

**Comparative Evaluation of Gingival Status and Postoperative Discomfort after Periodontal Flap Surgery Where Incision Is Approximated Using Isoamyl 2-Cyanoacrylate, With Conventional Silk Suture**

<sup>1</sup>Dr Ramu Vinayak P Menon, Dept of Periodontics, Amrita School of Dentistry, Kochi, Kerala.

<sup>2</sup>Dr Biju Balakrishnan, Dept of Periodontics, Amrita School of Dentistry, Kochi, Kerala.

<sup>3</sup>Dr Angel Fenol, Dept of Periodontics, Amrita School of Dentistry, Kochi, Kerala.

<sup>4</sup>Dr Mohammed Shereef, Dept of Periodontics, Amrita School of Dentistry, Kochi, Kerala.

<sup>5</sup>Dr Rajesh Vyloppillil, Dept of Periodontics, Amrita School of Dentistry, Kochi, Kerala.

<sup>6</sup>Dr Maya Rajan Peter, Dept of Periodontics, Amrita School of Dentistry, Kochi, Kerala.

**Corresponding Author:** Dr Biju Balakrishnan, Dept of Periodontics, Amrita Vishwa Vidhyapeetham Kochi, Kerala.

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**Abstract**

**Background:** A close approximation of the flap is vital following a periodontal flap surgery in order to obtain a good post operative wound healing. A primary union between the flaps is essential to establish a healthy dentogingival apparatus. Isoamyl 2-cyanoacrylate is a synthetic tissue adhesive; a newer member of the cyanoacrylate super family has found its application in intra-oral surgeries which require tension free flap closure and to overcome the disadvantages of conventional silk suture.

**Objective:** The present study was conducted to determine whether isoamyl 2-cyanoacrylate can be effectively used as an alternative to conventional silk suture.

**Materials and method:** The study was done on 12 subjects who required periodontal flap surgery on both the maxillary quadrants.

**Result:** It was seen that all the parameters assessed showed a statistically significant difference in the test site (cyanoacrylate) than control site (silk suture). The early wound healing was better at the test site on 2<sup>nd</sup> as well as 7<sup>th</sup> day post-op. Subjects reported a much less pain score in the test site on the 2<sup>nd</sup> day, however by 7<sup>th</sup> day it was statistically insignificant. All the subjects reported that they were more comfortable and compliant with the use of cyanoacrylate than silk suture.

**Conclusion:** isoamyl 2-cyanoacrylate can be effectively used as an alternative to silk suture where flap tension free flap closure is indicated.

**Keywords:** isoamyl 2-cyanoacrylate, silk suture, wound healing

## Introduction

Periodontitis is a multifactorial disease with dental plaque and calculus serving as the chief components for the disease progression. Hence the primary objective of any treatment for periodontitis is to remove these etiologic factors and provide a healthy environment for healing of the diseased periodontium and regeneration as well.<sup>1,2</sup>

Since the inception of periodontal flap surgical procedures, suture threads like silk, nylon and later on resorbable sutures like catgut, polyglycolic-polyacetic acid derivatives etc are used for the approximation of gingival tissues following a surgery.

The more commonly recommended material for intra-oral surgical flap closure is braided silk suture thread. Due to the easy availability and predictable outcome after using, the silk sutures have dominated in the field of dentistry for surgical flap closure. Regardless of the immense popularity of silk sutures they do carry certain disadvantages. 'Wicking' is the most important drawback of braided silk thread as it acts as a reservoir of bacteria during the initial healing period.<sup>3, 4</sup> Furthermore suturing of inaccessible areas is very demanding and it can easily fatigue a surgeon following a tedious surgical procedure. So in order to cope with the increasing demand for faster and more efficient treatment strategies, a need for an alternative method to conventional suturing was felt.

Cyanoacrylate,<sup>3, 5, 6</sup> a synthetic tissue adhesive was first developed by Coover *et al* in 1959. The chemical formula of cyanoacrylate material is  $H_2C = C(CN)COOR$ , where the 'R' can be replaced with any alkyl group starting from methyl to decyl. Methyl cyanoacrylate was the first

adhesive to be manufactured as an industrial adhesive followed by Ethyl cyanoacrylate. However their use in the field of medicine was largely restricted due to its adverse histotoxic effect.<sup>3</sup> In order to overcome the histotoxicity, new safer products were synthesized like n-butyl cyanoacrylate, octyl cyanoacrylate, isoamyl 2-cyanoacrylate etc.

Isoamyl 2-cyanoacrylate is among the latest generations of the cyanoacrylate family which is widely being used in the field of medicine. However the application of isoamyl 2-cyanoacrylate is limited in the field of dentistry. Hence this study was conducted to determine whether isoamyl 2-cyanoacrylate can replace silk suture as an effective alternative for the approximation of periodontal flaps following flap surgery.

## Materials and methods

This split mouth comparative study was carried out in the Department of Periodontics, Amrita School of Dentistry, Cochin. The Institutional ethics committee approval was obtained prior to the start of the study. The test material used was isoamyl 2-cyanoacrylate and 3-0 braided silk suture was used in the control site.

With 99.9% confidence and 90% power the total sample size came to 12 per each group. Hence 12 subjects aged between 35-50 years with generalized periodontitis and indicated for periodontal flap surgery were selected for the study. Subjects having any known systemic disease and/or drug therapy which may interfere with wound healing, drug allergies to any medication used in the study, smokers, tobacco users, or any such habits that might affect the study, pregnant and lactating mothers were excluded. Signed informed consents were obtained from the subjects prior to the start of the study. For better validity of the result only maxillary posterior quadrants were considered.

Phase 1 periodontal therapy and oral hygiene instructions were carried out for all the subjects. On completion of phase 1 therapy, subjects were called at 4 weeks for re-evaluation and those who fit the inclusion criteria were taken up for the surgery. In all subjects a split mouth study design was used. A full thickness mucoperiosteal flaps were elevated, debridement, and root planning was done to remove all the granulation tissues and to obtain a glassy finish over the cementum. A coin toss method was used to determine the site for the application of cyanoacrylate or silk suture. The site receiving isoamyl 2-cyanoacrylate was named group A and the site receiving silk suture was named group B. Following the surgical procedure an applicator tip was used to apply the adhesive over the flap<sup>2</sup>. in group A. This was done to prevent excess application of the material over a particular surface and to prevent back flow of the material. In group B simple direct loop sutures were placed for the approximation of flaps following surgery. No periodontal dressings were placed on either sides, post operative instructions were given and an analgesic (Tab FLEXON) was given three times daily for three days.

The subjects were recalled after two days to assess early wound healing index (*Wachtel et al*) and the pain level was recorded using a Visual analog scale (VAS). Subjects were again recalled after seven days and suture removal was done. The plaque index (modified Turskey index), gingival index (*Lobene et al*), early wound healing index and VAS pain were also recorded. Patient compliance was also recorded subjectively in terms of their perception towards both the materials.

**Parameters assessed**

- Plaque index on the 7<sup>th</sup> day (modified Turskey index)
- Gingival index on the 7<sup>th</sup> day (*Lobene et al*)
- Early wound healing index (*Wachtel et al*)
- VAS pain assessment

- Patient compliance

**Statistical analysis:** Statistical analysis was done using IBM SPSS statistics 20 windows (SPSS Inc., Chicago, USA). The results are interpreted in median with minimum and maximum for all continuous variables and in frequency (percentage) for categorical variables. Mann Whitney U test was applied to compare the median plaque index, GI Index, VAS score at 2<sup>nd</sup> day & 7<sup>th</sup> day and EWHI at 2<sup>nd</sup> day & 7<sup>th</sup> day between the 2 groups. Wilcoxon signed rank test was applied to compare the median VAS score and EWHI between 2<sup>nd</sup> and 7<sup>th</sup> day within groups. p-value <0.05 was considered statistically significant difference.

**Result**

The comparison of median values of plaque index between the two groups is shown in table 1. The table clearly shows a statistically significant reduction in the plaque index scores in group A as compared to group B from baseline to the 7<sup>th</sup> day post operatively (p= ≤0.005). The median value for group A was 1 within a range of 1-1 and for group B the median value was 2 within a range of 1-3.

Table 1: Comparison of plaque scores between group A and B

Group	median	Range (min-max)	p value
A	1	1-1	<0.001
B	2	1-3	

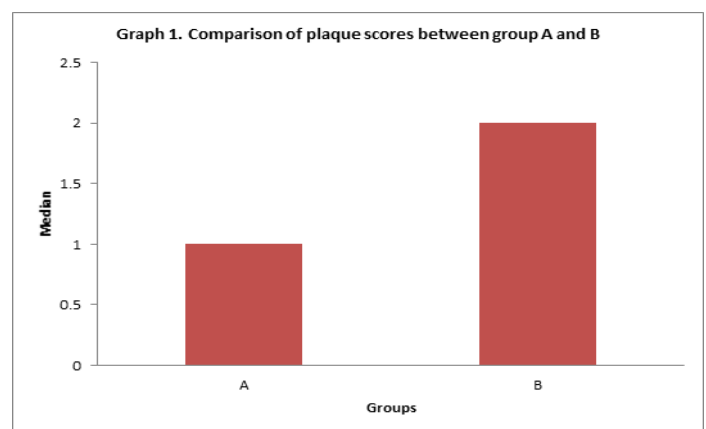
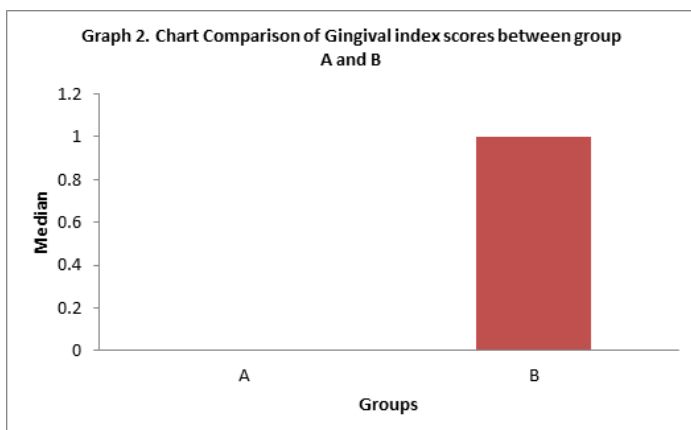


Table 2 shows the comparison of the median values for gingival index between the two groups. The difference was statistically significant between the two groups while comparing the values from the baseline and one week after the surgery. ( $p \leq 0.005$ ). The median value for group A was 0 within a range of 0-1 and for group B the median value was 1 within the range of 0-2.

Table 2: Comparison of Gingival index scores between group A and B

Group	Median	Range (min-max)	p value
A	0	0-1	<0.001
B	1	0-2	



The early wound healing index was assessed second and seventh day after the surgery. On second day group A showed better early healing as compared to group B. Group A showed a median value of 2 within the range of 2-3 and group B had a median value of 3 within the range of 2-3 on the 2<sup>nd</sup> day and by the seventh day group A showed a median value of 1 within the range of 1-1 and group B had a median value of 2 within the range of 1-2. A statistically significant result was noticed on comparison between group A and B on both second and seventh day. Table 3.

Table 3: Comparison of early wound healing index in the 2nd and 7th day between group A and B

Group	2 days		7 days		p value
	Median	Min-max	Median	Min-max	
A	2	2-3	1	1-1	0.001
B	3	2-3	2	1-2	0.002
p value	<0.001		0.002		

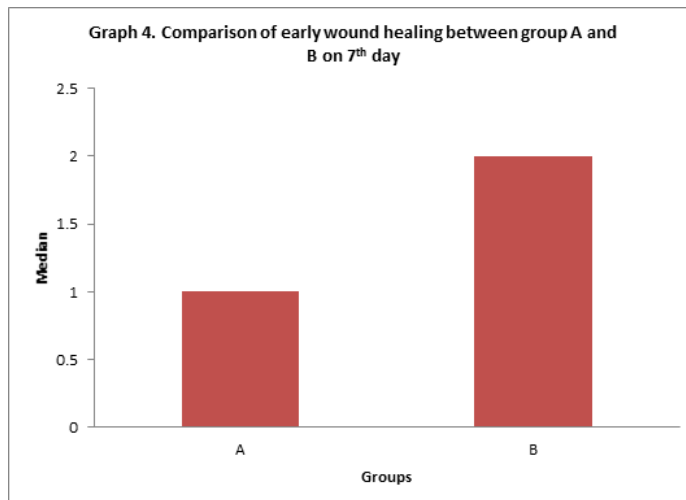
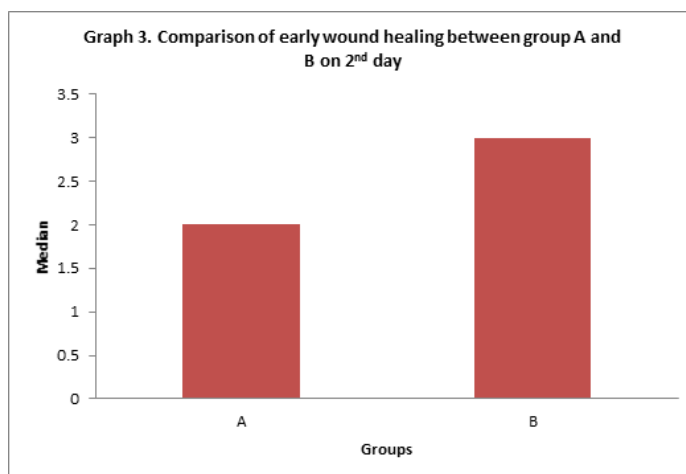
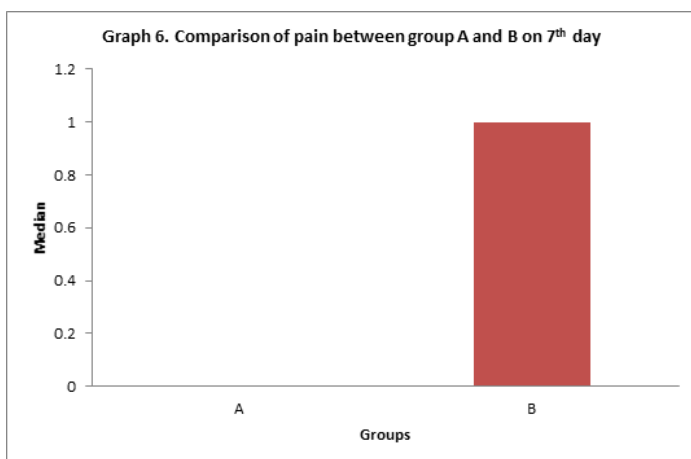
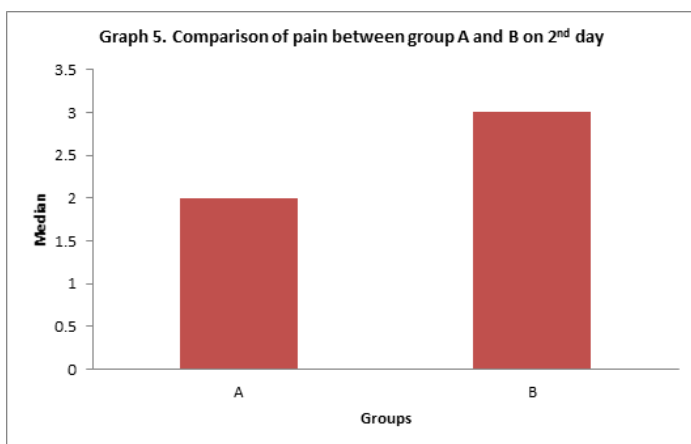


Table 4 compares the pain level of the subjects on a visual analog scale (VAS) on second and seventh day following the surgery. On comparing the VAS score on the second day, group A had a median value of 2 within range of 1-3 and group B had a median value of 3 within the range of 2-4. On comparison a statistically significant difference between group A and B in terms of post-operative pain on

the 2<sup>nd</sup> day was seen. The VAS score comparison on the 7<sup>th</sup> day shows that group A has a median value of 0 within a range of 0-1 and group B has a median value of 1 within a range of 1-1. A statistically nonsignificant result ( $p \geq 0.005$ ) was noticed while comparing the pain levels between both the groups seven days after the surgical procedure.

Table 4: Comparison of pain using visual analog scale on 3. 2nd and 7th day between group A and B

Group	2 days		7 days		p value
	median	Min-max	median	Min-max	
A	2	1-3	0	0-1	0.002
B	3	2-4	1	1-1	0.001
p value	<0.001		0.07		



Patient compliance was assessed following 7 days of the surgery subjectively. Patients were asked about the overall comfort level following the placement of cyanoacrylate and silk suture. All the 12 participants who took part in the study reported that the site approximated using cyanoacrylate was more comfortable as compare to silk suture after the surgical procedure.

### Discussion

The present study was done to determine whether isoamyl 2-cyanoacrylate can be used as an effective alternative to silk suturing following periodontal flap surgery. Isoamyl 2-cyanoacrylate is among the newest member of the cyanoacrylate family which is biocompatible and has good working properties such as flow rate and setting time. The adhesive polymerizes the moment it comes in contact with moisture and even blood and forms long and stable chains through covalent bonds and Van Der Waals forces.<sup>7</sup> Due to this property it can also act as a haemostatic agent and it can hold approximated tissues in position.<sup>8</sup>

In this study the increased plaque score at group B can be correlated to difficulty in maintaining oral hygiene at the surgical site due to the presence of suture threads which acts as anchoring agents of plaque,<sup>9, 10</sup> whereas much less plaque accumulation was noted in group A. A statistically significant difference was seen between group A and group B while comparing plaque scores 7 days post operatively. This result was similar to the results obtained by Binnie and Forrest.<sup>9</sup>

The gingival index can give us an idea regarding the inflammatory processes and tissue response towards both the materials. The higher gingival score in group B can be attributed to the plaque retention of the suture material which would trigger an inflammatory response.<sup>11</sup> the silk material itself is a foreign body and hence it is capable of causing foreign body reaction by the immune system which can cause inflammation of the gingiva.<sup>12</sup> Also the

phenomenon of wicking further harbors pathogenic bacteria in the suture thread which can further cause inflammation. Hence there was a statistically significant difference in the gingival index between the two groups.

Group A showed significantly different early wound healing on both 2<sup>nd</sup> and 7<sup>th</sup> days post operatively. In the second day after the surgery group A clearly had a better healing as compared to group B. The tension free approximation of the flap and absence of irritants such as plaque accumulation and the absence of silk thread itself might have contributed to the superior early healing of the surgical site as compared to group B. However on the seventh day after the surgery, group A and B showed relatively better healing of the soft tissue but group A showed a statistically significant early wound healing as compared to group B. The plaque accumulation tendency and wicking which is seen in silk sutures might have played a part in hampering healing of the flaps as compared to group A which showed excellent healing.<sup>10</sup> <sup>13</sup> the flaps were intact and showed no signs of detachment following the surgery in group A.

The post operative pain which was assessed on 2<sup>nd</sup> and 7<sup>th</sup> day using a visual analog scale showed statistically significant result on the second days after the surgery however on the 7<sup>th</sup> day review there was no statistically significant result between the two groups.<sup>14</sup> The possible explanation for this could be while suturing we are inducing secondary trauma while inserting the needle through the tissues. This could contribute to further pain at the surgical site where sutures were placed.<sup>10</sup> However by 7<sup>th</sup> day the needle entry points will start healing, hence the VAS score statistically not significant between the groups in 7<sup>th</sup> day.

Patient compliance was assessed subjectively in terms of patient's overall comfort towards both the materials. All the study participants reported that group A that is the site

which used cyanoacrylate was more comfortable than group B where silk sutures were used. As discussed earlier suturing induces secondary trauma which aggravate pain and the silk thread act as an irritant at the site would have resulted in patients opting cyanoacrylate as more comfortable material for flap closure.

From the clinician's point of view cyanoacrylate offers certain advantages over silk sutures. Suturing is a technique sensitive procedure which requires years of practice and patience. It is also time consuming and can easily fatigue the surgeon following the surgery.<sup>15</sup> However cyanoacrylate being an adhesive is relatively easy to apply and is not technique sensitive as compared to suturing. The relative easiness of application makes the procedure simpler, faster and less tiring.

Cyanoacrylates do carry a threat of tissue allergy but during the course of this study no participants showed any signs of local or systemic allergy towards the material. Cyanoacrylates, compared to silk sutures are expensive and not readily available hence limiting the use of the adhesives.

### **Conclusion**

The results from the clinical study on isoamyl 2-cyanoacrylate shows that it is safe, rapid, painless, and easy to use for the approximation of uninfected tension free periodontal flaps after bringing the edges of the flaps close together and creating a saliva-free field. Thus, looking at these aspects isoamyl 2-cyanoacrylate can be routinely and conveniently used for closure after periodontal flap surgery as an alternative to conventional silk sutures.

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