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Suturing, tensile strength during clinical application

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Abstract

Periodontal suturing is one of the sutures that beyond the basic purpose of fixing the lips of the lembo need the aesthetic and delicate effect of the clinical application on the lips of the wound.

Materials and methods: The study is of experimental type with the primary purpose of assessing the attractive force of the suture applied to the soft tissues of the mouth. Depending on the type of suture used, the attractive force is estimated, how much and to what extent, the type of suture stands against the tear forces of the wound lips. The in vitro experiment was performed on the head sample of a lamb and the evaluation of tensile force was performed on the dynamometer at the direct moment after suture placement and 3 days later, after the sample was stored under the effect of imitation saliva solutions.

Conclusion: 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 the field.

Introduction

There are study tendencies in the literature on the strength and physical properties of the suture fiber used in periodontal surgical procedures and on its ability to withstand or deliver bacterial invasion of the oral flora. These two directions are broad both for scientific research in this field, but also for the emergence of results that then have application and clinical approach to periodontal surgical procedures [1,2].

The study presented includes data on the strength and physical properties of the suture material used for suturing after periodontal surgical procedures. This division into two parts is made with the sole purpose of confronting the data collected from the experiment, with the data that have been published and are already known data from the literature sources. The experimental part makes this point of view more tangible and visible by appearing in numerical results of the suture endurance force at the moment of its post-justification and then, at the moment when this suture stays for 3 days placed and sutured in the tissues of buta. The other interesting element is the selection of some types of sutures, this regardless of the shape of the age, traumatic or non-traumatic, but depending on the type of suture material placed in the soft tissue, in accordance with the strict rules of suturing, depending on the type of suture. This data is again taken from literature sources [3,4].

Suture material selection is routinely performed by the dentist and is sometimes indicated by material selection routine or by someone else's experience. Often if we are asked theoretically about the types of suture materials, continuing education has remained on the data taught in school benches, relying on the fact that sutures in routine selection are obtained only on the basis of whether they are absorbable or non-absorbable, and depending on the caliber of the age standing at the end of

the suture thread; without wondering if this suture should stay in the patient's oral cavity for 7 to 14 days and be under the effect of the patient's saliva and combination of nutritional fluids or dietary pleasures (tea, coffee, coca-cola) and mouthwashes (chlorhexidine or listerine) individually selected by the patient [1,5,9-13].

Material and method

Through these experiments, the tightening / pulling force of the suture fibers was tested under the action of a maximum force tolerated by the thread, without causing laceration, the level of wound laceration under the action of a maximum pulling force, effects which directly affect healing of the wound. The ease of maneuvering was observed as well as the characteristics of the threads such as: Tissue retraction, ease of knot creation, knot safety, etc.

Experiment no.1 - Tensile strength test and ease of maneuvering and suturing at the moment of suturing, the level of laceration during suturing was also observed.

Experiment no.2 - Tensile strength test and ease of maneuvering 3 days after suturing

Experiment no.3 - The level of wound laceration induced under the action of maximum traction force.

The selected surgical sutures were:

- polyglycolic acid, woven, absorbable (purple) 4/0

- silk, knitted, non-absorbable. 3/0

- polyester, knitted, coated, non-absorbable 2/0

- polyester, knitted, coated, non-absorbable. 1/0

- polypropylene, monofilament, non-absorbable 2/0

Sample: Lamb head (small), main target were two maseter muscles, on both sides.

Measuring instrument: Dynamometer

Methodology: Suturing with each type of suture forming nodes with a suture passage. Testing of each type of suture at the time of suturing and after three days.

Experiment protocol description

Suturing day

Experiment no.1

To create the idea of a real wound, a horizontal incision was made along the masseter muscle by means of a scalpel. Part of the sutures was placed in the maseter muscle, while the rest along the lips. After selecting the auxiliary instruments for suturing and the suture types, a suturing queue was set specifically according to the condition suture types.

Respecting this order (from the posterior part of the head versus the anterior one) on both the left and right sides of the sample, suturing began with the help of a portage and a retraction tweezers (when necessary). The incision line was followed.

- Suture 1: PGA (polyglycolic acid), knitted, absorbable (purple) 4/0 with age ½ circle 40 mm and G40 with round drilling tip.

- Suture 2: Silk, knitted, non-absorbable (black), 3/0, with age ½ circle with reverse cutting edge 28 mm, with triangular drilling tip.

- Suture 3: Polyester, knitted, coated, non-absorbent (blue) 2/0, with straight edge 75 mm long, with triangular drilling tip.

- Suture 4: WEGO-PGA Polyglycolic acid, knitted, coated, non-absorbable (purple) 4/0, with age ½ circle 20 mm with circular drilling tip.

- Suture 5: Polypropylene, monofilament, non-absorbent (blue) 2/0 with age ½ circle 35 mm, with circular drilling tip.

The securing of the loop was done with 3 knots, 2 knots with clockwise rotations and 1 anti-clock knot. At the end of each suture the excess was cut with scissors.

The same was done for both sides (left-right).

Measurement process on the left side

A dynamometer was placed in turn on each of the sutures, capturing a slightly looser part of the loop. To perform the measurement, such an attractive force was applied that did not cause suture detachment (2.5 N/cm).

During the measurements all moments were photographed with continuous shooting of the camera, to provide as much detail as possible about the selected suture and its attractive force in the first moment after suturing.

After the measurements and the whole part of the test, the sample was placed in a glass container with a lid, filled with physiological solutions (2 units) and 5% glucose (1 unit) and stored in a dry and dark environment for the purpose of experiment no. 2 and no.3 which took place on the 3rd day after suturing.

The right side was not touched.

Day 3 after suturing

Experiment no.2

The suture fibers again on the left side were treated with the same methodology as in experiment no. 1, but the influencing factor was the three-day sutured stay of the tissue where the force is applied.

Experiment no.3

With the fibers on the right side a maximum force was exerted to initiate lasing, total detachment, rupture or loosening of the filament.

Even in this case every moment was photographed and documented, every data we got from the sutures used.

Results

The results of the experiment shown in the figures are as follows:

Figure 1: Application of different types of sutures.

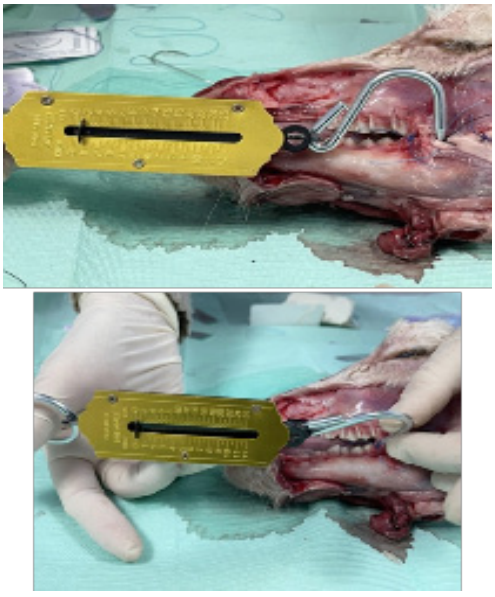

Figure 2: Testing sutures with dynamometer.

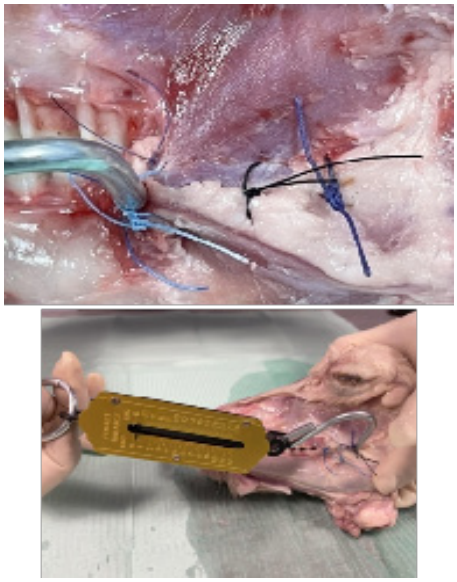

Figure 3: Tissue laceration during suture insertion 3.

Table 1: Results of tensile force on different types of sutures, at the moment of suture placement and after 3 days stored in saliva imitation solution.

Type of suture	Tensile strength on the day of placement	Tensile strength 3 days post suture	Difference
Atramat 1	1 unit	0.3 unit	0.7 unit
Silk Brainded 3/0	1.3 unit	0.3 unit	1 unit
Flexident 2/0	0.2 unit	0.0 unit	0.2 unit
G41202-75 4-0	0.5 unit	0.5 unit	0 unit
Polypropylene Monofilament 2/0	0.3 unit	0.0 unit	0.3 unit

Discussions

The idea is that the modification of sutures and suturing materials will be in the direction of finding the possibility of fixing these solutions in the suture materials and finding the systems of release of the same solutions so that the dosage in terms of disinfection, to be controlled. This would be ideal, but studies have shown that chlorhexidine and viryl plus coated sutures have no differences in the size of the antiseptic zone caused by S.Aureus, s. Epidermis, E.Coli. Faced with the facts that other studies have shown that this happens as chlorhexidine is not in the right percentage to be effective. Increasing the percentage of chlorhexidine depending on the carrier or binder there, the solution that holds the chlorhexidine bound to the suture, are factors that affect the whole process [3,5,6-13]. The antiseptic effect of chlorhexidine is documented to be higher than that of triclosan -it. Recall that chlorhexidine has an effect against fixation of periodontal bacteremia Actinomyces, porphyromonas beyond the bacteremia of S. Aureus, s. Epidermis etc. This is the field where the aim is to improve suturing materials, beyond the mechanical forces of tension force as suture material. Few studies have been performed in vitro and more in vivo studies are needed to reach more accurate and limiting conclusions [3,5,6-13.

At the end of these experiments the following results were obtained:

Experiment 1

Suture 1: PGA-Polyglolic acid: With the start of suturing there was ease in maneuvering and ease in tying the knot. Agia was a bit traumatic because it had wide lumen and 40 mm ½ circle length. Wound laceration was present during suturing due to the thickness of the thread. The attractive force of this suture was - 1.4 kg. Tissue retraction was evident during traction.

Suture 2: Silk: Very easy to maneuver and describes the tissue gently, without causing lacerations or tissue retraction. The knot was easily tied. The tensile strength of this suture was 0.6 kg, after which this force was resolved.

It was restructured to be tested again with experiment no.2.

Suture 3: Polyester: Lacer the wound from the beginning of suturing, shows difficulty in tying the knot and maneuvering. Traction - 0.3 kg. Not much pressure was exerted during the tensile strength test because the laceration was immediate.

Suture 4: PGA polyglycolic acid coated: Very well maneuverable and slightly traumatic age, as it has not very large lumen and age length 20 mm. Traction - 0.6kg.

Suture 5: Polypropylene: The suture showed maneuverability due to the material and difficulty in tying the joint, plasticity in tightening the joint. Traction force-0.2 kg.

Conclusions

Positive evaluations on the preservation of suture structure as material, post placement and suturing in the oral cavity, have for absorbable sutures up to 10 days, for non-absorbable up to 7 days. Positive evaluations 3 days after suture placement are more for absorbable sutures than non-absorbable ones.

Although the tensile strength of the sutures is known to have been evaluated even for 14 days after suture placement, such results on these data have not been published.

There are studies linking age size to maintaining the tensile strength of suture material, meaning that caliber 4 agia is rated as the most appropriate.

There are conflicting opinions about the application of mouthwashes, saying that chlorhexidine has an effect, or that mouthwashes are not needed and have no effect on the strength of the suture placed in the oral cavity.

Non-absorbable and absorbable sutures do not tolerate the effects of mouthwashes - listerine, or even low pH foods on the patient's diet. Negative effects on absorbable sutures are about twice as pronounced than on non-absorbable sutures.

Declarations

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Author contributions: Literature research was conducted by Prof.As. Saimir Heta. It was his insistent work that made it possible to reach the conclusions in this article.

Conflicts of interest: We declare that there is no conflict of interest between the authors and the material presented in this article.

Availability of data and materials: The datasets analyzed during the current study are available from the corresponding author.

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Author contributions: IR collected the scientific data and wrote the manuscript. SH revised and edited the manuscript. Literature research was conducted by SH and NA. GD and VO collected the scientific data. All authors read and approved the final manuscript.

Ethics approval and consent to participate: As the authors of the article, we state that there is no violation of the code of ethics during the realization of this article.

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References

1. Michael Newman, Henry Takei, Perry Klokkevold, Fermin Carranza; "Newman and Carranza's Clinical Periodontology. 2018; 13th Edition.
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; 18: 72-7.
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; 23: 559-565.
4. Varma SR, Jaber M, Fanas SA, Desai V, Al Razouk AM, et al. Effect of Hyaluronic Acid in Modifying Tensile Strength of Nonabsorbable Suture Materials: An In Vitro Study. J Int Soc Prev Community Dent. 2020; 10: 16-20.
5. Abullais SS, Alqahtani NA, Alkhulban 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; 99: e19831.
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; 46: 415-425.
7. Alsarhan M, Alnofaie H, Ateeq R, Almahdy A. The Effect of Chlorhexidine and Listerine® Mouthwashes on the Tensile Strength of Selected Absorbable Sutures: An In Vitro Study. Biomed Res Int. 2018; 2018: 8531706.
8. Vasanthan A, Satheesh K, Hoopes W, Lucaci P, Williams K, Rapley J. Comparing suture strengths for clinical applications: a novel in vitro study. J Periodontol. 2009; 80: 618-24.
9. Charbit Y, Hitzig C, Bolla M, Bitton C, Bertrand MF. Comparative study of physical properties of three suture materials: silk, e-PTFE (Gore-Tex), and PLA/PGA (Vicryl). Biomed Instrum Technol. 1999; 33: 71-5.
10. Goktas S, Pierre N, Abe K, Dmytryk J, McFetridge PS. Cellular interactions and biomechanical properties of a unique vascular-derived scaffold for periodontal tissue regeneration. Tissue Eng Part A. 2010; 16: 769-80.
11. Madurantakam P, Yoganarasimha S, Hasan FK. Characterization of Leukocyte-platelet Rich Fibrin, A Novel Biomaterial. J Vis Exp. 2015; (103): 53221.
12. Otten JE, Wiedmann-Al-Ahmad M, Jahnke H. Pelz K. Bacterial colonization on different suture materials—A potential risk for intraoral dentoalveolar surgery. J. Biomed. Mater. Res. 2005; 74B: 627-635.
13. 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. 2020; 24: 1527–1541.