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Comparative evaluation of healing after periodontal flap surgery using EPIGLUE and silk suture: A split-mouth clinical study

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Abstract
Sutures are used for wound approximation following periodontal flap surgery; however, sutures have a number of drawbacks, including increased postoperative discomfort, a higher infection rate, and trouble controlling plaque. The hunt for alternatives and even a suture-less method has proceeded in order to address these issues. Tissue adhesive cyanoacrylate can be used to close raised flaps and avoid the drawbacks of using traditional suture materials like silk. This study compared the healing outcomes of silk sutures with N-butyl-2 cyanoacrylate sutures following periodontal flap surgery.

Keywords: Conventional flap surgery, cyanoacrylate, sutures, tissue healing, Epiglue

Introduction
A persistent inflammatory illness called periodontitis can cause the periodontal attachment apparatus to be destroyed and even result in tooth loss [1].
The primary objective of periodontal therapy is to halt the disease's harmful progression. Reducing PPD, maintaining or improving clinical attachment level (CAL), and resolving periodontal inflammation are the goals of treatment in order to preserve periodontal health. It has been proposed that residual pockets of 5 mm or greater are a definite sign that surgery is necessary [2].
Close postoperative adaptation of the mature gingival connective tissue onto the prepared tooth surface is required for flap surgery for periodontal reattachment [3].
Sutures are used for wound approximation following periodontal flap surgery; however, sutures have a number of drawbacks, including increased postoperative discomfort, a higher infection rate, and trouble controlling plaque [4].
Numerous bacterial species normally populate the oral cavity, and infections by bacteria are more common in the oral tissues. Because of the suture thread's capillarity, the suture material is seen as a foreign body that raises the danger of microbial penetration into the wound margins [5].
To overcome this, tissue adhesives, as an alternative were first introduced by Ardis in 1949 [6]. In 1959, Coover *et al*. discovered the adhesive properties of cyanoacrylate and proposed their application in surgical procedures [7].
They are produced when formaldehyde and cyanoacrylate mix. Cyanoacrylates are liquid monomers with a viscosity and appearance akin to water. It releases heat and quickly polymerizes when it comes into contact with water. The length of the alkyl chain affects the rate at which it hydrolyzes and breaks down [8].
Longer alkyl chain derivative N-Butyl-2-Cynoacrylate accelerates polymerization while promoting a reduced initial inflammatory response. When comparing N-Butyl-2-Cynoacrylate versus sutures for cutaneous wound closure, there is little to no change in histology and a reduced inflammatory response [9, 10]. When cyanoacrylate comes into touch with even a trace amount of the usual atmospheric moisture content, it immediately polymerizes and loses its effectiveness.

For both manufacturers and physicians, the cyanoacrylate tissue adhesive's vulnerability to ambient moisture has proven to be an unsolvable challenge.
The issues with handling cyanoacrylate throughout transportation, handling, and final consumption are resolved by EPIGLUE's unique micro delivery system packaging.

Advantages
The precise amount of cyanoacrylate needed to close the wound is helped by micro distribution at the site of the wound. When using EPIGLUE, accidental overapplication is minimized, resulting in faster healing and less tissue damage from the heat of polymerization. The Micro Delivery method offers the ability to apply tissue adhesive to cuts and incisions as well as difficult-to-reach areas. Because of the moisture in the air, the crushable ampoule system prevents the product from hardening. This ensures that the product will stay liquid at the moment of application, making it effective and active. A fantastic convenience for physicians, who now hold a top-notch product in their hands. The solution is applied with a soft polymer microtip, which lessens the possibility of unintentional injury during the application process.

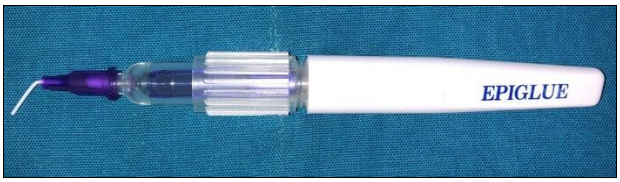

Fig 1: Epiglue new packaging system.

Patented micro delivery system
When using cyanoacrylate that is packaged in a plastic ampoule, there have been issues with applying it to the wound site. Using a syringe, extract the product from the container, and then press the plunger to release drips of cyanoacrylate along the skin's two edges. The innovative micro delivery technology of EPIGLUE is integrated into the packaging. The glass ampoule within is smashed when two figures are firmly pressed against the plastic jacket, releasing butyl cyanoacrylate into the plastic container. A built-in filter in the plastic container prevents glass particle waste. The substance is released as tiny drips through the needle. Applying the necessary pressure on the plastic jacket between the two fingers makes controlling the flow simple.

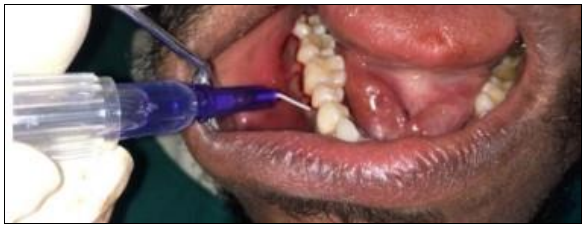

Fig 2: Patented micro delivery system

Long term stability
It has been reported that some products undergo polymerization within a few months of becoming bad, rendering them ineffective. Additionally, it has been noted that certain packages solidify a few days after leaving the manufacturing facility and being shipped to the distributors. In terms of temperature, dust, and moisture, epiglue is stable. Even at room temperature, the active ingredient—monomer form of n-butyl-2-cyanooacrylate—remains a transparent blue liquid. Cyanoacrylate is filled into a crushable glass ampoule that is hermetically sealed, providing much-needed stability. Even when stored at room temperature, the substance stays liquid for an extended period of time because the glass walls are impervious to moisture. In addition to providing the gadget with mechanical strength, the polymer sheath jacket serves as a mechanism for handling and utilizing the product.

Fig 3: Stability over the long run and a fresh packing method.

Suggested indications
ENT surgery: Tympanic perforations
Dental surgery: Dental implants, Periodontal surgery, Gingivetomy, extracting sites.
General surgery: Laparotomy, Hernia,
Appendicitis Plastic surgery: Cleft lip, Excision of scars, Skin graft
Gynaecology: Episiotomy, Cesarean Section, Tubectomy
Orthopaedic: Tendon repair, bone graft, Cartilage binding Surgical
Oncolgy: Thyroid & Breast Malignancy surgery
Pediatric: Lacerations, Hernia, Cleft palate, Cleft lip

Materials and Methods
Aim
The purpose of this study was to assess the healing process following periodontal flap surgery with silk sutures and N-butyl-2-cyanoacrylate (bio adhesive material).

Study population
10 patients who need flap surgical procedure for periodontal pocket therapy, with probing pocket depth more than 5mm were selected from the outpatient section, Department of Periodontics, College of Dental Sciences, Davangere, Karnataka and were divided into 2 groups
Five patients were taken for spilt mouth design.
- Group -A: - 10 sites –flap closure with silk suture
- Group -B: - 10 sites–flap closure with Epiglue

Informed written consent was obtained from all the subjects. The protocol was approved by the institutional review committee for human subjects, and the study was conducted in accordance with the Helsinki Declaration of 1975, as revised in 2013.

Exclusion criteria
- Patients having any known systemic diseases and/or drug therapy which may interfere with wound healing, drug allergies to any of medications used in the study,
- Habit of smoking, tobacco chewing, or any other habit that might influence the disease or the treatment and pregnant or lactating mother were excluded from this study.

Treatment procedure
Every patient received phase 1 therapy and advice on dental hygiene. Subjects were contacted four weeks after phase 1 therapy ended to take baseline measurements, and those whose inflammation had decreased were scheduled for

surgery.

Prior to the surgical operation on the day of the procedure, a brief case history was taken, which included specific clinical data such the periodontal probing depth, the Sulcus bleeding index (Muhlemann and Sons), and the Plaque index (Turesky–Gilmore–Glickman version of the Quigley–Hein index).

The Early Healing Index (Watchtel *et al*.) was evaluated after one week following surgery, the Sulcus Bleeding Index and Periodontal Probing Depth were evaluated once more six weeks and three months following surgery, and the Plaque Index at one week postsurgery.

A standard local anesthetic mixture of 2% lignocaine and 1:80,000 epinephrine was used for the surgical operation, and a sulcular incision was made in each tooth. The buccal and lingual/palatal portions of the teeth were elevated using the traditional nondisplaced mucoperiosteal flap. By eliminating local irritants and unhealthy granulation tissue, a thorough debridement was carried out. The flap was relocated and shortened following debridement in order to achieve maximal interproximal closure.

The surgical area to be treated was randomly selected into two areas as Group A and Group B.

Group A: Sites where flap was secured with sutures (3-0 silk) after surgery.

Group B: Sites where flap was secured with Epiglue (N-butyl-2 cyanoacrylate) after surgery.

N-butyl-2 Dropwise application of cyanoacrylate was applied to the flap borders, which were secured in place. A thin layer of cyanoacrylate was applied and allowed to solidify. Periodontal packs were not positioned. Postsurgical instructions were given. Sutures were removed after 1 week

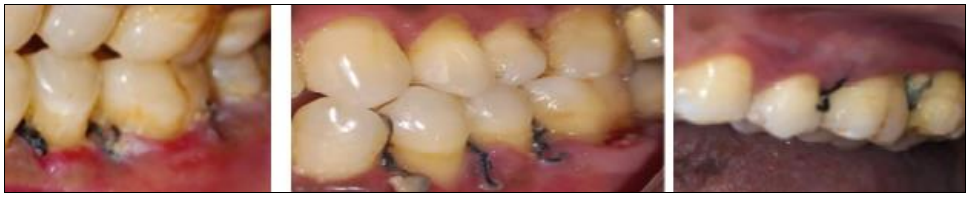

Fig 4: 1 week post operative with silk suture (Group 1)

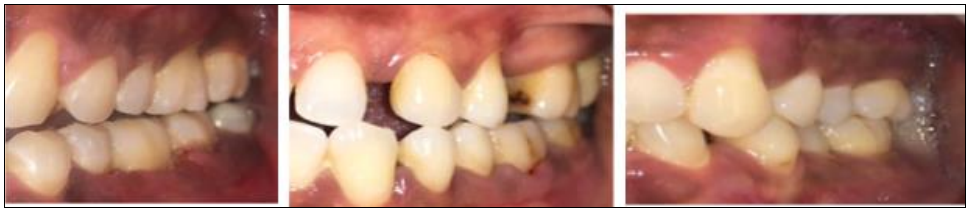

Fig 5: 1week post-operative with epiglue (Group 2)

Statistical analysis

The statistical analysis was performed using *t*-test.

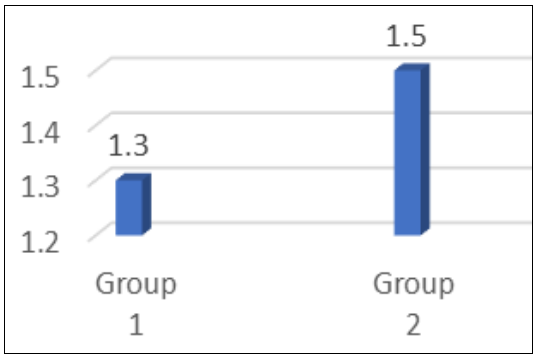

Fig 6: The comparison between group 1 and group 2 of early healing index at 1 week

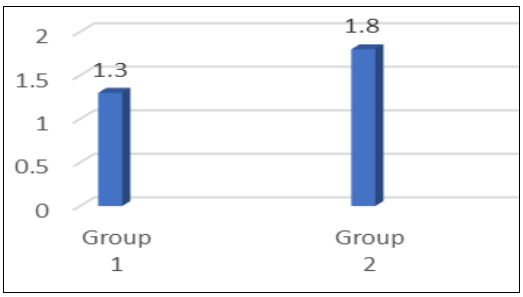

Fig 6: The comparison of percentage in plaque index between two group

Result

When comparing Group B to Group A, there was a relative improvement in the plaque index and early healing index. Our study's findings demonstrated that, in comparison to the sutured location, the site where n-butyl-2-cyanoacrylate was administered healed more well after one week.

Discussion

In 1974, Binnie and Forrest a histological comparison between silk sutures and butyl cyanoacrylates, which were employed to immobilize periodontal flaps. The outcomes showed that butyl-cyanoacrylate improved gingival shape and reduced edema and swelling [11]. Rezende *et al*. [12] in 2015 described a case that demonstrated aesthetic outcomes four years following the treatment and involved employing cyanoacrylate adhesive to fix a resorbable membrane to the recipient's bone in a vertical defect to allow directed tissue regeneration.

Joshi *et al*. [13] 2011 examined the use of sutures and an isoamyl cyanoacrylate glue to close wounds in 30 patients following third-molar disimpaction procedures. When using cyanoacrylate adhesive instead of sutures, there was a noticeable reduction in bleeding and pain during the first three days following surgery. In comparison to sutures, the authors found that cyanoacrylate adhesive causes less tissue manipulation and irritation. Forrest *et al*. [14] Tissue adaptation is better than sutures, according to a clinical trial, since it secures the flap to the entire surface, while sutures only offer a peripheral attachment. Padhye and Pol said that cyanoacrylate offered an additional benefit in terms of time

and technique, reducing the two-step suturing and dressing process to only one step of material application [15].

Our study's findings make it evident that, as compared to the sutured location, the site where Epiglue was administered had improved Healing and Plaque indices after one week. Similar to sutures, Epiglue is also found to be superior due to its many benefits, including immediate hemostasis, ease of application, lack of technical skill requirement, patient acceptance, improved aesthetics, noninvasiveness, reduced chair-side time, lack of postoperative pain or infection, ease of maintenance, and lack of food impaction. Furthermore, all trial participants reported good tolerance of the biologic sealant with no adverse effects, and it was well-received by the oral tissues.

Conclusion

Since tissue glue has been shown to be hemostatic in nature, effective in reducing post-operative discomfort, and not necessitate repeat visits for suture removal, Epiglue is the greatest substitute for wound closures in small oral surgical operations.

Conflict of Interest

Not available

Financial Support

Not available

Reference

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