



COMPARATIVE EVALUATION OF HEALING AFTER PERIODONTAL FLAP SURGERY USING ISOAMYL 2-CYANOACRYLATE AND SILK SUTURES: A SPLIT-MOUTH CLINICAL STUDY

Dental Science

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ABSTRACT

BACKGROUND: Isoamyl 2-cyanoacrylate is a tissue adhesive, which can be used for the closure of the incised wounds to overcome the problems associated with conventional suture materials like silk. They are well accepted owing to their properties including bacteriostatic effect, hemostatic effect, biodegradation, biocompatibility, easy manipulation and reduced surgical time.

AIM: To assess the effect of amcrylate and silk suture on wound healing and patient satisfaction following periodontal flap surgery.

METHODOLOGY: 20 periodontal flap surgeries was carried out on 10 patients. Flap approximation was done by silk suture (Group A) and cyanoacrylate adhesive (Group B) in a split mouth design. At 7th day of surgery plaque index and healing index was evaluated. Patient satisfaction was assessed by severity of pain and bleeding by visual analogue scale.

RESULTS: Cyanoacrylate group demonstrated a statistically significant lesser mean plaque score of 0.10 ± 0.00 as compared to suture group with mean score of 1.46 ± 0.73 , at $P < 0.001$ as seen by independent student t test. Cyanoacrylate group showed statistically significant VAS response for bleeding and there was better healing response in cyanoacrylate group.

CONCLUSION: This study suggested that, efficacy of cyanoacrylate & suturing in wound closure were similar in the severity of pain but use of cyanoacrylate showed better early healing, hemostasis and less plaque score.

KEYWORDS

INTRODUCTION

Precise wound approximation, reduction of patient discomfort, easy handling of the working properties of wound closure materials and low infection rates are essential to promote wound healing. Scar formation, need for dressing to protect the wound and suture, and revisit for suture removal are the disadvantages of conventional suture materials.¹ Cyanoacrylates have been found to be a good alternative to sutures in wound closure, as they carry advantages of rapid application, patient comfort, resistance to infection, hemostatic properties, and no suture removal anxiety.²

Cyanoacrylates were first recognized to have adhesive properties by Coover in 1959. Their general formula is $CNCH_2=COO-R$ where R is side chain. They belong to the family of polymers whose monomer is formed by reversible condensation of formaldehyde with a cyanoacrylate ester. These adhesives polymerize in the presence of anions especially hydroxyl ions. This indicates that it forms a firm adhesive bond on coming in contact with water or tissue moisture, by undergoing exothermic polymerization. The number of alkyl groups in the side chain of cyanoacrylate can be increased from one (methyl cyanoacrylate), to two (ethyl), to four (butyl), and to five (isoamyl) but usually not more than eight (octyl cyanoacrylate). Isoamyl-2-cyanoacrylate contains 5 carbon alkyl constituents of the carboxyl group (COO-R).

Cyanoacrylate adhesive is a compound synthesised by condensation of a cyanoacetate with formaldehyde in the presence of a catalyst. The application of an adhesive film of cyanoacrylate develops by rapid polymerization (5–60 s), triggered by hydroxyl groups on the surface to be glued. Water can act as a catalyst to activate this anionic polymerisation. Cyanoacrylate retain their adhesive qualities even in the presence of moisture and also have the added benefits of being bacteriostatic and haemostatic.⁴ When applied on tissue surface the inhibitor is eliminated and the chemical action allows the molecule to polymerize in 10 seconds. The adhesive strength depends on relation to the approximation of the molecules attraction to each other. Physical locking is also a factor by virtue of the penetration of the adhesive into irregularities of the tissue surfaces.³ Cyanoacrylates are biodegradable and their rate of removal from the application site is by polymer degradation and surface sloughing. They undergo hydrolytic attack of carbon-carbon bond to produce formaldehyde and cyanoacetate.

Hence the aim of the study was to assess the effect of amcrylate and silk suture on wound healing and patient satisfaction following periodontal flap surgery.

MATERIALS AND METHODS

The subjects were recruited from the department of Periodontics, The Oxford dental college and hospital, Bangalore. A total of 10 subjects were selected for the study based on inclusion and exclusion criteria. Chronic periodontitis patients were included in the study. Exclusion criteria were smokers, those who have known allergy to cyanoacrylate adhesive, systemic involvement and pregnant and lactating women. All the subjects were given a detailed verbal and written description of the study. They signed a written informed consent form prior to commencement of the study. Chronic periodontitis were diagnosed based on criteria of American academy of periodontology, classification of periodontal diseases (1999). 20 periodontal flap surgeries was carried out on 10 patients. Flap approximation was done by silk suture (Group A) as shown in figure 1 and cyanoacrylate adhesive (Group B) as shown in figure 2 in a split mouth design. At 7th day of surgery plaque index (Silness-Loe index) and healing index (Landry healing index) was evaluated. Patient satisfaction was assessed by severity of pain and bleeding by visual analogue scale (VAS).



Figure 1: flap approximation done with cyanoacrylate



Figure 2: flap approximation done with sutures

STATISTICAL ANALYSIS:

Statistical Package for Social Sciences [SPSS] for Windows Version 22.0 Released 2013. Armonk, NY: IBM Corp., will be used to perform statistical analyses.

Inferential Statistics:

Chi Square test was used to compare the proportional distribution of responses for healing index & visual analogue scale between the two study groups.

Independent student t test was used to compare the mean plaque index between two study groups at day 7.

The level of significance was set at P<0.05.

RESULTS

Cyanoacrylate group demonstrated a statistically significant lesser mean plaque score of 0.10 ± 0.00 as compared to suture group with mean score of 1.46 ± 0.76, at P<0.001 as seen by independent student t test and depicted in table 1 and figure 3. Cyanoacrylate group showed statistically significant VAS response for bleeding and there was better healing response in cyanoacrylate group as seen in table 2, figure 4 and figure 5.

Table 1: comparison of mean plaque index between two study groups at day 7 using independent student t test.

Comparison of Mean Plaque Index between O2 study groups at Day 7 using Independent student t test							
Group	N	Mean	SD	S.E.M	Mean Diff	t	P-Value
Suture	10	1.46	0.73	0.23	1.36	5.887	<0.001*
Cyanoacrylate	10	0.10	0.00	0.00			

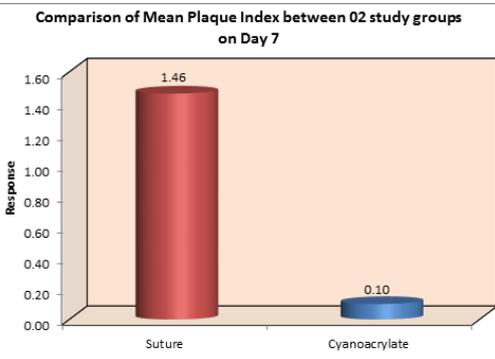


Figure 3: comparison of mean plaque index between two study groups on 7th day

Table 2: comparison of proportional distribution of responses for healing index and visual analogue scale between the two study groups using chi square test.

Comparison of proportional distribution of responses for Healing Index & Visual Analogue Scale between the O2 study groups using Chi Square test							
Parameters	Response	Suture [n=10]		Cyanoacrylate [n=10]		χ ² Value	P-Value
		n	%	n	%		
Healing Index at Day 1	Poor	1	10%	0	0%	7.200	0.07
	Good	4	40%	0	0%		
	Very Good	1	10%	4	40%		
	Excellent	4	40%	6	60%		
Healing Index at Day 7	Poor	1	10%	1	10%	0.400	0.82
	Good	2	20%	1	10%		
	Very Good	0	0%	0	0%		
	Excellent	7	70%	8	80%		
VAS Scale_Pain	No Pain	7	70%	9	90%	1.583	0.45
	Mild Pain	2	20%	1	10%		
	Moderate Pain	1	10%	0	0%		
	Severe Pain	0	0%	0	0%		
VAS Scale_Bleeding	no bleeding	5	50%	10	100%	6.667	0.01*
	mild bleeding	5	50%	0	0%		
	moderate bleed	0	0%	0	0%		
	severe bleeding	0	0%	0	0%		

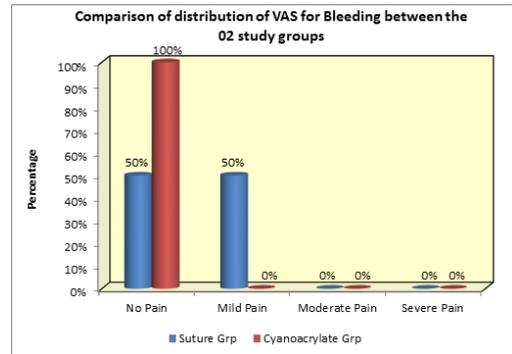


Figure 4: comparison of distribution of VAS for bleeding between the study groups.

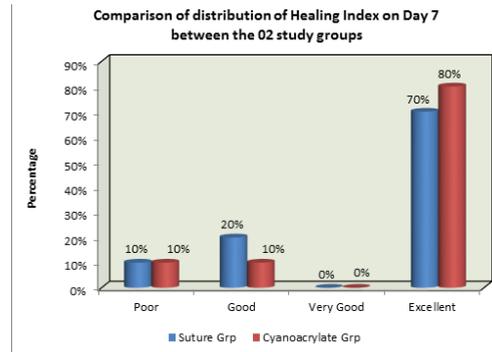


Figure 5: comparison of distribution of healing index on day 7 between the two study groups.

DISCUSSION

Cyanoacrylates include short chain (methyl and ethyl cyanoacrylates) and longer chain (butyl, isobutyl, isoamyl, and octyl cyanoacrylates) derivatives. The long chain derivatives are the least histotoxic.⁵ Some authors have reported the clinical use of cyanoacrylates with several advantages including the ease of use with shorter operative time, formation of protective barrier, and painless application. There is no risk of needle stick injury to the surgeon when using cyanoacrylate rather than suture and it greatly reduces the patient psychological stress and anxiety during suturing. The major disadvantage is reduced tensile strength (they should not be used in high tension areas). They also should be avoided over areas subject to frequent moisture and friction such as the hands and feet (unless splinted and dressed appropriately).⁶ These adhesives are contraindicated in infected wounds, immunocompromised patients, and patients with known allergy to cyanoacrylates and formaldehyde.

In the study when the plaque scores were compared between the suture and the cyanoacrylate sites, there was a significant difference found in suture group (p<0.001). The suture site was found to accumulate more plaque (1.43 ± 0.10) as compared to the cyanoacrylate site (0.10 ± 0.00). This can be attributed to the suture threads acting as a site for plaque accumulation. This finding was in conjunction with studies done by Binnie and Forrest,⁷ Giray et al.⁸

When healing response was compared, it was found that the clinically appearing redness was more on the suture site than on the cyanoacrylate site. This could be attributed to the fact that silk was present within the tissues, which might have provoked the response, according to Macht and Krizek.⁹ Levin believed that silk was treated as a foreign protein by the body, it had a tendency to fragment the wound and increased inflammatory response.¹⁰

VAS for bleeding for cyanoacrylate was superior to suture. This is in accordance with studies done by Forrest et al.¹¹ Cyanoacrylate has good bonding properties and strength to hold the tissue margins together and hence a good hemostatic agent.^{12,13} Other advantages are, in cyanoacrylate tissue adaptation is better, and healing is faster. Forrest reported that the tissue adaptation is better as it provides fixation of the flap to the whole surface, while sutures provide only marginal fixation.¹¹ Miller et al¹⁴ have shown similar findings. Isoamyl

2-cyanoacrylate is also found to be better as compared to sutures as it has advantages such as immediate hemostasis, easy application, no technical skill is required, patient acceptance, esthetically more acceptable, noninvasive, less chair side time, absence of postsurgical pain or infection, easy maintenance, and no food lodgment. Moreover, the biologic sealant is well accepted by the oral tissues and shows good acceptability with no side effects by all the subjects in the study.

CONCLUSION

This study suggested that, efficacy of cyanoacrylate & suturing in wound closure were similar in the severity of pain but use of cyanoacrylate showed better early healing, hemostasis and less plaque score.

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