40 implants (2006a)	6 months (2005), 12 months(2006a)	100%
Schwartz et al. (2006b) (2008)	Open flap, nanocrystaline hydroxyapatite, or bovine bone combined with a collagen membrane	22 patients, 22 implants	6 months (2006b), 2 years (2008)	100%, 100%
Renvert et al. (2006)	Sub-mucosal mechanical debridement, Topical minocycline microspheres or 1% chlorhexidine gel application	30 patients, 87 implants	12 months	100%

Table 1. Comparison of different treatment modalities

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