Comparative Assessment of Conservative and Surgical Treatment Methods of Peri-Implantitis

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Abstract

While in many cases dental implants have been reported to achieve long-term success, these are also not immune from the complications. Peri-implantitis is one of the complications of implant treatment, which may lead to implant failure. The optimal result of peri-implantitis treatment is a regeneration of the lost implant supporting hard and soft tissues. Many different treatment strategies for peri-implantitis have been suggested, however, as of today, no consensus exists regarding effective peri-implantitis treatment.

The aim of the present study is to assess the effectiveness of different treatment methods for peri-implantitis.

The 32 patients involved in this study (14 females, 18 males, at a mean age 48, 3 years) with inflammatory-destructive processes in the field of peri-implant tissues of osseointegrated implants. A total of 46 implants were treated. (16 implants diagnosed with peri-implant mucositis, 14 implants-early peri-implantitis, 12 implants-moderate peri-implantitis and 4 implants severe peri-implantitis).

The patients were examined clinically and radiographically. 16 implants with peri-implant mucositis, 8 implants with early peri-implantitis and 5 implants with moderate peri-implantitis was treated only conservative treatments methods, 6 implants with early peri-implantitis, 7 implants with moderate peri-implantitis and 4 implants with severe peri-implantitis was treated surgically.

The diagnostic parameters used for assessing peri-implantitis include clinical indices-probing pocket depth (PPD), bleeding on probing (BOP), suppuration, mobility, peri-implant radiography.
PPD and BOP data at the re-examination were retrospectively compared to baseline data. The results of the study showed a reduction in mean PPD and BOP after therapy.

Conservative treatment methods are effective in the treatment of peri-implant mucositis and early peri-implantitis. When peri-implantitis category moderate and severe effective surgical treatment combined conservative therapy. Surgical reconstructive procedures combined with mechanical and chemical detoxification of the implants’ surface, magneto-laser therapy, and regenerative therapy effective method for stopping and treatment of peri-implantitis.

Introduction

Although the high predictability and long-term success rate of dental implants are well documented in the literature, complications, and failures do occur. The number of such complications according to different authors varies from 5 to 24% [2,6,13,21].

Implant complications may be described as early or late. Typical early complications include intrasurgical problems such as hemorrhage, damage to adjacent teeth, neurosensory disturbances, jaw fracture, and maxillary sinus violations [11,14,15,18,22,34,37]. Early complications during implant placement include overheating of bone during implant osteotomy, contamination of the surgical site and/or the dental implant surface from bacteria during implant placement, which can result in the failure of the implant to integrate [13,33]. Lack of primary stability can result in implant micro-motion above 100 microns and loss of the implant due to fibrous tissue bonding to the implant surface instead of bone [8]. A late complication occurs as a result of peri-implantitis and/or excessive mechanical stress in a successfully osseointegrated implant.

The most common complication of dental implantation, which occurs in post-implantation period is peri-implant mucositis and peri-implantitis. If they are not prevented or managed appropriately they may lead to failure of the implant. The term peri-implantitis first appeared in the literature in 1987 in a study by MombelliA.et al. describing peri-implantitis is defined as an inflammatory reaction to the loss of supporting bone in the tissues surrounding a functioning implant [35]. Peri-implant mucositis is defined as a reversible inflammatory reaction in the soft tissue surrounding a functioning implant [31]. Systematic review Mombelli et al. (2012), suggested prevalence at a patient level of 20% peri-implantitis [36]. Zitzmann et al. (2008), have reported that 28–56% of the patients had peri-implantitis [50]. The reason for this large variation in the reported literature might be associated with patients variables such as smoking, preexisting periodontal disease, oral hygiene [42,32,45].

According to a statement released in 2013 by the American Academy of Periodontology (AAP) on the “current diagnosis and clinical implications of the peri-implant disease,” there are risk factors that can increase the potential for peri-implant disease. These factors include previous periodontal disease, poor oral hygiene, residual cement from cement-retained restorations, smoking, genetic factors, poorly controlled diabetes and occlusal overload [3].

The etiopathogenesis of peri-implantitis is complex and include 3 main factors: microbiological factors, biomechanical factors and patient-related factors [2,3,5,41].

The microbiological component plays an important role during implant placement, and also later when the implant is in function. The microorganisms most commonly related to the failure of an implant are the Gram-negative anaerobes, Prevotella intermedia, Porphyromonas gingivalis, Aggregatibacter actinomycetemcomitans, Tannerella forsythia, Treponema denticola, Prevotellaniagrescens, Peptostreptococcus micros and Fusobacterium nucleatum [4,25,40]. The formation of a biofilm on the implant surface plays a significant role in the initiation and progression of peri-implant diseases [47].

Peri-implantitis, like periodontitis, occurs primarily as a result of a change in the microflora and a host immune
response. Markers typical for periodontal pathologies and for severe peri-implantitis, represented by a series of interleukin (IL)-1, IL-6, IL-8, IL-12 and tumor necrosis factor-alpha (TNF-α) [10,27].

Biomechanical factors include excessive mechanical stress caused by occlusal overload due to malocclusion, bruxism. Prosthesis-related factors: as a result of cantilevers in the prosthesis [6-8]. In addition to the above, iatrogenic factors such as cement left following restoration, the mobility of the restorative component, fractured restorative component, can also play a significant role in the development of peri-implantitis [28,29].

Patient-related factors include systemic diseases e.g. diabetes mellitus, osteoporosis, long-term treatment with corticoids, chemotherapy, history of periodontitis, dental plaque, poor oral hygiene, smoking, alcohol consumption [2,23,33,43,46].

Clinically peri-implant mucositis is characterized by:
- Presence of bacterial plaque and calculus.
- Oedema, redness and mucosal hyperplasia.
- Bleeding mucosal on probing.
- Exudate on occasions.
- The radiological absence of bone reabsorption.

Clinically Peri-implantitis is characterized by:
- Presence of bacterial plaque and calculus.
- Oedema and redness, slight pus formation after palpation.
- Mucosal hyperplasia in zones with a lack of keratinized gingiva.
- Increased probe depth.
- Bleeding after probing.
- Peri-implant bone destruction.
- Radiological presence of bone reabsorption.
- In the final stage, total loss of the bone-implant interface, implant mobility, pain.

From and Rosen proposed classification system, which depending on the pocket depth and bone loss, peri-implantitis has been put under three categories (Table1) [16].

Many methods of treating peri-implantitis have been documented in the literature and most focus on removal of the contaminating agent from the implant surface [19,24,26,38,39].

Treatment of peri-implantitis may include surgical and nonsurgical methods, either individually or combined. So the therapy of peri-implantitis comprises (a) the nonsurgical phase, which includes debridement by mechanical means, ultrasonic, or laser devices, either alone or combined with antiseptic and/or antibiotic agents and (b) the surgical phase, utilizing either respective or regenerative technique. Which therapy treatment will be applied depends on the level of destruction of the alveolar bone and the clinical characteristics of implant mobility.

Laser therapy is another therapeutic option for decontaminating both implant surfaces and peri-implant tissues. Diode, erbium lasers are suitable for implant irradiation because of their bactericidal effects, they are used within the appropriate parameters [1,20,30,48,49]. Photodynamic therapy can be a new alternative approach for decontamination of implant surfaces combined with mechanical debridement during surgical therapy. It is a non-invasive therapeutic treatment of various infections caused by bacteria, fungi, and viruses. Using this therapy, the target bacteria can be destroyed without adverse effect on the implant surface and surrounding peri-implant tissue [37,41].

The high prevalence of peri-implantitis reflects the insufficient effectiveness of methods of their treatment, which makes it important to search for new therapeutic approaches.

Surgical treatment of peri-implantitis involves flap surgery the infected area and debridement, mechanical cleaning of the implant surface and removal of granulation tissue [9,37,44,45]. Surgical treatment can be combined with different bone regenerative procedures, such as autologous or allogenic bone grafts [12,17]. In addition to bone grafts, resorbable and non-resorbable membranes can
be used.

All of the treatment modalities mentioned here have been used by various authors with varying degrees of success, yet there is no standardization for the treatment of peri-implantitis, no consensus regarding the best regenerative material. The search for optimal methods for the treatment of peri-implantitis is ongoing.

Magneto-laser therapy unites in themselves widely spread in modern medicine therapeutic factors: magnetic field, low laser radiation and light-diodes infra red radiation (magnet-light-laser therapy). Curative effect of magneto-laser therapy is determined by the biostimulation and mobilization of the existing energetic potential and is manifested as immune-modulating, anti-inflammatory, antispastic, regenerative, normalizing blood rheology and hemodynamics.

Contraindications for magneto-laser therapy are oncological diseases, emergency conditions, pregnancy, hepatic and renal insufficiency in the stage of decompensation, convulsive conditions, systemic blood diseases, cardiovascular and endocrine diseases.

The most successful magneto-laser therapy is used in the following diseases: in surgery - long-term non-healing wounds, trophic ulcers, burns, frostbite, vascular diseases of the lower limbs; in traumatology and orthopedics - inflammatory and traumatic diseases of the joints and spine, fractures of bones, myalgia, arthralgia; in dentistry - gingivitis, stomatitis, pulpitis, periodontitis.

The aim of the present study is to assess the effectiveness of different treatment methods for peri-implantitis.

Materials and Methods

The 32 patients involved in this study (14 females, 18 males, at a mean age 48, 3 years) with inflammatory-destructive processes in the field of peri-implant tissues of osseointegrated implants. A total of 46 implants were treated. (16 implants diagnosed with peri-implant mucositis, 14 implants-early peri-implantitis, 12 implants-moderate peri-implantitis and 4 implants severe peri-implantitis). In 34% of patients, peri-implantitis was developed early, already after having implants in function for 1 years. In 29% of the cases peri-implantitis was developed after 3 years and in 37% between 4 and 6 years of implants in function. Peri-implantitis was observed: in 14 patients with unsatisfactory hygiene; in 12 patients with non-observance of the periodicity of dispensary examination and occupational hygiene; 6 in patients with the initial presence of periodontitis.

Before the surgical procedure, all patients received extensive oral hygiene instructions. All patients were given a detailed description of the treatment procedures and were required to sign an informed consent form. The patients were examined clinically and radiographically. The diagnostic parameters used for assessing peri-implantitis include clinical indices, bleeding on probing (BOP), probing pocket depth (PPD), suppuration, mobility, peri-implant radiography.

Bleeding on probing (BOP), evaluated as present if bleeding was evident within the 30s after probing or absent if no bleeding was observed within 30s after probing.

BOP index was evaluated according to the following criteria:
0 - there is no bleeding;
1 - bleeding occurs not earlier than 30 seconds;
2 - bleeding occurs less than 30 seconds;
3 - bleeding occurs when eating or brushing your teeth.

The degree of bleeding was judged by the evaluation criteria:
0,1 - 1,0 - mild inflammation;
1,1 - 2,0 - the average inflammation;
2,1 - 3,0 - severe inflammation.

Probing pocket depth (PPD) was measured full millimeter with a manual periodontal probe from the mucosal margin to the bottom of the examined pocket.

Marginal bone loss readings from periapical radiographs (taken at the baseline diagnostic appointment). Clinical and radiographical parameters were recorded before treatment (baseline) and at 1, 3, 6 and 12 months after
treatment. Diagnosis is based on changes of color in the gingiva, bleeding and probing the depth of peri-implant pockets, suppuration, X-ray. Outcome measures were a reduction in PPD and BOP.

16 implants with peri-implant mucositis, 8 implants with early peri-implantitis and 5 implants with moderate peri-implantitis was treated only conservative treatments methods, 6 implants with early peri-implantitis, 7 implants with moderate peri-implantitis and 4 implants with severe peri-implantitis was treated surgically.

**Treatment Protocols**

Conservation treatment includes systemic antibiotics (amoxicillin 500mg and metronidazole 200mg or augment in 875mg or ciprofloxacin 250mg) all the above antibiotics were administered per with duration of 7-10 days. Microbial testing allows choosing the most effective antibiotic for every case. Mechanical implant cleaning with titanium or plastic-curettes, Air-Flow Perio Soft, local antiseptic medication (irrigation of the circus-pocket with 0.12% chlorhexidine, hydrogen peroxide), magneto-laser therapy with a wavelength of 810nm power density of 100mW during 60 seconds(Laser therapy apparatus MILTA-F-8-01,CJSC“Space Instrument Engineering” Moscow, RF), local applications 25% metronidazole dental gel (Elzylol dental gel). Patients received 10 days magneto-laser therapy with a wavelength of 810 nm power density of 100mW during 2min.

Surgical treatment includes systemic antibiotics, suprastructures were removed if reasonably possible (in all but 3 patients). Incisions were made using a surgical blade (no.15) under local anesthesia, a mucoperiosteal flap is lifted to expose the implant, granulation tissue is eliminated from the bone defect with a metal curette without touching the implant. After degranulation and antiseptic preparations bone loss were evaluated intrasurgically. The implant surface is decontaminated with Air-Flow Perio Soft, successive topical applications of citric acid, 0.12% chlorhexidine and sterile physiological saline, adjunctive magneto-laser therapy with a wavelength of 810 nm power density of 100mW during 30 seconds. Bone defect is restored using autogen bone, grafts materials-Oss (Geistlich Biomaterials, Wolhuser, Switzerland) combined with a Hyaluronic acid Gengigel (RicerFarmaS.r.l., Milano, Italy). An autologous bone and Bio-Oss had mixed with Gengigel outside the mouth and the peri-implant bone defect was filled. A bioresorbable collagen membrane Bio-Gide (Geistlich Biomaterials, Wolhuser, Switzerland) was placed over the filled defect. After bone grafting full thickness buccal and lingual flaps were repositioned and sutured, postoperative instructions were provided. Local applications 25% metronidazole dental gel (Elzylol dental gel). After surgery, the patients received 7 days magneto-laser therapy with a wavelength of 810 nm power density of 100mW during 2min. Following surgery, the patients rinsed twice a day for 1 min. with chlorhexidine 0.12% for a period of 2-3 weeks. The sutures were removed 7 days to 10 days after the surgery. Patients were recalled every three months for data collection and maintenance therapy. Professional hygiene was conducted every six months. 4 implants with remaining pathology and progressive bone loss, causing symptoms and discomfort to the patients were removed.

Statistical analysis: Statistical processing of the data was performed in the environment of the SPSS 11.5 package. Comparisons of quantitative traits were carried out using Student’s t-test. The paper presents the arithmetic mean and its error (M ± m). All differences were of statistical significance (p< 0.01).

**Results and Discussions**

Clinical and radiographical parameters were recorded before treatment (baseline) and at 3, 6 and 12 months after treatment. Treatment was considered successful if the following criteria were met: (1) absence of progressive bone loss, (2) absence of suppuration, (3) bleeding on probing at ≤ 50% of sites and (4) probing pocket depth <5 mm. Radiographically, increased or stable marginal bone levels compared with the baseline periapical x-rays were synonymous with treatment success. The clinical dental status was assessed after 1 months of treatment: the tissue around the implants was a dense consistency,
Figure 1: Bleeding on probing (BOP) before and after treatment

Figure 2: Probing pocket depth (PPD) before and after treatment

In implants treated with surgical treatments methods after 6 months x-ray examination demonstrated newly formed hard tissue was observed filling the defects around the implants, bone level changes was 2.8 mm. Stable clinical measurements PPD and BOP were demonstrated after 6 months, 1 year the initial treatment, remaining stable during the following two years. After 2 years of observation, clinical and radiological indices were stable, only two patients showed signs of peri-implant mucositis in the area of 3 implants without formation of pathological pockets, after the conduct of professional hygiene phenomenon of mucositis disappeared. Longer periods of observations continued to show positive dynamics clinical dental status. Filling of the defect, obtained 6 months after surgical treatment with bone graft, remains stable for three years. Implants following treatment peri-implantitis tended to remain healthy during the 3-year period.

The implants treated with conservative treatments methods successful treatment of peri-implantitis was
On the basis of the results of this study it was developed treatment algorithm for the different degrees of peri-implant disease (Table 5).

Treatment of peri-implantitis is a challenging task in modern implantology, the strategy of therapeutic measures and their effectiveness remains largely debatable. A number of protocols have been suggested in the treatment of peri-implantitis. However, as of today, no consensus exists regarding effective peri-implantitis treatment. A consensus report from the 8th European Workshop on Periodontology emphasized the need for identifying a standard mode of therapy for the treatment of peri-implantitis [6].

This study describes clinical results of a combined treatment of peri-implantitis. Treatment protocol depends on the radiographic bone loss. The evaluation of outcomes in the present study was confined to treatment success criteria that included the combination of findings from clinical and radiological assessments. Significant reductions in both PPD and BOP were shown in the group with less pronounced bone loss pre-surgery. Treatment led to positive effects on clinical and radiologic parameters over the long-term subsequent period of time. Implants with less bone loss before surgery presented better treatment result than more severe cases.

The results of this study indicated that a surgical procedure based on pocket elimination, bone grafting with grafts materials and hyaluronic acid Gengigel, magneto-laser therapy was an effective therapy for treatment of peri-implantitis. The use of magneto-laser therapy for stabilization and decontamination of the affected surface of the implant has demonstrated promising results treating peri-implantitis. Magneto-laser therapy has advantages in comparison to traditional therapy, with faster healing of the wound.

Based upon in our clinical experience with hyaluronic acid Gengigel, it as a highly promising material for improving outcomes treatment of peri-implantitis. The significant clinical advantages of hyaluronic acid Gengigel are that it allows optimizing work with materials for bone regeneration. It effectively fixes the augmentation

62%, the implants treated with surgical treatments methods the successful treatment of peri-implantitis was 89%(during the post-surgical period the implants stood stable, there were not noticed any symptoms of inflammation, the healing process was smooth).
material, regardless of whether it is an autograft or in xenograft, and acts as a biological membrane. Protective action and slow absorption of hyaluronic acid provide reliable and predictable regeneration of augmentation. This barrier function of hyaluronic acid is very important in the healing process of the wound. Due to its specific properties, hyaluronic acid has great potential for application in implantology practice and could be a very valuable addition to those used to treat peri-implantitis. The results to date with this regenerative approach for the treatment of peri-implantitis appear to be encouraging.

In the cases of bone resorption extending to >50% of the length, it is recommended to remove the implant and after the reconstruction of hard and soft tissues and obtaining acceptable results, it could be replaced in the area.

Oral health assessment and oral hygiene instructions act as key factors in ensuring implant success. Early diagnosis of peri-implantitis is considered to be of critical importance to arrest the progression of the disease before it reaches a terminal stage. Systematic monitoring and radiographic follow-up minimize the risk of peri-implantitis. Prevention of peri-implant disease starts with a sufficient planning including individual evaluation and minimization of risk factors (smoking, compliance, oral hygiene, periodontal disease, systemic diseases).

Conclusions

Conservative treatment methods are effective in the treatment of peri-implant mucositis and early peri-implantitis. When peri-implantitis category moderate and severe effective surgical treatment combined conservative therapy.

Our results suggest that magneto-laser therapy and hyaluronic acid Gengigel represents a reliable adjunctive treatment to conventional therapy. This combination of surgical and therapeutic treatment aims at improvement of the quality of regenerated bone structures. Early detection and treatment are essential for effective treatment of peri-implantitis.

Protection of Human and Animal Subjects

The authors declare that the procedures followed were in accordance with the regulations of the responsible Ethics Committee Yerevan State Medical University after M. Heratsiand in accordance with those of the World Medical Associatio on and the Helsinki Declaration.

References


