CODEN [USA]: IAJPBB ISSN: 2349-7750

INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES

http://doi.org/10.5281/zenodo.1472779

Available online at: http://www.iajps.com Research Article

KERATINIZED ATTACHED GINGIVA AROUND DENTAL IMPLANTS: THE ROLE, STRUCTURE, INCREASING TECHNIQUES

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Abstract:

This study includes review of scientific literature about modern concept of keratinized attached gingiva increasing around implants. It covers experimental and clinical cases, studied the relationship between the presence of the gingiva and tissue condition, surrounding the implants. Also, keratinized tissue increasing methods, with collagen matrix usage, was described.

Key words: *keratinized gingiva, attached gingiva, collagen matrix, free gingival graft, connective tissue graft*

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QR code

Please cite this article in press Ashurko I.P et al., ***Keratinized Attached Gingiva around Dental Implants: The Role, Structure, Increasing Techniques.,*** *Indo Am. J. P. Sci, 2018; 05(10).*

INTRODCTION:

The role of keratinized attached gingiva as a factor that provides prevention of the development of mucositis and peri-implantitis has been discussed for a long time. A lot of studies conducted for the purposes to identify the relationship between the presence of a keratinized attached gingiva and the state tissues surrounding the implants. At 1981 Schroeder et al. [28] established that implants, placed in the non-stabilized/loose/mobile gingiva, commonly lose the connection with the surrounding tissues, which contributes the development of inflammatory process. Warrer's et al. [34] experimental study in monkeys showed that the loss of attachment and the establishment of recession happened primarily in the mobile gingiva which has been surrounding the implants. However, the previous study of Strub JR. et al. [29] in dogs didn't found any difference in the development of recessions or the loss of alveolar bone around implants between areas with attached mucosa and without.

The results of another studies also controversial [4,10,30,37].

The role of keratinized attached gingiva presence

At 2006 Chung et al. [6] examined/explored 339 implants which was implanted more than 3 years ago. The study approves that the absence of normal amount of keratinized attached gingiva around implants will result more intensive accumulation of plaque and inflammation of gingiva, but signs of alveolar bone resorption the authors didn't find. Output of this study conforms with data of M.Roccuzzo's et al. [21] study, which also showed the intensive accumulation of plaque around implants as a result of non-stabilized position of gingiva. According to authors opinion, after exploring the bleeding gingiva could be the sign of resorption of alveolar bone, but didn't find any significant difference in that.

JL. Wennstrum et al. [35] researched the condition of soft tissues around implants, that implanted more than 5 years ago. The study didn't show significant difference in the condition of the soft tissues in the absence or presence of attached mucosa.

A.Bouri et al. [5] examined 200 implants at 76 patients. The result of the study showed, that more volume of plaque and inflammation signs identified if the width of attached keratinized gingiva around implants was less than 2mm than width more than 2mm. Also, the study confirms that the narrow area of attached gingiva gives more risk for the injury of soft tissues around implants.

Despite the results, all authors of these studies agree, that the absence of keratinized attached gingiva around implants gives more risk for injury of the soft tissues [10,21,36]. The presence of attached keratinized gingiva around implants is preferable, because it enables high aesthetics and prevents from resecessions. Also, this factor relieves performing prosthetic procedures and gives higher level of oral hygiene [2].

The structure of keratinized attached gingiva

Keratinized attached gingiva is a distance between mobile mucosa and gingival sulcus. Histological difference between the gingiva and mobile oral mucosa includes variance in layers of cells. So, epithelium of keratinized attached gingiva has 5 layers, but mobile mucosa has 3. The gingiva doesn't have glycogen, therefore it doesn't colour with iodine. This fact is used for identification of keratinized mucosa. Width of the gingiva increases with age and dentoalveolar elongation.

Biotype of mucosa depends on the difference between anatomical and topographic properties. The thin biotype has less expression of stratum spinosum (epidermal layer) and narrow vessels. Conversely, the thick biotype has more expression of the stratum spinosum, wide vessels in derma and lamina propria. As we know, the cells of this layer have important role in protective, regenerative functions, because they have well advanced group of tonofilaments and keratinosomes (Odland bodies). During performing surgical manipulation, also implantation, thick oral mucosa biotype with wide area of keratinized attached gingiva is preferable [11].

Keratinized attached gingiva: area enlargement methods

For today we have quite surgical techniques, which give us wider area of keratinized attached gingiva around implants [31].

Healing of the wound goes through the appropriate tissue. Different structures will develop in dependence of which tissue and relationship included in oral mucosa wound.That's why the classic methods of vestibuloplasty with wound secondary epithelization give slight increase in area of keratinized mucosa [3]. Except the slight increase, these methods can lead to such complications as relapse or scars.

Golden standard of keratinized mucosa area increasing for today is free gingival graft (FGG) [15]. This technique includes mucous strip replantation from the palate to the recipient site: incision and

apical shifting of mobile mucous membrane,herewith cutting muscular fibers and ligaments, and finally, tissue fixation on the new depth. From the point of procedure efficiency, period of wound healing and comfortable rehabilitation this method is most appropriate. Despite the high efficiency, it has number of disadvantages such as extra injury of the donor site, low aesthetics and graft limited size [12,22,32].

Other common technique is connective tissue graft (CTG). Main advantage of using CTG for increasing keratinized mucosa is minimal risk of complications at the donor site.

According to different data reduction of the CTG reaches 80%, when FGG reaches on average 30-35% [22,23].

Alternative way to receive mucous graft, that includes large amount of collagen, is making a CTG with following deepithelization. Comparing this technique with tunnel and "open door" methods [13,17,20,24] statistically significant difference in postoperative pain of patient's donor site is not revealed by G.Zucchelli et al [38].

Despite all the advantages for using free gingival and connective tissue grafts for keratinized attached gingiva width increasing this methods have some disadvantages. Additional donor site extends operation time, gives high risk for bleeding and for postoperative pain, can lead to paresthesia for several weeks after operation [7,8,25,26].

For the last 10 years have been trying to develop methods, that allows escaping necessity of using mucous autografts.

Since 1970 years in mucogingival surgery starts using allograft, such as freeze-dried skin. In the present more popular non-cellular dermal matrix, which initially used for treat skin burns [33]. However, significant volume loss (up to 90%) and possible recipient site contamination by donor tissue limits usage of this technique [18,22,32]. With creation of xenogenic origin collagen membrane relevance of using non-cellular dermal matrix gradually being lost [1,9,16,27].

Usage of xenogenic collagen matrix shows soft tissues good healing and growth of keratinized epithelium [12,18,22,23,27]. This kind of membranes causes high increase of keratinized tissues in comparison with dermal matrixes, which dictated by more porous structure, that allows keeping a large volume of blood clot.

Sanz et. al [22] performed comparative analysis of two keratinized gingiva increasing techniques: transplantation of connective tissue graft and transplantation of collagen matrix. Author examined groups of 10 patients and monitoring period was 6 month. Exam included value of increased keratinized tissues, graft volume loss, probing gingival pocket depth, bleeding index, oral hygiene index. By results of this study authors didn't find any important statistically significant difference in keratinized gingiva increasing between CTG (3,1mm) and collagen matrix (2,8mm). Difference in the graft and collagen matrix volume loss also includes limits of statistically insignificant value. In the first month it was 60% after CTG transplantation and 67% if collagen matrix used. Following 5 month CT graft volume loss was 17%, collagen matrix- 8%. The data about volume loss matches data, received by Orsini et al. [19], which identified 37% in first 4 weeks and up to 43% - in a year. Authors of the study also didn't find any statistically significant difference by comparing bleeding index, probing gingival pocket depth, oral hygiene index. Researcher concludes, that the usage of collagen matrix for keratinized gingiva increase also effective, such as usage of connective tissue graft. This confirms also by Lorenzo R. et al. study [14], where were 2 groups of 12 patients.

Kang-Ho Lee et al. [12] compared 3 keratinized attached gingiva increasing techniques: apically positioned flap (APF), APF in combination with free gingival graft (FGG), APF in combination with collagen membrane. Totally explored 9 patients, 3 patients in each group. Keratinized gingiva increasing made in average: 1,6mm in first group, 2,5mm in second and 1,8mm in third. Authors notices, collagen matrix received keratinized gingiva have more physiological structure, although histological evaluation didn't perfomed.

M.Nevins et al. [18] compared two keratinized gingiva increasing methods around teeth: apically positioned flap in combination with free gingival graft, apically positioned flap with collagen membrane. The study made on 5 patients, which have keratinized gingiva deficit around distal mandibular teeth of the both sides. Transplantation of free gingival graft made on the one side, and collagen matrix on other side. Keratinized gingiva increasing was 3,1+-0,6mm by FGG and 2,3+-1,1mm by collagen matrix. About other parameters, such as depth of gingival pocket, oral hygiene index, bleeding index, statistically significant difference didn't find. After 13 week 4 patients had keratinized tissue biopsy by the studied and control sides. Histological examination of all bioptates showed the presence of connective tissue, which covered by

keratinized epithelium with orthokeratine inclusions and collagen matrix usage in operation area, which indicated by insignificant fibrous inclusions.

Schmitt C.M. et al. [23] compared operation results with free gingival graft and collagen matrix usage on 14 patients, which divided into 2 equal groups. Collagen matrix volume loss was 32,98% against 28,35% in case using free gingival graft. Histological examination of bioptates, performed 90 days after operation, showed the presence of all cell layers, specific for epithelium type tissue.

CONCLUSION:

The absence of fundamental studies about the usage of collagen matrix in mucogingival surgery, calls into question about authenticity of successful usage of the matrix in clinical cases.

The current study describes a variety of materials and techniques used to increase attached keratinized gingiva width. However, in nowadays, available histological data received from small sample of patients. Besides, in most cases the treatment was made around teeth, while small amount of studies was dedicated about keratinized gingiva increasing around implants. The urgency of the keratinized tissue width creation around implant is obvious. It is necessary to make comparative analysis of different keratinized attached gingiva increasing techniques in order to select the most appropriate method.

ACKNOWLEDGEMENTS:

Supported by the “Russian Academic Excellence Project 5-100”

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