

Indications and Characteristics of Clinical Application of Periodontal Suturing

Saimir Heta, Ilma Robo, Vera Ostreni, Glorja Demika, Sonila Kapaj

Abstract—Suturing, as a procedure of joining the lips of the lembo or wound, is important at the beginning of the healing process. This procedure helps to pass the healing process from the procedure per secundam to the stages of healing per primam, thus logically reducing the healing time of the wound. The purpose of this article is to publish some data on the clinical characteristics of periodontal suturing, presenting the advantages and disadvantages of different types of suture threads. The article is a mini-review type of articles selected from the application of keywords on the PubMed page. The number of articles extracted from this article publication page is in accordance with the 10-year publication time limit. The element that remains in the individual selection of the dentist applying the suture is the selection of the suture material. At a moment when some types of sutures are offered for use, some elements should be considered in the selection of the suture depending on the constituent material, the cross-section of the suture elements, and whether it collects bacteria in the "pits" created by the material. The presence of bacteria is a source of infection and possible delay in the healing of the sutured wound. The marketing of suture types offers a variety of materials, from which the selection of the most suitable suture type for specific application cases is a personal indication of the dental surgeon based on professional experiences and knowledge in this field.

Keywords—Suture, suture material, types of sutures, clinical application.

I. INTRODUCTION

PERIODONTAL diseases have a major impact on oral health. There are many ways of treatment and cure of these diseases, which have a specific nature with stages of activation and inactivation, but never in the complete disappearance of the oral flora responsible for causing periodontal diseases. Regardless of the fact that systemic antibiotic treatments can be applied, the bacteria that cause periodontal diseases persist in the saliva and when they "find" the moment when the immunity of the affected individual falls due to various systemic reasons, periodontal diseases pass into their active phase where they have as primary clinical signs activation of bone resorption of supporting structures. Periodontal surgery is one of the phases of periodontal therapy, much needed for the periodontal health of the patient. The main objective of periodontal surgery is the maintenance of periodontal tissue, the healing of periodontal tissue affected by inflammation, the preservation of their function and the regular physiological anatomy of the patient's own periodontium, so that bone structures are not resorbed, and

the pathology worsens by needed further dental treatments, such as orthodontic treatments, fixed prosthetic treatments, implants, with orientation based on periodontal pathology [1]-[3].

In periodontal surgery, the best method for closing wounds is the suturing technique. The main purpose of the suturing technique is to stabilize the soft tissue, a healthy closure of the lip lips, as well as to create a healthy dento-gingival junction. This process is important and should be performed as accurately as possible to present a satisfactory result. Sutures consist of needles and suture material attached to the needle, which are indicated by the type of incision, the thickness of the lembo or its type [1]-[5].

Sutures are sterile surgical threads, which in the case of periodontal surgery, have the main purpose of holding the periodontal lembo in the right place, as well as the lips of the lembo at the place where the incision was made. According to lembo classifications there are also indications for the selection of the type of suture used. Mucoperiosteal lesions are applied for free field of view, to perform periodontal pocket curettage, to eliminate sharp corners of bone tissue and to remove necrotic bone and necrotic and granulomatous burrow tissues. Periodontal ligaments are formed by incisions of different types and shapes, divided into larger groups: vertical incisions and horizontal incisions. The combination of these incisions forms different types of lumbar shapes. Depending on these shapes of open sutures according to the application of the incision combination, different types of sutures and different types of sutures are indicated [1]-[5].

II. MATERIALS AND METHODS

The articles included for further analysis in this article were selected from the PubMed website, as a result of the application of keywords for a publication period of about 10 years. This mini-review study aims to evaluate different types of sutures depending on the type of suture material on the physical characteristics of the suture, in accordance with the purpose of application. The physical characteristics of the suture are significantly affected by the bacterial invasion of the oral flora that strikes the suture material, especially if its composition is with organic elements that fall "prey" to bacterial decay.

The development of technology that leads to the development and modification of dental materials and even

Saimir Heta is with University Hospital, Pediatric Surgery, Pediatric Surgeon, Tirana, Albania.

Ilma Robo is with University of Medicine, Faculty of Dental Medicine, Department of Therapy, Tirane, Albania.

Vera Ostreni is with Department of Morphology, University of Medicine,

Tiranë, Albania.

Glorja Demika is with Albanian University, Faculty of Medical Sciences, Department of Dentistry, Tirana, Albania.

Sonila Kapaj is with Department of Gynecology, Hospital Center, Fier, Albania (e-mail: ilmarobo@yahoo.com).

sutures, orienting towards the indications for the use of synthetic resorbable suture. Based on these data and the elements that were used as a suture selection criterion, Table I summarizes these elements in a more indicative way about the indication [1]-[5].

TABLE I
 TYPES OF SUTURES DIVIDED ACCORDING TO THE CHARACTERISTICS OF THE
 CONSTITUENT MATERIAL [1]

Type of suture	Absorbable		Not absorbable	
	Synthetic	Natural	Synthetic	Natural
Monofilaments	Monocryl	Goat gut	Nylon	EPFe
	Ethicon Maxon	Chrome gut		(Goretex)
Knitted	Vicryl		Silk	
	Ethicon Dexon		Poliester (Ethibond)	
	Davis dhe Geck			
Total	7 types	2 types	3 types	1 type

The shelf life of the suture material in the oral cavity increases the duration of bacterial invasion and bacterial colonization on this material regardless of whether the suture is composed of natural material, or synthetic material. The other element that adorns the picture even more, is the fact that the suture is monofilament or woven, as the latter adds three-dimensional spaces for bacterial colonization that is not affected or affected by mechanical cleaning of the area.

Regardless of the suture material, the suturing technique has the basic principles of performing with a 90 degree angle of incision and 3 mm from the edge of the incision. Suture floss support should not be performed on the edges of the suture, but the suturing methodology helps to rest it on the adjacent limbo teeth. This working logic is based on the principles of selecting the type of suture that can be a single suture or a continuous suture. The area of diffusion of forces exerted on the lembo in the case of continuous sutures is larger than in the case of single sutures, so the possibility of suturing school is also reduced to continuous suturing [3]-[5].

In order to have the most accurate suturing, the sutures must enjoy several properties:

- Be sterile and correctly packaged.
- Have the right dimensions and a uniform diameter along the entire length.
- Be biocompatible.
- Have uniform clamping force and the ability to form a secure, non-dissolving joint.

According to the type of suture component material, the latter are divided into:

1. Catgut/Chromic gut: Catgut is one of the oldest sutures. This type of suture is composed of the submucosa of the intestines of the sheep cleaned and sterilized and immersed in isopropyl alcohol as a preservative solution (not autoclaved but boiled, because they reduce the pulling force), while chromic gut is a modification of the catgut suture. It is treated with chromium salts which give a brown color to the suture material, thus making this material absorb more slowly and reducing the tissue reaction around this suture, unlike catgut (or plain cutgut) which has a

higher incidence of causing tissue inflammatory reaction. It is indicated in tissues where tissue regeneration is fast, as well as for the suturing of blood vessels. The tensile strength of plain catgut reaches its maximum on day 5-7, while that of chrome cutgut is 10-15 days. The breakdown of this suture material induces an inflammatory reaction, as biodegradation of the collagen in its composition occurs by the process of phagocytosis. It takes approximately 60-90 days for this material to be fully absorbed, while intraoral digestion begins in the first 5 days where it reaches the maximum pulling force. In the presence of infection, it is absorbed more quickly because inflammatory cells migrate towards the thread.

2. Silk: The silk suture is a natural non-absorbable suture material, composed of fibrin protein covered by bee's wax or various silicones. Silk suture is multi-filamentous twisted or woven. This material has a soft glide on the tissue making its management easy and flexible as well as minimal indoor retraction, followed by the ability to form a secure knot. It is usually a distinct color from the oral mucosa (white or black) to make it as obvious as possible. It is used to suture mucosal tissues, but it can also be used as a temporary suture during an intervention. A type 1 reaction may occur and should not be used in the presence of infection. It can be used wet or dry, but the latter is stronger.
3. Vicryl (Polyglactin 910): It is a synthetic multifilament, absorbable suture material. It has a polyester composition and is coated with a layer of polyglactin 370 and calcium stearate which make it easier to describe on the tissue and tie the knot. Easy to maneuver. Healing of the sutured wound with this material occurs faster, without showing local internal reaction. It maintains its hardness for up to 3 weeks and then begins to be absorbed by hydrolysis, being broken down by enzymes. The process of resorption of this suture is prolonged, and thus promotes the growth of bacteria, since it is multifilamentous, the incidence of bacterial establishment is higher. It can be used on infected tissue. Complete absorption occurs in 50-70 days.
4. Prolene: The prolene suture is a non-absorbable monofilamentous synthetic suture material that comes as a polymer of propylene. The prolene suture has a very good material that is widely used in surgery, not only in oral surgery. It has several positive characteristics including: minimal tissue retraction around the thread, a very good tensile strength that does not lose over time, exhibits high plasticity and forms a secure and strong knot. A weak point of this material is that it loses its stiffness (loose) when the tissue edema begins to subside. It is used in infected or contaminated wounds.
5. Dexon (polyglycolic acid): It is a polymer of glycolic acid, which forms an absorbable woven thread. It is difficult to maneuver and gets tangled by forming knots. There are difficulties in describing the tissue. This kind of suture gives minimal tissue reaction. This suture has the ability to be absorbed by hydrolysis. It is not used in infected wounds or as a percutaneous suture. MAXON is synthetic,

absorbable and monofilamentous. It has tensile strength that lasts up to 14-21 days (greater than dexon) [5]-[9].

6. PDS II (polydioxanone): The PDS II suture is a monofilament synthetic suture, derived from polyesters. It has good tissue witeability and minimal retraction. The node is created easily and is secure. It is used for wounds that are under pressure and contaminated. The tightening force lasts from 14-21 days. Absorption occurs through hydrolysis.
7. Nylon (ethylon, dermalon): The nylon suture is a non-absorbable synthetic thread and this suture is a monofilament. It has high tensile strength and minimal tissue reaction.
8. Polyester Multifilament yarn that may or may not be coated with polybutylate (dacron, ethibon). It exhibits very good tensile strength. When worn it exhibits very low tissue reaction, minimal tissue retraction and a secure joint. Removal of these sutures is easy.

The sizes of the sutures are different, depending on the type of tissue and the pulling force that can be exerted on the suture: thicker suture has lower number and finest suture has a bigger number. The principles of suturing are the same regardless of the size of the age:

- The needle is caught in half the length or in $\frac{3}{4}$, starting from the piercing tip.
- The tip of the needle must always be perpendicular to the surface or it will pierce the tissue.
- Drilling should be done 2-3 mm away from the edge of the limbus.
- The needle must pass from the deepest side to the most superficial side of the limbus.
- The flaps should not be closed under tension or pressure from the suture, because they may become lacerated or necrotic around it.
- The knot should not extend over the incision.
- The distance between the sutures should be 3-4 mm apart.
- When the needle comes out of the wound, it should not be caught at the tip.
- When approaching the lembo, we must be careful with the pull and not fold or overlap the lembo.

The assessment of different types of sutures is performed based on the type of material of the suture thread, based on the characteristics of the suture thread, all in accordance with the clinical indications of its application. The physical properties of the suture are significantly vulnerable to bacterial invasion of the oral flora that impinge or attack the suture material. The bacterial invasion of the oral flora is carried out on the suture material, depending on the content of organic residues between the twists or interweaves of the thread or component threads of the suture, which fall "prey" of bacterial colonization.

The longevity in the oral cavity of the suture increases the duration of bacterial invasion and the possibility of colonization not of one bacterial strain, but of a complex of bacterial strains, which in an organized and symbiotic way coexist on the surface of the suture fixed to the edge of the periodontal flap. Bacterial colonization does not depend on the type of suture material, whether it is natural or synthetic. So, initially, this procedure of

fixation and bacterial colonization on the suture "needs" only surfaces protected from mechanical force that can elucidate the colonized bacteria. It does not stand the fact that the natural suture will serve as a decomposing material for the bacteria placed on it.

The other element that complicates the clinical picture even more is the fact whether the suture is single-threaded - monofilamentous, or twisted - polyfilamentous. The latter at the moment and in the areas of the twisting of the suture threads creates dimples or three-dimensional spaces for bacterial colonization that are more protected and do not face the mechanical force of friction, or of rinsing the area, which can penalize the removal mechanism of bacterial colonization. All these elements must be evaluated one by one and in combination with each other, as this is how the effect that each of the elements has on each other, or on a group of combination elements is understood [5]-[9]

III. DISCUSSIONS

Suturing is presented with the primary purpose of fixing the suture in the proper position until healing reaches the point where sutures are no longer needed. Sutures differ from materials and needles. Based on the suture material, the types of sutures are initially divided into absorbable and non-absorbable, so the suture should be removed or left and resorbed from the tissues where it is applied. This element reduces the dental treatment by one stage, as the patient does not have to appear to remove the sutures, on the other hand sutures as a resorption process can have a time interval that varies, but over 7 days duration, i.e. typically from 16 to 120 days, so the longer the resorption process, the longer the lembo stays fixed to aid healing as a process [1], [2].

The types of sutures are different, but their selection is also influenced by the clinical case. The distance between the edges of the wound is one of the indications that indicates the application of suturing for dental wounds. The lack of tissue and the possibility of "per secundum" healing is a clinical case when suturing the dental wound is required with the aim of bringing the edges of the wound closer together, so that the wound healing can be converted into "per primam" type healing. Always the first step of suturing is to never lacerate the edges of the wound, so you must always respect that distance of at least 3 mm to 5 mm from the edge of the wound to insert the tip of the suturing needle. In the procedure of selecting the type of dental suture, it is preceded by the selection of mono or multifilament, knowing that this suture will remain for about 7 to 10 days in the oral cavity and the possibility of bacteria invading the suture threads to cause infection of the wound is growing. The fact whether or not we use absorbable sutures or not has to do with the selection element that is also influenced by the patient, with the element of how cooperative the patient is or not [1]-[5].

IV. CONCLUSIONS

Close coordination and cooperation between the dentist and the patient are necessary to maintain passive periodontitis and

prevent its transition to active stages through non-surgical periodontal treatment. This joint effort can reduce the potential for oral bacteria to enter the bloodstream and prevent the appearance of proinflammatory monocytes, which can cause a marked increase in the level of fibrinogen in the blood, leading to arteriosclerosis or worsening of existing pathology.

DECLARATIONS

Ethics Approval and Consent to Participate

Not Applicable.

Consent for Publication

Not Applicable.

Availability of Data and Materials

The datasets analyzed during the current study are available from the corresponding author.

Competing Interests

The authors declare that they have no competing interests.

Funding

No funding was obtained for this study.

Author Contributions

IR collected the scientific data and wrote the manuscript. SH and GD revised and edited the manuscript. Literature research was conducted by IR and GD. SK and VO collected the scientific data. All authors read and approved the final manuscript. All authors ensure that all data and materials, as well as software application or personal code, support their published claims and conform to field standards.

ACKNOWLEDGEMENTS

Acknowledgments belong to Henri and Hera, for the help they give us by understanding and supporting us to continue further and with more commitment, in the field of scientific research.

REFERENCES

- [1] Michael Newman, Henry Takei, Perry Klokkevold, Fermin Carranza; "Newman and Carranza's Clinical Periodontology"; 13th Edition - May 29, 2018; Contributor: Austin OSaben; eBook ISBN: 9780323533232; Hardcover ISBN: 9780323523004
- [2] Kulkarni S, Dodwad V, Chava V. Healing of periodontal flaps when closed with silk sutures and N-butyl cyanoacrylate: a clinical and histological study. *Indian J Dent Res.* 2007 Apr-Jun;18(2):72-7. doi: 10.4103/0970-9290.32424. PMID: 17502712.
- [3] Asher R, Chacartchi T, Tandlich M, Shapira L, Polak D. Microbial accumulation on different suture materials following oral surgery: a randomized controlled study. *Clin Oral Investig.* 2019 Feb;23(2):559-565. doi: 10.1007/s00784-018-2476-0. Epub 2018 May 2. PMID: 29717362.
- [4] Varma SR, Jaber M, Fanas SA, Desai V, Al Razouk AM, Nasser S. Effect of Hyaluronic Acid in Modifying Tensile Strength of Nonabsorbable Suture Materials: An *In Vitro* Study. *J Int Soc Prev Community Dent.* 2020 Feb 5;10(1):16-20. doi: 10.4103/jisped.JISPCD_343_19. PMID: 32181217; PMCID: PMC7055341.
- [5] Abullais SS, Alqahtani NA, Alkhalban RM, Alamer SH, Khan AA, Pimple S. In-vitro evaluation of commonly used beverages on tensile strength of different suture materials used in dental surgeries. *Medicine (Baltimore).* 2020 Nov 25;99(48):e19831. doi: 10.1097/MD.00000000000019831. PMID: 33235053; PMCID: PMC7710252.

- [6] Park JC, Koo KT, Lim HC. The hidden X suture: a technical note on a novel suture technique for alveolar ridge preservation. *J Periodontal Implant Sci.* 2016 Dec;46(6):415-425. doi: 10.5051/jpis.2016.46.6.415. Epub 2016 Dec 26. PMID: 28050319; PMCID: PMC5200867.
- [7] <https://www.boztibbi.com/en/dental-suture-techniques-and-materials-in-oral-surgery/>
- [8] Otten, J.-E., Wiedmann-Al-Ahmad, M., Jahnke, H. and Pelz, K. (2005), Bacterial colonization on different suture materials—A potential risk for intraoral dentoalveolar surgery. *J. Biomed. Mater. Res.*, 74B: 627-635. <https://doi.org/10.1002/jbm.b.30250>
- [9] Dragovic, M., Pejovic, M., Stepic, J. et al. Comparison of four different suture materials in respect to oral wound healing, microbial colonization, tissue reaction and clinical features—randomized clinical study. *Clin Oral Invest* 24, 1527–1541 (2020). <https://doi.org/10.1007/s00784-019-03034-4>