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Efficacy of Fascia Lata Allograft and Platelet Rich Fibrin versus Connective Tissue Graft on the Periodontal Phenotype Around Dental Implant in Upper Anterior Region: A Randomized Controlled Clinical Trial

Protocol of Thesis Submitted in Partial Fulfillment of the Requirements for Doctor Degree in Periodontology

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Introduction

Nowadays, dental implants offer a reliable therapeutic option for tooth replacement therapy. However, along with the widespread application of dental implants, the risk of peri-implant disease has emerged. The new classification of peri-implant diseases and condition are classified the peri-implant diseases into peri-implant health, peri-implant mucositis, peri-implanitis, soft and hard tissue deficiencies. [(1)]

Peri-implant health is characterized by the absence of erythema, bleeding on probing, swelling, and suppuration. The main clinical characteristic of peri-implant mucositis is bleeding on gentle probing. Erythema, swelling, and/or suppuration may also be present. Peri-implantitis is a plaque-associated pathological condition occurring in tissues around dental implants, characterized by inflammation in the peri-implant mucosa and subsequent progressive loss of supporting bone. The evidence is equivocal regarding the effect of keratinized mucosa on the long- term health of the peri-implant tissue. It appears, however, that keratinized mucosa may have advantages regarding patient comfort and ease of plaque removal. Hard- and soft-tissue deficiencies at dental implants are common clinical findings. They can lead to complications and compromise implant survival and, hence, may require therapeutic interventions. [(2)]

The term "periodontal phenotype" comprises two terms, gingival phenotype (gingival thickness and keratinized tissue width) and bone morphotype (buccal bone plate thickness). Periodontal phenotype can be evaluated through clinical or radiographic assessments and may be divided into invasive/non-invasive (for gingival thickness), static/functional (for keratinized tissue width), and bi/tridimensional (for buccal bone plate thickness) methods. [(3)]

The connective and support tissue around the implant keeps and protects the implant as it is in natural teeth. [4] Unlike natural teeth, the parallel course of connective tissue fibrils around the implant abutment creates a weaker sulcular barrier area. So, Sufficient amount of keratinized gingiva around the implant protects the connective and supporting tissue by reducing the accumulation of plaque and creating an immobile gingival sulcus. There is a consensus about the positive effects of keratinized tissue width on the survival rate of dental implants. The proper width and thickness of the gingival connective tissue has been proven to be one of the success criteria in dental reconstructive surgery. [5]

Good quality soft tissue determines the possibility not only to obtain full primary wound closure during the bone defect reconstruction, but also assures effective implant treatment. [6] Moreover, it is very important to assure the proper emergence profile of the implant supported restoration, which gives the opportunity to achieve the highest aesthetic appearance. [7]

Thick, soft tissue helps to prevent the development of an inflammatory reaction and clinical attachment level loss (CAL), as well as alveolar bone loss. Besides, it prevents gingival recessions arising, which have an influence on the final aesthetics and on the likelihood of developing inflammatory complications. [8] They found that the initial gingival tissue thickness at the crest may significantly affect the marginal bone loss (MBL) around implants and when the soft tissue was less than 2.0 mm thick, more crestal bone loss appears. [9]

Augmentation is a method to gain keratinized gingiva and various graft alternatives can be used in an augmentation. Augmentations with autogenous grafts are preferred due to the low costs and less complications however, connective tissue grafting showing some operative difficulties like connective tissue harvesting, the possibility of bleeding, technique sensitivity in addition to postoperative complications like bleeding from the donor site, pain, patient

discomfort, and delayed wound healing. [10] Alternative allograft materials have been developed to eliminate the disadvantages of autogenous grafts. [11]

Connective tissue graft (CTG) is the best choice for peri-implant soft tissue augmentation. [12] From the biological point of view, SCTG has the potential to induce the differentiation of mesenchymal cells into fibroblasts, which promotes epithelial proliferation and, consequently, helps modulate the soft tissue phenotype. [13] Nevertheless, postoperative donor-site morbidity, bleeding, infection, necrosis, limited availability of graft tissue, and the possible patient's discomfort at the second surgical site are the main drawbacks of such treatment modality. [14]

A novel allogenic-derived acellular matrix produced from human fascia lata allograft (FLA) has been authorized as a viable alternative to soft tissue grafts and SCTGs in periodontal plastic surgery, ridge augmentation, socket grafting, as well as gingival recession and intraoral soft tissue abnormalities. [15] Fascia lata offers the advantage of eliminating the morbidity associated with human donor tissue, as well as being more widely available, affordable, and scalable. The antigenic cellular components are eliminated without compromising the structural integrity of the tissue, while leaving the extracellular collagenous matrix intact. [16]

Platelet rich fibrin (PRF) has been introduced as an alternative to the SCTG to augment the gingival phenotype. It consists of a fibrin network containing platelets and a variety of growth factors, including transforming growth factor-beta1 (TGF-β1), platelet-derived growth factor (PDGF), vascular endothelial growth factor (VEGF). [12] These molecules are slowly released and act directly to promote the proliferation and differentiation of fibroblasts. Even though the efficacy of applying PRF membrane in improving peri-implant soft tissue phenotype has been reported, more research work is still required to investigate its clinical performance. [17]

PRF efficacy in optimizing and preserving the existing osseous structure and gingival architecture across peri-implant need to be corroborated. Shetty et al. in their study demonstrated that the placement of PRF membrane over denuded root surface in conjunction with coronally advanced flap results in the improvement in the thickness of gingiva. [18] In the long-term, the correct width and thickness of the attached keratinized tissue is the key point to ensure the stable position of the gumline around the implant's neck. [19] Therefore, the aim of this study was to improve periodontal phenotype surrounding the dental implants placed in patients to prevent any possible future complications which may occur.

Aim of the study

To compare between the efficacy of fascia lata allograft and platelet rich fibrin versus subepithelial connective tissue graft on periodontal phenotype (thickness and width of keratinized tissue, labial bone thickness) around dental implant in upper anterior region.

Materials and Methods

Study Design:

The present study will be conducted as a randomized controlled clinical study,

Study setting:

The study will be conducted in the clinic of Oral Medicine, Periodontology, Oral Diagnosis and Oral Radiology Department, Faculty of Dentistry, Kafer El sheikh University.

Ethical approval:

Before the treatment, the purpose of the study and the surgical procedures will be

explained to the patients who will be selected to participate in the study and an informed consent will be obtained from all patients before the beginning of any dental treatment by presenting the available three treatment options which were used in this study, representing the possible complications which may occur due to the presence of thin gingival biotype at the site of future implant placement, and the possible post-surgical complications which may occur after implants placement such as possible pain, post-operative bruising and extra-oral swelling.

Participation in the study is voluntary and stated the possibility to withdraw at any time. An official permission to conduct the study will be obtained from the Research Ethics Committee (REC), Faculty of Dentistry, Kafer El sheikh University. The research will be conducted in compliance with the 2004 revision of the Declaration of Helsinki. Confidentiality of the information where it will not be accessed by any other part without taking permission of the participants.

Sample size calculation:

Totally 24 patients. Allocated equally into three groups, 8 patients treated with sub-epithelial connective tissue graft (SCTG), another 8 patients treated with platelet-rich fibrin (PRF)graft, and another 8 patients treated with Fascia Lata Allograft.

Sample size was calculated using the G*power, version 3.1.9.2, Universität Kiel, Germany based on comparing the pink esthetic score six months after implant placement (T1) among patients treated with SCTG and PRF (Elkashty, A.A., et al.,2022)

Mean ± SD of T1 among patients treated with SCTG = 5.1 ± 0.99

Mean ± SD of T1 among patients treated with PRF = 3.5 ± 1.1

α error probability = 0.05

Power (1-β error probability) = 0.80

So, the sample size for each group will be 8 patients.

Site selection:

Twenty-four patients diagnosed with missing upper anterior due to factors other than periodontally involvement based on clinical and radiographically examination and fulfill the following eligibility criteria:

Inclusion criteria:

1. Patients age ranged from 20 to 50 of both genders.
2. Patients are systemically medically free according to the American Society of Anesthesiologists (ASA) considered as ASA I. [20]
3. Patients with thin gingival biotype (gingival thickness was ≤1 mm)
4. The height of keratinized gingiva (HKG) for the site selected should be ≥2 mm.
5. Ability to maintain good oral hygiene as evidenced in recall visits.
6. Sufficient mesiodistal and interocclusal space and have an intact facial bone wall which does not require bone augmentation procedures.
7. Adequate bone quality.
8. Ability to maintain good oral hygiene as evidenced in recall visits.

Exclusion criteria:

1. Smoker patient and pregnant or lactating woman.
2. Patient with poor oral hygiene or active periodontal disease.
3. Traumatic occlusion or para-functional habits such as clenching or bruxism.
4. Patient with limited mouth opening.

5. Participation in other clinical trials

Materials:

1) Implant system* Dual implant
2) Fasia lata allograft from Maxxeus company
3) PRF will be prepared according to Choukroun et al. [21]
4) CTG will be taken according to Langer & Langer [22]

Study design:

1) Patients group:

   Patients were classified into three main groups:

   - Group 1 (Study group)

     It includes eight patients seeking for implant placement in the upper anterior areas and implants will be placed with the application of fascia lata allograft membrane.

   - Group 2 (Study group)

     It includes eight patients seeking for implant placement in the upper anterior area and implants will be placed with the application of PRF.

   - Group 3 (Control group)

     It includes eight patients seeking for single implant placement at the upper anterior area and those patients will be received their implants with subepithelial connective tissue graft.

2) Pretreatment preparation before surgery:

   All the patients participate in this study regarding the patient's groups will undergo:

1. History taking, examination and preoperative laboratory investigation (bleeding tendency tests, HIV, HBV and HCV) to confirm suitability to the eligibility criteria.
2. A cone beam computed tomography (CBCT) will be taken to confirm the diagnosis and evaluate bone level and bone density.
3. Occlusal adjustment will be done in cases with clinical and radiographic evidenced trauma of occlusion.

3) Phase I therapy:

All the patients will undergo comprehensive phase I therapy and re-evaluation will be done after 4 weeks to evaluate the patient response to phase I therapy.

4) Surgical phase:

Implant placement:

1- Group 1: (Dental implant + Fasia lata)

Preparation of the alveolus for delayed dental implant placement will be done according to manufacturer instructions and fasia lata will be fixed around dental implant.

2- Group 2: (Dental implant + PRF)

Preparation of the alveolus for delayed dental implant placement will be done according to manufacturer instructions and PRF will be fixed around dental implant.

3- Group 3: (Dental implant + CTG)

Preparation of the alveolus for delayed dental implant placement will be done according to manufacturer instructions and CTG will be fixed around dental implant.

5) Postoperative care:

All patients will receive post-operative instructions including, rinsing with 0.2% chlorhexidine (twice daily for 2weeks), For postsurgical pain control, 600 mg ibuprofen every 4 to 6 hours was

prescribed, and 500 mg amoxicillin was prescribed 3 times daily for 7 days to prevent infection. The patient was instructed to avoid brushing and trauma to the surgical site.

6) Prosthetic phase:

The final implant impression restoration will be made after 6 months from the surgery and fabrication of the abutment.

Clinical assessment:

The patients will be recalled at two weeks, month, 3 months, and 6 months post-surgery to record the clinical parameter which will be recorded by the same doctor.

A. The following clinical parameters will be recorded:

1- Pink aesthetic score (PES) (23) (Table 1)

Parameter	0	1	2
Mesial papilla	Missing	Incomplete	Complete
Distal papilla	Missing	Incomplete	Complete
Tissue contour	Unnatural	Virtually natural	Natural
Gingival level	>2mm	1-2 mm	1 mm
Alveolar process	Clearly resorbed	Slight resorbed	No difference
Coloring	Clear difference	Slight difference	No difference
Texture	Clear difference	Slight difference	No difference

2- Wound healing index (WHI): will be recorded at 7,14 days 1 and 3months according to

Huang et al. [24]

3- **Gingival thickness (GT)** will be measured at the mid-buccal 2 mm apical to the free gingival margin (at baseline, 3 months, and 6 months post-surgery) by penetrating a probe into the tissue. [24]

4- **Peri-Implant Periodontal Probing depth (PPD):**

This index depends mainly on the usage of 0.5 mm Michigan O probe with graduations. Measurements were evaluated at six sites per each implant i.e., the distofacial surface, mid facial surface, mesiofacial surface, mesio-lingual surface, mid lingual surface, and disto-lingual surfaces of the implant. PPD was measured by taking the reading from the free gingival margin to the base of the pocket. The mean score of the implant was obtained by adding the six scores and dividing it by six. [29] Measurements were recorded to the nearest 0.5 mm six months after implant placement (prosthetic phase) (T1) and three months after the prosthesis placement.

Radiographic Evaluation:

Marginal (crestal) bone loss (MBL):

Radiographic examination of the patients will be done firstly pre-operative then just after the surgical procedures as a base point and at six months follow-up period post-operative by using CBCT (Morita) device. On Demand3D program was used for image reconstruction and analysis. For the calculation of marginal (crestal) bone loss (MBL), the implant was used as a reference by adjusting the cross-sectional long axis in the center of the implant and bisecting it. A line was drawn parallel to the implant, starting at the crest of the bony cortical plate of bone and ending at the apical level of the implant; height was recorded in millimeters immediately, 6 months postoperative. The same process was repeated from the palatal direction.

Statistical analysis:

The data will be collected and tabulated where statistical analysis will be done using statistical package for social science software (SPSS version 20) and comparison between the studied groups will be performed.

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