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Research Article

Evaluating Tensile Strength of Absorbable Suture Material in Commercially Available Oral Rinses: An *In vitro* Study

Gayathri Radhakrishnan*, Vandana KV and Shobha Prakash

College of Dental Sciences, Davangere, Karnataka, India

***Corresponding Author:** Gayathri Radhakrishnan, Post graduate Student, College of Dental Sciences, Davangere, Karnataka, India.

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Abstract

Background: In periodontal and oral surgical treatments, suture materials are frequently employed. Suture strength is determined by a variety of parameters, including tensile strength, compressive strength, and knot configuration. The aim of this in vitro study was to compare 2 commercially available mouth rinses and chlorhexidine mouth rinse on tensile strengths of commonly used absorbable suture material.

Materials and Methods: The commonly used absorbable suture material polyglactin 910 (PLG 910) was selected. A total of 12 samples for each suture material for a combined total of 36 were used. The sutures were tested for pre- and post-immersion tensile strength after being placed in three different solutions. Tensile strength was determined by a testing machine with a load set at 50 N.

Results: Intragroup comparison was done using paired t test and quantitative data evaluation between two groups using post hoc test. Among the rinses, there was no statistically significant value in terms of stabilizing tensile strengths of the suture materials.

Conclusions: The tensile strength of polyglactin 910 (PLG10) significantly decreased post immersion in all the mouth rinses. This decreased value needs to be evaluated in a sample with longer time frame.

Keywords: Absorbable Suture; Chlorhexidine; Polyglactin 910; Tensile Strength

Introduction

Suturing is important for preserving the tissue integrity of surgical incisions. Sustained flap margin approximation that remains constant throughout time is a crucial component of successful wound closure. This allows for extensive tissue regeneration and a positive treatment outcome [1].

Failure to close a wound can induce delayed healing or wound dehiscence, both of which can cause practical and aesthetic problems [2]. Based on their degenerative and resorptive properties, sutures are classified as synthetic or natural, as well as absorbable or nonabsorbable. Tensile strength is one of the most important mechanical characteristics of suture materials, as it reflects their ability to withstand stress during knotting [3]. Furthermore, maintaining the basal tensile strength of the suture material is crucial for stabilising and securing the sutured flaps.

Polyglactin 910 has a stronger breaking strength than natural sutures, particularly when submerged in physiological and acidic pH solutions [4]. The oral cavity is a complicated environment with a wide range of temperature and pH. Such variations are induced by the ingestion of various foods and beverages, as well as the use of oral healthcare products such as toothpastes and mouthwashes. Many absorbable and non-absorbable suture materials are utilised in oral and periodontal procedures, including silk, polyglactin 910 (PLG), and polytetrafluoroethylene (PTFE). Silk is the most commonly utilised natural suture material due to its remarkable handling qualities [5].

PLG is a commonly used absorbable synthetic suture material. It's made up of 90% glycolide and 10% L-lactide, with calcium stearate and a lactic acid-glycolic acid copolymer as a coating [6]. Because there are so many mouthwashes in the market with different active components, patients and practitioners are usually in a dilemma as to which one to use. Although CHX is still considered the most effective anti-plaque agent, it has significant disadvantages.

Several herbal products in dentistry have been produced as a result of the search for a more effective and safe alternative to CHX mouthwash, all of which are devoid of major side effects, as well as being inexpensive and readily available [7]. The tissues lose flexibility when the suture material loses tensile strength in the oral

environment, causing tissue to open more quickly and creating secondary infection and difficulties [8]. Tensile strength has been measured using *in vitro* tests and animal models [9]. Sutures lose tensile strength with time, according to Kim., *et al*. with most sutures losing around 60% of their baseline strength, resulting in breaking [10].

Therefore, the purpose of the present *in vitro* study was to determine the effects of different commercially available mouth rinses on the tensile strength of polyglactin 910 suture material commonly used in periodontal surgical procedures.

Materials and Methods

Suture material polyglactin 910 (PLG 910) was exposed to different media (1 control and 2 tests) in in-vitro settings to simulate intraoral exposure at controlled time frame. The suture materials were tested for tensile strength pre immersion and after 48 h post immersion in different media. Tested suture material was obtained from sterile, unexpired and commercially available packets: 3-0 PLG 910 (Vicryl™, Ethicon Inc., Somerville, NJ, USA).

Three experimental media which were controlled with temperature gradient were used in this study: (1) Control group – clohex ADS Mouthwash; (2) Test group-1 –complete care mouth wash; and (3) Test group-2 –hiora mouth wash. All of them were obtained commercially. Twelve samples were obtained for each of the selected suture materials, resulting in a total of 36 samples. The suture materials were measured to a length of 5 cm to accommodate the material in the testing machine. The first suture material (n = 5) was tested for tensile strength pre immersion in a selected medium and was calculated. The sutures were then placed in the same medium for a period of 48 hours and the tensile strength was calculated in N/mm2. This was repeated again for the second and third media, respectively.

Universal testing machine from HTE hounsfield was used to record the tensile strength of the samples. The testing was done with an initial load cell capacity set at 50 N for pre immersion. The testing speed to standardize the tensile strength determination for each sample was placed at 2 mm/min to avoid any damage to the suture material. The length of the specimen was kept at 5 cm. Tensile strength was determined pre immersion with a single pull till failure sets in. For post immersion, load cell was raised correspondingly to 100 N and was recorded at this level as this value was the maximum that failure was seen. Intragroup comparison was done using paired t test and quantitative data evaluation between two groups using post hoc test. Analysis was done using SPSS version 20.0 (IBM SPSS Statistics Inc., Chicago, Illinois, USA) Windows program. Level of significance was set at $P \leq 0.05$.

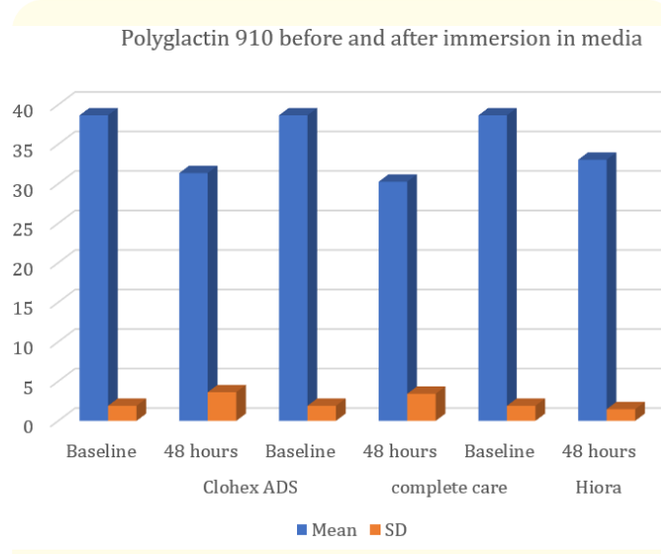
Results and Discussion

Table 1 and graph 1 comprise of the tensile strength of polyglactin 910 suture material pre immersion and 48hour post immersion. The results were not statistically significant. At post immersion, tensile strength of polyglactin 910 was reduced in all the three mouth rinses, and there was no statistically significant results were obtained.

		Mean	SD	P
Clohex ADS	Baseline	38.6667	1.91089	0.444
	48 hours	31.3583	3.62804	
Complete care	Baseline	38.6667	1.91089	0.325
	48 hours	30.2667	3.43202	
Hiora	Baseline	38.6667	1.91089	0.945
	48 hours	33.0500	1.48048	

Table 1: Polyglactin 910 before and after immersion in media.

SD: Standard deviation, P: Level of significance.



Graph 1: Polyglactin 910 before and after immersion in media.

Table 2 and graph 2 depicts multiple comparisons by post hoc test analysis. While evaluating quantitative data between groups, there were also no statistically significant values observed. PLG in Clohex ADS showed superior retention of tensile strength among three mouth rinses.

Discussion

The goal of this *in vitro* study was to compare three different mouth rinses to polyglactin 910, a routinely used absorbable su-

			Mean Difference	P	95% Confidence Interval	
					Lower Bound	Upper Bound
Baseline	Clohex ADS	Complete Care	0.00000	1.000	-1.9143	1.9143
		Hiora	0.00000	1.000	-1.9143	1.9143
	Complete Care	Clohex ADS	0.00000	1.000	-1.9143	1.9143
		Hiora	0.00000	1.000	-1.9143	1.9143
	Hiora	Clohex ADS	0.00000	1.000	-1.9143	1.9143
		Complete Care	0.00000	1.000	-1.9143	1.9143
After48Hrs	Clohex ADS	Complete Care	1.09167	.651	-1.9210	4.1043
		Hiora	-1.69167	.364	-4.7043	1.3210
	Complete Care	Clohex ADS	-1.09167	.651	-4.1043	1.9210
		Hiora	-2.78333	.075	-5.7960	.2293
	Hiora	Clohex ADS	1.69167	.364	-1.3210	4.7043
		Complete Care	2.78333	.075	-.2293	5.7960

Table 2: Multiple comparisons by post hoc test.

P: Level of significance.

Graph 2: Multiple comparisons by post hoc test.

ture material (PLG 910). Suture material was chosen because of its versatility and widespread use in a variety of oral and periodontal surgical procedures. Mouthwashes were also chosen based on the widespread usage of chemotherapeutic medicines to inhibit plaque formation [11].

According to the current study, the mean tensile strength varied substantially depending on the immersion medium and time frame. The findings of our current research are in line with earlier findings on all types of sutures. Furthermore, the tensile strength of synthetic multifilament absorbable sutures is maintained at acidic or neutral pH levels [12].

Antiseptic mouthwashes are commonly prescribed by oral surgeons following surgical procedures, however the effects of various antiseptic mouthwashes on sutures have not been adequately examined. Previous clinical studies found no significant difference in polyglactin 910 suture strength loss when exposed to chlorhexidine mouthwash, refuting the current study premise that antiseptic commercial mouthwashes had an effect on polyglactin 910 suture tensile strength. This discrepancy could be explained by the fact that the sutures were only exposed to chlorhexidine mouthwash for a brief period of time in the clinical studies stated earlier. Furthermore, those studies focused on durability rather than tensile strength [13].

According to McCaul and colleagues [14], who tested the effect of chlorhexidine mouthwash on polyglactin 910 (PLG) absorption time, the mouthwash had no influence on suture material survival. PLG degradation occurs *in vivo* after proteolytic enzymatic breakdown, resulting in tensile strength decrease. PLG lost tensile strength more fast when exposed to saliva, especially after 7 days [15] Pilu, bibhitaka, nagavalli, gandhapurataila, ela, peppermint satva, and Yavanisatva were among the constituents in HiOra mouthwash that contributed to better dental health. Bibhitaka and nagavalli have been found to reduce the cell-surface hydrophobicity of three early plaque settlers and inhibit bacterial adhesion to host tissues [16,17]. Pilu, also known as miswak, contains salavdorin, an alkaloid that is used as an anti-plaque and anti-microbial agent. Ela is a fantastic mouthwash to use if you have bad breath or dental issues. E. cardamomum has been found to significantly reduce the growth of oral bacteria [16].

Complete care is formulated with an active combination of neem, pomegranate and miswak. Herbal products like pomegranate, meswak and Azadirachta indica (neem) are used to promote oral hygiene, and their inhibitory effect on biofilm formation is shown in several studies. In these species antibacterial, anti-inflammatory, astringent and anticarcinogenic activity were observed. If such herbal products are often formulated effectively, this might cause an improvement within the general dental health of the population [18].

The limitation of the study is the small sample size (n = 36) used and also the short time frame (48hours) kept to evaluate.

Conclusions

The tensile strength of polyglactin 910 (PLG10) significantly decreased post immersion in all the mouth rinses. This decreased value needs to be evaluated in a sample with longer time frame. Clohex ADS shows better retention of tensile strength compared to Complete care and Hiora. Further clinical studies needs to be formulated to confirm the results of this *in vitro* study.

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