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RESEARCH ARTICLE

CURRENT TREATMENT MODALITIES FOR PERI-IMPLANT DISEASES.

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Abstract

Peri-implant diseases are of major concern in dentistry now a days. Despite the severity of this disease, that not only affect patient health but also financial burden for them. Still acceptable standard treatment protocols are missing to address this issue. Hence, the present literature reviews the various treatment aspect of peri-implantitis and reconnoitre their benefits and limitations. Peri-implantitis can be treated by surgical and nonsurgical approaches or combined. Nonsurgical therapy aimed to conservatively debride local irritants from the implants surface with or without surface decontamination and possibly may include adjunctive therapies agents or devices. Systemic antibiotics has also been incorporated. Surgical therapy is aimed at removing subgingival deposits, dead and necrotic tissues and it also reduce the inflammaotry peri-implant pockets. This can be done alone or in conjunction with either osseous resective approach or regenerative approach. Finally, if nothing works, explantation might be the last resort in order to arrest the further destruction of the osseous structure around the implant, thus preserving whatever is left in this site if future reconstruction has to be attempted. The available literature is still not conclusivedue to large heterogeneity in the treatment dilemma. Therefore, at present treatment of peri-implantitis should be considered possible but not necessarily predictable.

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Introduction:-

The use of dental implants has revolutionized the treatment of partially and fully edentulous patients today. Implants have become a treatment approach for managing a broad range of clinical dilemmas due to their high level of predictability and their ability to be used for a wide variety of treatment options. While in many cases dental implants have been reported to achieve long-term success, they are not immune from complications associated with improper treatment planning, surgical and prosthetic execution, material failure, and maintenance. Implant success rates are often reported in the high-90% range. This number reflects a very predictable procedure, but not a procedure that is always (100%) successful. Thus, complications and failures do occur, and for the patient with the failure, the failure rate remains 100%.

In 2008 Zitzmann and Berglundh have suggested that 80 percent of the patients and 50 percent of the implants will develop peri-implant mucositis during the years. These corresponding figures for peri-implantitis are 28–56% and 12–43% for the patients and implants respectively¹

To the contrary, Mombelli et al in 2012, have suggested lesser numbers of peri-implantitis cases, 20 percent of the subjects and 10% of the implants²

Also, Koldslund et al 2010 in their study have shown 39.4% subjects and 27.3 % implants suffered peri-implant mucositis and 47.1 % subjects and 36.1% implants for peri-implantitis.³

The reason for this large variation in the reported literature might be associated with lack of universally accepted definitions of peri-implantitis. Also patients variables such as smoking, pre-existing periodontal disease, oral hygiene quality of prosthetic reconstruction and some systemic conditions and medications also affects the outcome of therapy.

Nonsurgical Treatment of Peri-Implantitis:-

1. Debridement of implant surface:-

Implant surfaces shows growth of various bacteria and it is in dynamic state, with proportion of bacteria varying as the days advances. Like *Porphyromonas gingivalis* was not detected at baseline, but after 20 and 40 days it was detected in 33.34% of implants and at 60 days it was detected in 29.03% of dental implants. Streptococci were detected in 16.67% of implants at baseline and in 83.34%, 72.22%, and 77.42% of implants at 20, 40, and 60 days respectively. Also, the proportions of the pathogens from the red complex were elevated, while host-compatible beneficial microbial complexes were reduced in diseased compared with healthy implants.⁴

Thus, implant debridement in order to eliminate bacterial flora that is likely associated with the peri-implant disease is much needed. Renvert et al. in 2009 found minimal pocket reduction from baseline (5.1 mm) and 6-month (4.9 mm). Also, Plaque scores at treated implants decreased from 73% to 53% ($P < 0.01$).⁵

So it seems judicious to advocate that mechanical or ultrasonic debridement alone may not be an enough for the resolution of peri-implantitis.

2. Surface Decontamination:-

In order to improve the outcome of nonsurgical therapy of peri-implantitis site, the use of surface decontamination has been studied and can be performed mechanically via the use of air abrasive devices or chemical agents. Sahmand coworkers compared the efficacy of nonsurgical treatment of peri-implantitis using an air abrasive device versus mechanical debridement and local application of chlorhexidine solution (CHX). After six months, the air abrasive group revealed significantly higher changes in mean BOP scores when compared with mechanically treated sites ($43.5 \pm 27.7\%$ versus $11.0 \pm 15.7\%$). However, pocket reduction was minimal (0.6 mm) in both treatment groups.⁶

Muthukuru et al 2012 in the systemic review stated that Glycine air powder polishing reduced BOP better than CHX irrigation.⁷ Tastepe et al in a recent review concluded that the in vivo data on air powder abrasive treatment as an implant decontamination is not sufficient to draw definitive conclusions.⁸

3. The Use of Lasers:-

Salmeron et al in an animal model have studied laser therapy alone or with photodynamic therapy and compared them to both negative and positive controls for implant surface decontamination. The results of this histomorphometric study were then followed longitudinally, while photodynamic therapy showed some improved early (7 days) results; over longer time periods (> 14 days), all methods produced similar results.⁹

Schwarz et al 2006 compared the efficacy of Er YAG laser with plastic curett and irrigation with 0.2% chlorhexidine Er YAG Laser. He found that both therapies- improved clinical parameters (BOP, PD CAL) at 3, 6, 12 months and Laser shows higher reduction in BOP at 12 months.¹⁰

Renvert et al 2011 used Er YAG laser 100mJ/ pulse 10 Hz for mechanical debridement and compared with the subgingival glycine air powder polishing they found out that BOP and PPD reduced at 6 months, however no significant difference was observed between the 2 groups.¹¹

Muthukuru et al 2012 in the systemic review stated that Er YAG laser reduces, BOP scores more as compared to CHX irrigation.

The adjunctive effect of photodynamic therapy in conjunction with soft laser therapy was also studied in vitro by Haas et al. After contaminating these rough surface implants with *Actinobacillus actinomycetemcomitans* or *Porphyromonas gingivalis* or *Prevotella intermedia*, these surfaces were then treated with a toluidine blue solution and irradiated with a diode soft laser with a wave length of 905nm for 1min. smears obtained from the treated surfaces did not show any bacterial growth, whereas the smears obtained from the controls showed unchanged growth of every target organism tested.

Esposito and coworkers in a multicenter randomized controlled clinical trial compared the adjunctive use of light-activated disinfection (LAD) in the treatment of peri-implantitis with mechanical cleaning of implants affected by peri-implantitis and concluded that LAD therapy did not improve any clinical outcomes when compared to mechanical cleaning alone up to 1 year after treatment.¹²

It was further suggested that a single course of treatment with the Er:YAG laser may not be sufficient for achieving a stable therapy of peri-implantitis and that additional treatment modalities, such as additional use of the Er:YAG laser and/or subsequent osseous regenerative procedures, might be required.

4. The Adjunctive Effect of Local Delivery of Antibacterial Agents:-

In 2001 Mombelli and coworkers explored the adjunctive effect of tetracycline fibers in the nonsurgical treatment of peri-implantitis. After one year, a significant decrease in the proportion of *Prevotella intermedia/nigrescens*, *Fusobacterium* sp., *Bacteroides forsythus* and *Campylobacter rectus* was noted. Clinically, mean pocket reduction was 1.2–1.9mm which was maintained up to 12 months postop. However all the subjects in this study did not show any improvement¹³

Buchter et al 2004, adjunctive local delivery of 8.5% doxycycline hyclate resulted in significantly lower BOP scores and PPD's and CAL's when compared with mechanical debridement alone at 18 weeks in the peri-implant pockets.¹⁴

More recently, Eli E. Machtei in 2012 has conducted a randomized double blind placebo controlled multicenter clinical trial on the use of chlorhexidine containing chips (Periochip) in the treatment of peri-implantitis. In this study, chlorhexidine containing chips were inserted over and over again into the peri-implant pockets of moderate to severe peri-implantitis sites every other week for a period of up to 3 months. This novel approach of repeated placement of chlorhexidine chips has resulted in a significant improvement of the peri-implant soft tissue parameters six months postop: pocket reduction (mean 2.29 mm) and attachment level gain (2.21 mm) were significantly better than those previously reported for nonsurgical treatment of peri-implantitis.¹⁵

However, Renvert et al did not obtain significant improvement in pocket reduction on repeated subgingival application of minocycline microspheres (Arestin) once a month for up to three months. They have obtained mean pocket reduction in the deepest sites to 0.9mm in the experimental group.¹⁶

5. Use of systemic antibiotics:-

Hallström et al in 2012 have compared, in a randomized clinical trial design, nonsurgical treatment of peri-implant mucositis with or without systemic antibiotics. 48 subjects received nonsurgical debridement with or without systemic Azithromycin for four days and were followed during 6 months. Pocket reduction was 0.9mm in the antibiotics group (1.4mm in the deepest sites) and 0.5mm in the debridement only group (0.8mm in its deepest sites). However, these differences were not statistically significant.¹⁷

Most recently, Javed et al 2013 in a systematic review of the use of antibiotics in the treatment protocol of peri-implantitis concluded that the significance of adjunctive antibiotic therapy in the treatment of peri-implantitis remains contentious.¹⁸

A potential explanation for this minimal adjunctive effect for these systemic antibiotics comes from study by Rams and coworkers. They found that one or more cultivable submucosal bacterial pathogens (most often *Prevotella intermedia/nigrescens* or *Streptococcus constellatus*) were resistant in vitro to clindamycin, amoxicillin, doxycycline, or metronidazole in 46.7%, 39.2%, 25%, and 21.7% of the peri-implantitis subjects respectively.¹⁹

Another important issue that needs to be addressed is the risk of antibiotic resistance as a worldwide health hazard. The wide spread use of antibiotics in medicine and in dental practice leads to large increasing prevalence of resistant bacterial strains.

Thus, the use of antibiotics should be restricted to patients and conditions where it has been clearly shown to have significant benefits which outweigh the risks that are involved. Thus, current research has not yet substantiated such benefits and consequently systemic antibiotics should be limited to acute phase of peri-implant infection rather than to be the treatment of choice for peri-implantitis.

If peri-implantitis is associated with progressive periodontal disease, then both the conditions need to be treated. In this case, the adjunctive use of systemic antibiotics may be considered. However, there are no clinical trials available nowadays on the systemic administration of antibiotics for the therapy of peri-implantitis.

Surgical Treatment of Peri-implantitis:-

1. Open Flap Debridement:-

Máximo et al. 2009 in a short term clinical study have shown that three months following access flap surgery all clinical parameters have improved. For the peri-implantitis groups, mean reduction in CAL was 2.3 ± 1.6 mm and mean implants pocket reduction was 3.1 ± 1.7 mm. Levels of *Treponema denticola*, *Tannerella forsythia*, and *Parvimonas micra* and of *Fusobacterium nucleatum* were significantly reduced after peri-implantitis therapy. In addition, counts of *Porphyromonas gingivalis* and *Treponema socranskii* and the proportions of red complex were also reduced. They also have shown that TNF alpha levels, initially much greater than healthy controls, were significantly reduced achieving the same level as the healthy group at 3 months after therapy.²⁰

Lagervall and Jansson 2013 in a retrospective study of treatment outcome in patients with peri-implantitis have reported that open flap debridement was selected for forty-seven percent of the sites affected by peri-implantitis.²¹

Albouy et al 2011 in a preclinical experimental peri-implantitis study in canines have compared responses to open flap debridement surgery (as a stand-alone procedure) in four different implants design and surface topographies. Two of the four TiUnite implants were lost after surgical therapy. Radiographic bone gain occurred at implants with turned, TiOblast, and SLA surfaces. Resolution of peri-implantitis was achieved in tissues surrounding implants with turned and TiOblast surfaces.²²

Thus, they concluded that resolution of peri-implantitis following treatment without systemic or local antimicrobial therapy is possible, but the outcome of treatment is influenced by implant surface characteristics.

2. The Supplementary Use of Osseous Resection:-

de Waal and coworkers reported on 79 implants with peri-implantitis that were treated with apically repositioned flap, bone recontouring, and surface debridement and decontamination with 0.12% chlorhexidine gluconate + 0.05% cetylpyridinium chloride or placebo. 9 implants in the placebo-group were lost due to severe persisting peri-implantitis. The test group showed a significantly greater reduction in bacterial load, but clinical improvement (i.e., bleeding, suppuration, implants pocket depth, and radiographic bone loss) was significant however similar in both groups.²³

Serino and Turri 2011 reported on their two-year prospective clinical trial of thirty-one subjects (86 implants) treated for peri-implantitis using a surgical procedure based on pocket elimination and bone recontouring. Two years after treatment, 48% subjects had no signs of recurrent peri-implant disease; 77% had no implants with probing pocket depth of 0.6mm associated with bleeding and/or suppuration following probing. Nevertheless, 42% out of the original 86 had persistent peri-implant disease despite this treatment. The proportion of implants that remained healthy following treatment was higher for those with minor initial bone loss (2–4mm bone loss as assessed during surgery) compared with the implants with an initial bone loss of 0.5mm (74% versus 40%). Among the eighteen implants with bone loss of 0.7mm at baseline, seven were explanted.²⁴

A randomized comparative clinical trial by Romeo *et al* concluded that respective surgical procedures coupled with implantoplasty could have a positive influence on the survival rates of rough-surfaced implants affected by peri-implantitis as well as on peri-implant clinical parameters, such as pocket-probing depth, suppuration, and sulcus bleeding.

3. Negotiating with Regenerative Techniques:-

As early as 1993, Grunder et al. in his experimentally induced peri-implantitis study in canines using guided tissue regeneration with a non-resorbable ePTFE membrane and comparing it to flap surgery alone, reported that there were no differences between any of the clinical parameters in both the control and experimental sites from the submerged and nonsubmerged groups. Histologic and histomorphometric analyses also revealed no significant differences between groups with regard to new bone formation.²⁵

Nociti et al. in an animal model compared different membranes, with and without additional bone graft, to flap surgery only for the treatment of peri-implantitis. Their results showed that debridement alone as well as grafting alone had the same effect as did either membrane.²⁶

However, Hurzeler and coworkers reported in an *in vitro* canine study that guided bone regeneration procedures resulted in the greatest amount of new bone formation, followed by bone grafts alone, and flap debridement.²⁷

In humans, Roos-Jansaker et al. were able to show similar response to therapy i.e implants pocket reduction of 2.9–3.4mm and new bone fill of 1.4–1.5mm for peri-implantitis sites treated with either bone grafts alone or bone grafts in conjunction with resorbable collagen membrane.

Recently, Wiltfang et al. 2012 have reported significant bone fill in a 12 months clinical trial in which peri-implantitis sites were treated with surface decontamination and regenerative flap surgery that included a 1:1 ratio of autogenous and xenogeneic bone graft.²⁸

Sahrman et al. 2011 in a systematic review have concluded that complete fill of the bony defect using GBR seems not to be a predictable outcome²⁹

Well-controlled trials are needed to determine predictable treatment protocols for the successful regenerative treatment of peri-implantitis using GBR technique.

A possible explanation to the diversity in clinical response to regenerative surgical treatment around dental implants was suggested by Schwarz et al. In this study, three types of osseous defects around dental implants with peri-implantitis were treated with bone graft and resorbable collagen membranes. The circumferential defects yielded significantly better results than the sites with dehiscence type defect. Thus, defects anatomy might affect the consequence of these regenerative techniques.

4. Systemic Antibiotics to Adjunct Surgical Approach:-

Flap surgery treatment are commonly adjunct with systemic antibiotics. Leonhardt et al. reported on a five-year clinical, microbiological, and radiological study into the treatment of peri-implantitis. Surgical exposure of the lesions and surface debridement of the implants were performed using hydrogen peroxide. The patients were put on systemic antibiotics. The treatment was evaluated clinically, microbiologically, and radiographically at 6 months, 1 year and 5 years. Seven out of 26 implants with peri-implantitis at baseline were lost during the 5-year follow-up period despite a significant reduction in the presence of plaque and gingival bleeding. Four implants continued to lose bone, 9 had an unchanged bone level, and 6 gained bone. Five of the patients were treated with antibiotics directed against putative periodontopathogens that is *A. actinomycetemcomitans*, *P. intermedia* or *P. gingivalis* three patients were treated for presence of enterics (*E. coli* and *E. cloacae*) and in one patient, treatment was directed against *S. aureus*. Thus the use of systemic antibiotics should be limited only to medically compromised individual or in which persisting periodontitis is present³⁰

Explantation:-

The management of peri-implantitis may at time be capricious especially for the more advanced lesion associated with severe bone loss. This may in turn lead to further bone loss, increase in pocket depth and suppuration, and consequently severe damage to the alveolar bone. Thus, explantation as a treatment option that will help arrest the progression of the destructive process is sometime advocated. Moreover, mechanical fracture of implant may also be seen, which further advances the bone loss phenomenon.

Reimplantation of a new implant in the sites of the previously diseased implant is a viable treatment option; however, this treatment approach has its own limitation: bone loss that has occurred around the diseased implant might not allow for frank reimplantation. Instead, sometimes an intricate augmentation procedure are required to make the site for redo implant placement.

Mardinger et al. in a retrospective analysis reported that the chances of a patient with minor bone loss undergoing reimplantation were 20 times greater (odds ratio, 20.4) than those of a patient with severe bone loss. The main patient related reasons for evading reimplantation were the additional costs (27%), fear of additional pain (17.7%) and fear of a second failure (16.2%).³¹

The survival and success rates of dental implants in previously failed implant sites were first reported by Alsaadi and coworkers. A total of 41 patients (58 implants) experienced the non-integration. Of those, seven implants (in seven subjects) have failed again (which represents a survival rate of 87.9%).

Replacement of maxillary and mandibular failed implants have shown similar results. Most of the failures occurred during the first year after implant replacement.³²

Another valid alternative is to do a hybrid tooth-implant- supported fixed partial denture. In a systematic review, Weber and Sukotjo have shown that, after an observation period of at least six years, implant survival and prosthetic success were similar for implant supported and tooth to implant supported prostheses.³³

Likewise, Lang et al. in their systematic review on the survival and complications of combined tooth-implant-supported FPD reported 90.1% implants survival after 5 years and 82.1% after 10 years. The corresponding figures for the FPD survival were 94.1% and 77.8% after five and ten years respectively. These results are very similar (both for survival and success) to what was reported for teeth-born and implants-born fixed prosthesis.³⁴

Thus, such rehabilitation may be considered in cases where a potential abutment tooth is present across an edentulous site where one of the implants has failed.

Conclusion:-

Both nonsurgical and surgical treatment strategies have shown to produce some beneficial effect on the peri-implant disease.

The most annoying piece of information is the heterogeneity in the clinical response of peri-implantitis sites that were treated similarly as it was reported in the different studies.

Likewise, Esposito and coworkers in a recent systematic review and meta-analysis that tried to identify the most effective interventions for treating peri-implantitis around osseointegrated dental implants have concluded that there is no reliable evidence suggesting which could be the most effective interventions for treating peri-implantitis.

With the ever growing prevalence of peri-implant diseases, there is need to address this issue is both real and urgent.

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