

Influence of Myricetin and Nicotine on Absorbable Sutures

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ABSTRACT

Objective: Suture is often used to close wounds following dental extractions, biopsies or other oral surgical procedures. Suture that is rapidly absorbed is generally preferred to avoid the need for removal. The purpose of the study is to evaluate the effects of secondary metabolites mainly present in foods on the properties of the suture materials (PGA and Vicryl) used in the oral cavity.

Material and method: Myricetin extract is prepared using guava leaves and nicotine was collected from tobacco by means of ethanolic extract and mixed together. Both the extracts were kept in two test tubes separately for analysing its influence on PGA and Vicryl which is used as sample sutures for this study.

Results: The antioxidant activity clearly indicates that the combined effect drastically decreases and the anti-inflammatory activity of myricetin nicotine combination the same as myricetin. Results are indicating that the coating decreases the mechanical property of the PGA and vicryl whereas the degradation study shows that this coated material influences the degradation by means of increasing the strength slightly over time in vicryl suture and decreases in PGA.

Conclusion: Consumption of foods containing myricetin and the habit history of tobacco consumption that has nicotine affects absorbable sutures in the oral cavity. Hence that consumption of foods and smoking should be avoided till the healing has taken place.

Keywords: Secondary metabolites, Myricetin, Nicotine, PGA, Vicryl

HOW TO CITE THIS ARTICLE: Divya dharshini A, Rubin S John, Rajalakshmanan Eswaramoorthy, Anju Cecil, Influence of Myricetin and Nicotine on Absorbable Sutures, J Res Med Dent Sci, 2023, 11 (3): 46-50.

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Received: 01-March-2023, Manuscript No. jrmds-22-77435;

Editor assigned: 04-March-2023, PreQC No. jrmds-22-77435(PQ);

Reviewed: 18-March-2023, QC No. jrmds-22-77435(Q);

Revised: 23-March-2023, Manuscript No. jrmds-22-77435(R);

Published: 30-March-2023

INTRODUCTION

Absorbable stitches keep their rigidity for however long it is expected over the required healing time Lined up with the rising strength of the tissue, they are degraded by the tissue digestion through proteolytic enzymatic disintegration until they are totally disintegrated [1,2]. Absorbable sutures are ideal for internal wounds and in dentistry they are mostly used in case of requirement of sutures for impaction procedures and OGS procedures where it takes a lot of work and time to remove sutures and sometimes for comfortability.

Since this research deals with dentistry PGA and Vicryl are the choice of absorbable sutures taken into consideration due to its wide use for suturing in dentistry. Polyglycolic Acid Suture is an absorbable, sterile, synthetic suture which was one of the first Synthetic absorbable sutures introduced in early 1970s [3,4]. PGA Sutures are braided and coated composed of polymers made from 100% Homo-Polymer of glycolide. Vicryl is an absorbable, synthetic, usually braided suture. A monofilament version is also available [5,6]. It is indicated for soft tissue approximation and ligation [7]. The suture holds its tensile strength for approximately two to three weeks in tissue and is completely absorbed by acid hydrolysis within 56 to 70 days [8].

Myricetin is one of the key constituents of various human foods and beverages including Vegetables, teas and fruits and is recognized mainly for its anti-oxidant and anti-inflammatory properties [9]. Myricetin is a member of the flavonoid class of poly phenolic compounds [10]. Common dietary sources include vegetables including tomatoes, fruits like oranges, nuts, berries, teas and

red wine. It's been documented that flavonoids have inhibitor, medicinal drug, anticancer, anti-diabetic, and antimicrobial effects. Tobacco consumption globally is one of the leading causes of potentially preventable morbidity and mortality. About 28.6% of the population consumes tobacco [11]. Nicotine narrows the small blood vessels that normally bring oxygen, nutrients, and healing factors to your injured area. This slows down healing and may extend the duration of your pain [12].

This research aims to evaluate the effects of secondary metabolites (myricetin, nicotine) mainly present in daily consuming foods such as guava and habit history of Indians commonly on the properties of the suture materials (PGA and Vicryl) used in the oral cavity

ETIOLOGY AND PATHOGENESIS

Artificial saliva preparation

The artificial saliva of 1000ml was prepared by the mixture of 8.035g of sodium chloride, 0.355g of sodium bicarbonate, 0.0225 of potassium chloride, 0.231g of potassium hydrogen phosphate, 0.311g of magnesium chloride, 40ml of 1.0M hydrochloric acid, 0.292g of calcium chloride, 0.072g of sodium sulphate, 6.118g of Trizma base and IM hydrochloric acid, the prepared saliva was divided into 2 separate beakers of 500ml with 7.4ph and 500ml with 4.4ph.

Preparation of extract and coating on suture

Myricetin extract is prepared using guava leaves and nicotine was collected from tobacco by means of ethanolic extract and mixed together. Both the extracts were kept in two test tubes separately for analysing its influence on PGA and Vicryl which is used as sample sutures for this study.

PGA and Vicryl were cut into 6 pieces of which 3 were 1.5 mm and 3 were 10 mm respectively. These pieces were immersed in the respective extracts for 6 hours followed

by air dry. The threads measuring 10 cm were used for analysing the tensile strength and the threads measuring 1.5cm were used for analysing Antioxidant and anti-inflammatory reactions of myricetin and Nicotine on these absorbable sutures.

The suture soaked extract was kept in the shaker for uniform coating of myricetin and Nicotine over the sutures. After 24hrs, the sutures threads were taken from the test tube and dried in a glass plate for 4-5 hrs.

Analysis

Anti-inflammatory activity, Antioxidant activity, Tensile strength testing and SEM analysis of surface roughness has been checked.

RESULTS

The anti-inflammatory activity of myricetin, nicotine and the combination of both in comparison to Diclofenac. The amount of anti-inflammatory activity is not much pronounced in the myricetin group compared with the nicotine group. Combining these together nicotine influences the myricetin, anti-inflammatory property which is similar to that of myricetin. Here, we used dichlorophenol for anti-inflammatory. It clearly indicates that the combined effect is the same as Myricetin anti-inflammatory properties.

The antioxidant activity of myricetin, nicotine and the combination of both in comparison to Ascorbic acid. From the above data, the antioxidant property of myricetin is stronger than the nicotine group. Adding that together nicotine reduces the activity of myricetin. Both the groups are compared with clinically proven drugs. Here, for antioxidants we used Ascorbic acid. It clearly indicates that the combined effect drastically decreases the antioxidant properties.

In terms of mechanical strength the results indicate that the coating improves the mechanical property of the PGA

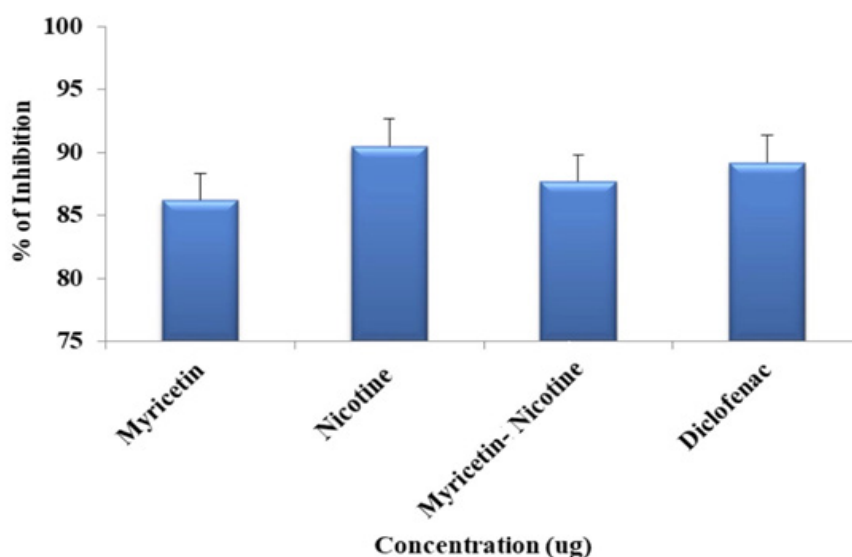


Figure 1: Anti-Inflammatory (Protein Denaturation Assay).

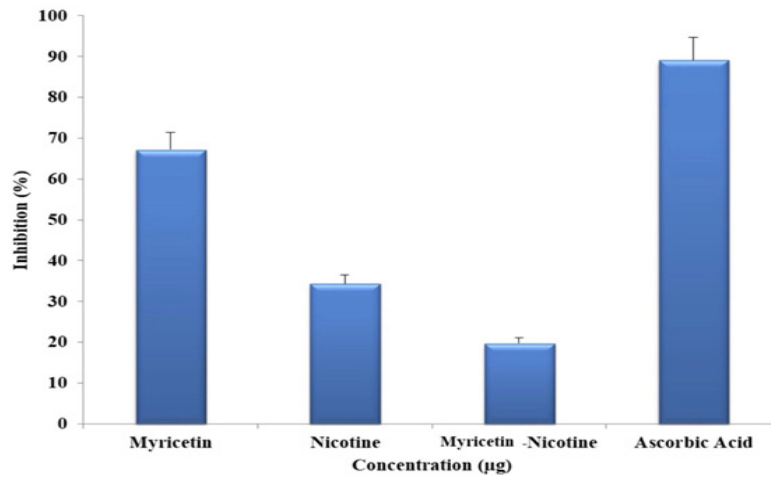


Figure 2: Anti-Oxidant Assay (DPPH Assay).

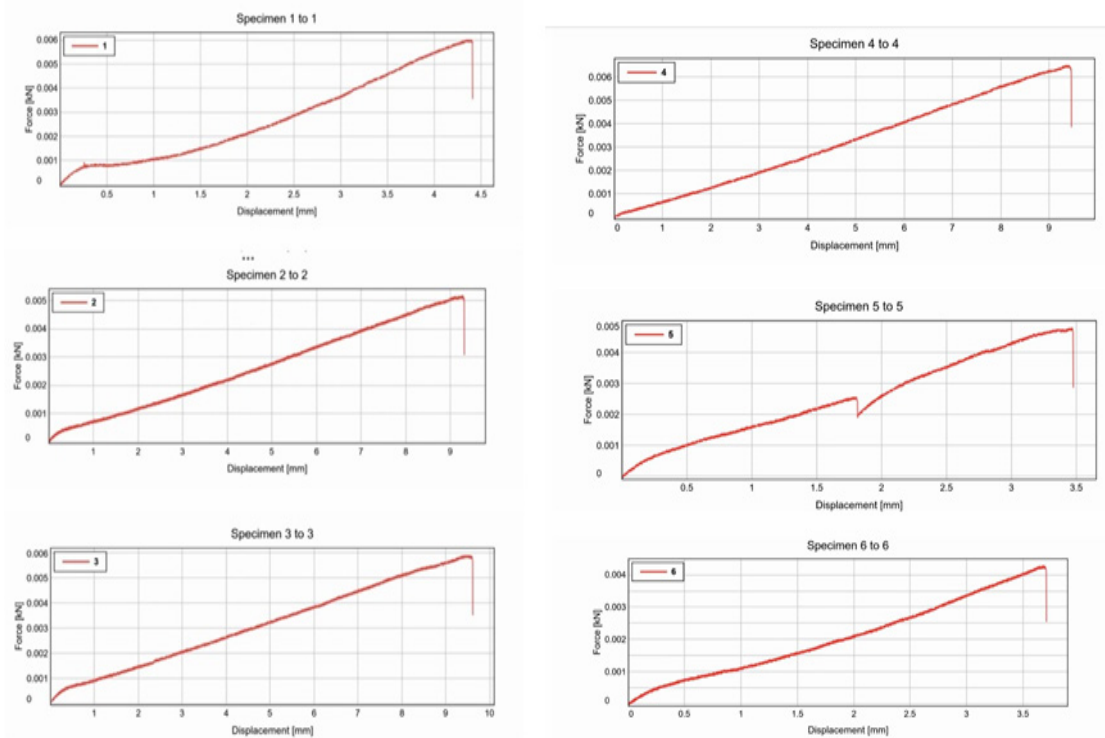


Figure 3: Tensile strength testing (specimen 1 to 6).

Table 1: Tensile strength testing.

| | Maximum Force [N] | Tensile stress at Tensile strength [MPa] | Tensile strain (Displacement) at Break (Standard) [%] |
|----------------|--|--|---|
| 1 | 6.02 | 933.8 | 8.81 |
| 2 | 5.18 | 798.91 | 18.61 |
| 3 | 5.91 | 909.58 | 19.22 |
| 4 | 6.48 | 1003.27 | 18.92 |
| 5 | 4.8 | 746.98 | 6.95 |
| 6 | 4.29 | 660.61 | 7.41 |
| Specimen label | Tensile stress at Break (Standard) [MPa] | | |
| 1 | PGA | | |
| 2 | vicryl | | |
| 3 | vicryl 4.4 | | |
| 4 | vicryl 7.2 | | |
| 5 | PGA 4.4 | | |
| 6 | PGA 7.2 | | |

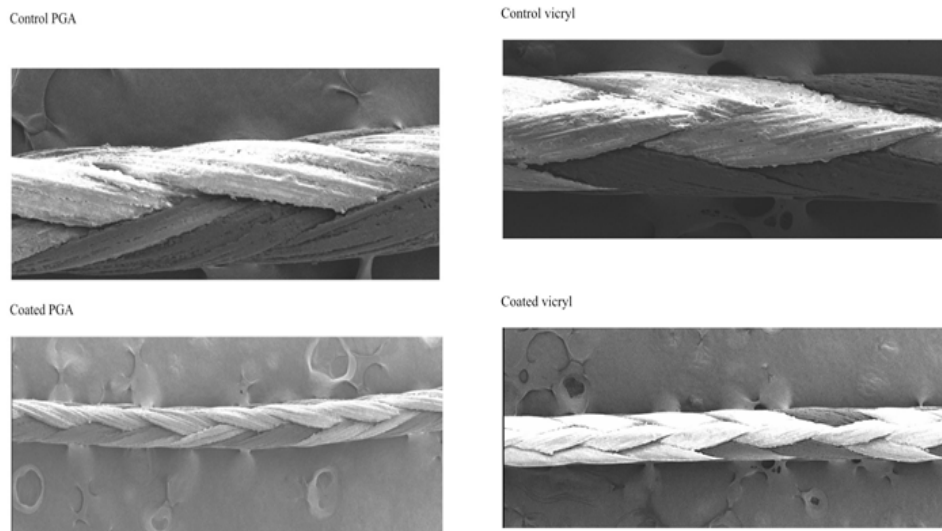


Figure 4: SEM analysis.

and vicryl whereas the degradation study shows that coated material influences the degradation by means of decreasing the strength over time. The Tensile test for control groups in PGA is showing around 1279 whereas the coated groups are showing 927 which shows slight decrease in tensile strength which is similar in vicryl as well. Hence, coating reduces the tensile strength. Then, we kept the sutures under the artificial saliva solution at two different pH 7.2 and 4.4. Which reflects 4.4 for the pedo patient whereas 7.2 for the adult patient. The degradation profile shows that after 7 days of immersion in the two different pH the 4.4 in the vicryl group increased tensile strength is noticed. Vicryl group at 7.2 which is more than the day 0 value whereas the PGA value is less than the day 0 value. We are using an immersion method of dip coating. So, the materials are immersed in the alkaloids and flavonoids solution. Here, we used 25mg/ml of alkaloids and 75mg/ml of flavonoids.

The SEM images confirm that the coating has been done uniformly Figure 4. The scanning electron microscopy shows the images of control and coated groups. The control group shows a symmetrical clear picture whereas the coated one shows similar pictures with the added film layer on the top of it. We can clearly see that PGA as well as Vicryl thickness is increased.

DISCUSSION

Synthetic absorbable sutures provide temporary and mechanical support while wounds are healing. They can also work as supports for soft tissue to regain strength until the tissue heals naturally. All sutures were intact at the end of their respective soaking periods and were suitable for mechanical testing. All sutures demonstrated an obvious breaking point during mechanical testing.

Of the two sutures used in this study, the PGA suture had the lowest tensile strength. In salivary serum solution, PGA sutures maintained tensile strength during the first three days, but showed a significant decline by day

14. However, in another study using lactated Ringer's solution, PGA showed no significant change in tensile strength from day 0 to day 13. This may have been due to being placed in the C incubator, which was not the case in other studies [13]. Therefore, temperature and type of solution can affect the tensile properties of sutures.

Vicryl soaked in saliva compared to other liquids such as saline or milk. In our study, saliva appears to promote suture degradation, and coating with myricetin and nicotine slightly increases tensile strength. The ideal suture should be flexible, have sufficient tensile strength, and be resorbed in 7-10 days [14]. Sutures in dentistry differ from other parts of the body because of the types of tissue involved, the presence of saliva, advanced tissue vascularization, and functions associated with speaking, chewing, and swallowing [15]. Sutures require certain physical properties and characteristics such as good tensile strength, dimensional stability, lack of shape memory and sufficient flexibility to avoid damage to the oral mucosa [16]. Compared to other PGA monofilament and multifilament sutures, Vicryl showed the most favorable response in this study. In addition, the inflammatory response had gradually subsided over the course of three days and was almost completely gone by the seventh day. In vitro studies favour the use of synthetic absorbable sutures, and intraoral suture selection should be based on restoration needs and surgeon preference [17].

In our study, myricetin has less anti-inflammatory effects than nicotine. Other studies have shown that the enhancement of inflammatory cytokines and systemic reorganization after myricetin treatment plays an important role in promoting wound healing [18]. The results suggest that treatment with higher myricetin doses improved wound healing in rats. It may act as a potent anti-inflammatory agent [19].

In our study, the antioxidant effect of nicotine is low. During the patient's healing period, blood clots need time to form, and smoking should be stopped till the

healing is complete to avoid its effect on sutures. Another study also quotes that the nicotine in cigarettes can interfere with the healing process and increase the risk of complications¹² like risk of tearing threads. Anything that interferes with the stitches can slow the healing process and cause healing complications.

CONCLUSION

The addition of myricetin and nicotine coated polyglactin and vicryl sutures did affect physical handling properties or performance characteristics based on the testing and evaluations performed. Thus it is clear that consumption of foods containing myricetin and the habit history of tobacco consumption that has nicotine affects absorbable sutures in oral cavity. Hence that consumption of foods and smoking should be avoided till the healing has taken place.

ACKNOWLEDGEMENT

This research was done under the supervision of the Department of research of Saveetha dental college and hospitals. We thank our colleagues who provided insight and expertise that greatly assisted the research.

CONFLICT OF INTEREST

No potential conflict of interest is declared in this study.

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