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TO COMPARE AND ASSESS N-BUTYL CYANOACRYLATE GLUE AND 3-0 BLACK BRAIDED SILK SUTURE'S EFFECTS ON HEALING POST PERIODONTAL FLAP SURGERY-AN IN VIVO SPLIT MOUTH STUDY

Dental Science

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ABSTRACT

BACK GROUND: A periodontal flap is a section of gingiva, mucosa, or both that is surgically separated from the underlying tissues to provide for the visibility of and access to the bone and root surfaces. Silk is the most commonly used suture material in dentistry and many other surgical disciplines (Macht SD, Krizek TJ,1978) for approximating tissues including periodontal flap surgery. To overcome the disadvantages of silk sutures an alternative material is required to close the periodontal flaps after periodontal flap surgery. N-butyl cyanoacrylate is one of the tissue adhesive used for the closer of the periodontal flaps after surgery. **OBJECTIVES:** Objectives of this study were to clinically compare plaque index, sulcus bleeding index, probing depth, wound healing by wound healing index, sulcus bleeding index and visual analog scale (VAS) between N-butyl cyanoacrylate glue and 3-0 black braided silk on periodontal flap surgery.**MATERIAL AND MATHOD:** The present study was carried out in 15 patients and divided in to two groups: Group A control site (n=15) – the sites were treated with open flap debridement closed with 3-0 black braided silk suture material, Group B test site (n=15) – the sites were treated with N-butyl cyanoacrylate glue.**RESULTS:** This study showed statistically significant plaque reduction in both groups at 1 week, 6 weeks and 3 months compared to baseline. On comparison, Group B (cyanoacrylate) showed statistically significant plaque reduction as compare to Group A(silk sutures).There was statistically significant sulcus bleeding index in both Group A and Group B at 3 months interval. Statistically significant periodontal probing depth reduction was present in both Group A and Group B at 3 months interval. Better wound healing was observed in Group B as compared to Group A at 1 week post operatively. Less pain and discomfort was present in Group B as compared to Group A one day post operatively and after 1 week. **CONCLUSION:** N-butyl-cyanoacrylate can be easily and conveniently used for closure after treating periodontal pocket of ≥ 5 – ≤ 8 mm by periodontal flap surgery for better healing.

KEYWORDS

N-butyl Cyanoacrylate, Healing, Periodontal Flap Surgery, Suture.

INTRODUCTION:

The periodontal disease is one of the most prevalent diseases of the oral cavity. The affected tissues in periodontium, such as periodontal ligament, cementum, and alveolar bone, suffer morphological alterations and cause negative consequences to the patient's oral health. PERIODONTAL POCKET is Pathologically deepening of gingival sulcus. Several periodontal surgical techniques have been employed for the treatment of periodontal pockets. Periodontal flap surgery for periodontal reattachment, demands close postoperative adaptation for the mature, gingival connective tissue onto the prepared tooth surface for healthy dentogingival unit[1,2,3] Materials like silk, nylon, steel, catgut and polyglycolic-acid , polylactic acid derivatives are being used for closure of the flaps. Now a days different tissue adhesive materials are also used for the closure of the flap. Braided silk has a phenomenon of "wicking," making it a site for secondary infection[3]. Furthermore, it has the maximum amount of inflammatory tissue response (Postlethwaite 1974). Hence, a need for an alternative to sutures is felt. Cyanoacrylates [4] are tissue-adhesive materials that were synthesized in 1959 by Coover et al. The cyanoacrylate materials have a chemical formula H 2 C = C (CN) COOR,where R can be substituted for any alkile group ranging from methyl to decyle. N-butyl cyanoacrylate (NBC) is a biocompatible tissue adhesive and is hence used for closure of wounds. N-butyl cyanoacrylate (NBC) and its isoform iso-butyl cyanoacrylate are biocompatible tissue adhesives and have good working properties like flow and fast setting, within 5-10 s. Tissue adhesion is by valence bonding and van der Waal's force (Miller et al.1974)[6]. N-butyl cyanoacrylate (NBC) sets by polymerization in presence of moisture and even blood, with release of heat. It is also a good haemostat. N-butyl cyanoacrylate (NBC) is found to be bacteriostatic, and reduced postoperative pain has been found in sites closed with NBC. The material is degraded by breaking the C=C bond and is eliminated from the body through urine and faeces. It has good bonding properties and strength to hold the tissue margins together (McGraw and Caffesse, 1978), haemostasis(Greer)[5].

MATERIALS AND METHOD:

This clinical study was conducted at Department of Periodontology, A.M.C. Dental College and Hospital, Ahmedabad. Prior to the study, the purpose was explained to the patients. A written informed consent was obtained from subjects for participating in study.

Surgical sites were identified and divided into 2 groups:
Group A control site (n=15) – the sites were treated with open flap debridement closed with 3-0 black braided suture material
Group B test site (n=15) – the sites were treated with N-butyl cyanoacrylate glue.

The selection of the site for suture and cyanoacrylate were done as per the randomised sheet.

The surgical procedure consisted of the modified flap operation given by Kirkland. In this procedure after administration of local anaesthesia, incisions were placed intracrevicularly, through the bottom of the pocket on both the labial and lingual aspects of the interdental area. The incision was extended in a mesial and distal direction in selected sites. The periodontal flap was reflected labially/buccally and lingually/palatally to expose the diseased root surfaces. The surgical area was debrided to remove the granulation tissue and root planning was performed. The flap was trimmed to remove the pocket lining and to remove the tissue tags. Surgical site was irrigated with 0.9% normal saline. Closure of the sites were done by either of the two selected materials. The selection of the site for suture and cyanoacrylate were done randomly and entered into the randomised sheet.

SUTURE SITE:

Interdental ligation sutures were taken with 3-0 black braided silk suture material on one surgical site.

CYANOACRYLATE SITE:

The application of N-butyl cyanoacrylate was done on the other surgical site.

APPLICATION OF THE N BUTYL CYANOACRYLATE GLUE:

Ampoule was broken just before the application and a pre-sterile dropper provided with the N butyl cyanoacrylate, connected with a 23 gauge needle was loaded with the material. The material was used according to the technique described by De BonoR (1997)", The cyanoacrylate was placed in drop wise manner on the flap margins, which were held in place with a blunt instrument. While placing the drops of cyanoacrylate on the margin of the flaps care must taken that it remains only on external surface of the flap. By firm and gentle pressure seepage of the material between tooth and flap margins was minimised. The application was done till a thin film of cyanoacrylate was formed.

Once the flaps were closed, no external pressure was placed so as to avoid interference with the test material.

Image-1 3-0 Black Braided Silk Suture

Image-2 N-butyl Cyanoacrylate Glue

Image-3 Crevicular Incision (control Site)

Image-4 Crevicular Incision (test Site)

Image-5 Reflection Of The Flap

Image-6 Reflection Of The Flap

Image-7 Debridement

Image-8 Debridement

Image-9 Suturing Of The Flap

Image-10 N Butyl Cyanoacrylate Glue Application

Image-11 Probing Pocket Depth After 3 Months

Image-12 Probing Pocket Depth After 3 Months

CLINICAL PARAMETERS :

Clinical parameters assessed were Plaque Index (PI), Sulcus Bleeding Index (SBI),Early wound healing index (WHI),periodontal pocket depth(PPD),visual analog scale for pain and discomfort(VAS)

RESULTS:

There was statistically significant mean PI reduction in both groups. Mean PI reduction in control site from baseline (2.66±0.23) to 1 week(1.71± 0.26), 6 week (1.00±0.00), 3 months(1.00±0.00) respectively. While for test site mean PI reduction from baseline (2.72±0.24) to 1 week (1.07±0.22), 6 weeks(1.00±0.00), 3 months(1.00±0.00). However, on comparison by Independent t test, there was statistical significant difference at 1 week, but on 6 weeks and 3 months, there was no significant mean PI reduction on test site as compared to control site (p value < 0.05, S).

There was significant mean reduction in SBI at 3 months in both the groups. Mean reduction in SBI from baseline (3.40±0.15) to (0.07±0.15) at control site while at test site from baseline(3.35±0.16) to (0.02±0.06) at 3 months. However, on intergroup comparisons by independent t test, there was no significant change found at all time intervals. (p value > 0.05, NS).

There was statistically significant PD reduction in both groups. Mean PD reduction in control site from baseline(5.70±0.26) to (2.45± 0.32) and test site from baseline (5.71±0.28) to (2.47±0.33) at 3 months. However, on comparison by Independent t test, there was no statistical significant difference at 3 months, (p value > 0.05,NS).

Better healing evaluated by early wound healing index can be seen on test side as compared to control site and the results are statistically significant (P value <0.05,s).

Reduced post-operative pain and discomfort on test side as compared to control site.(P value < 0.05).

DISCUSSION:

Silk is the most commonly used suture material in dentistry and many other surgical disciplines(Macht SD, Krizek TJ,1978) for approximating tissues including periodontal flap surgery. It is a natural, braided, multifilament, non-resorbable suture material. It has good handling characteristics and is relatively inexpensive compared with other nonresorbable suture materials [7]However there are distinct disadvantage while using silk sutures. First it is a non-resorbable suture material and thus must be removed usually a week or so following surgery. Second ,the conventional braided silk suture material has a tendency of "wicking" making it as site of potential secondary infection[8] Complications like fistulation and granuloma formation, which is supposed to result mainly because of incompatibility of suture materials, moreover, these suture materials have a spectrum of drawbacks such as cutting through the parenchymal and inflammatory tissues during suturing, exhibition of capillary action by braided or twisted black suture materials etc, leading to increased risk of wound infection, apart from these, the manipulation of tissue margins using these suture materials demand a high level of clinical judgement ,dexterity, time and patience from surgeon and exact control over the force application on the suture to avoid excess/inadequate tension in the sutures. Tearing of the wound margins/necrosis in case of excess forces or else, slackness in suture resulting in gaping between the wound margins resulting in incomplete healing or reinfection/scarring. More over the emergence of diseases like AIDS, Hepatitis etc. which carry high risk of transmission through needle prick also apprehends the operators in executing this process[9].

Owing to such disadvantages, the need for alternative procedure and materials has led to the discovery and development of tissue adhesives,(i.e. cyanoacrylate, firm glue) staples, adhesive tapes, etc. Fibrin adhesive system (fibrin glue) is topical adhesive solution that contains concentrated human fibrinogen and bovine thrombin is main constituents. Risk of allergic anaphylactic reaction to bovine thrombin is associated with fibrin sealant[10]and risk of transmission of blood borne disease. High cost also remains for the limiting factor for its regular use. Tissue adhesives have become popular because of their perceived ease of placement.

Among the generations of cyanoacrylates the earlier generations of cyanoacrylates (ethyl 2-cyanoacrylate and methyl 2-cyanoacrylate) carried with them the disadvantage of local histotoxicity which was attributed to the by-product of the polymer degradation. The alkyl side chain (R) determines the rate of degradation rate of polymerization (with release of heat in the process), toxicity, flexibility and the properties of the adhesive. The first generation cyanoacrylates which were mainly Methyl Ethyl derivatives were short chained which would degrade at a faster rate, releasing formaldehyde, resulting in significant tissue toxicity. According to Papatheofanis FJ. (1989)[11], adhesives generate lipid hydroperoxides that activate prostaglandins and thromboxane biosynthesis, and participated in membranal oxidation and lysis.

Cyanoacrylates have been evolved and developed as alternative to overcome these problems. Favourable qualities like strong bonding in the presence of moisture, workable polymerization time, bacteriostatic ability, good haemostatic property, which enhances the healing of the tissues[12]. Longer alkyl chains (i.e. Higher homologues such as N-butyl-2-cyanoacrylate and 2-octyl cyanoacrylate) polymerize slowly, they form flexible polymer and they degrade slowly to form fewer toxic degradation products [13]. The extent of cell growth inhibition by the cyanoacrylate microspheres decreases with the increasing molecular weight (Yin-Chao at al.1990). In dentistry application of N Butyl cyanoacrylate (NBCA) and Octyl cyanoacrylate are commonly used. The N butyl cyanoacrylate is a biocompatible tissue adhesive. It has good working properties like fast setting time within 5-10 seconds. Tissue adhesion is by valence bonding and van der Waals forces.[14] It sets by polymerization in presence of moisture and even blood, with release of heat. It has good haemostatic property, good bonding properties with bond strength to hold the tissue margins together[15] They are bacteriostatic and their use is usually painless. Butyl esters provide stronger bond and are rigid[16] N-butyl cyanoacrylate (NBCA) has properties of excellent tensile strength, hence, very effective in closing surgical or wound incisions[16]. So in present study we have used N-butyl cyanoacrylate as a material of choice among all the available materials.

CONCLUSION:

With the limitations of the present study, only 30 sites with 3 months of clinical follow ups, it can be concluded that N-butyl-cyanoacrylate can be easily and conveniently used for closure after treating periodontal pocket of $\geq 5 - \leq 8$ mm by periodontal flap surgery for better healing. It can be suggested that future long-term studies with a large sample size should be carried out to further explore the role of cyanoacrylate in the management of periodontal flap surgery and to verify the results of in vitro studies in a clinical study. Further, histological studies are needed to establish the exact nature of healing.

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