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ADVANTAGES AND DISADVANTAGES OF USING SUTURES VS CYANOACRYLATES FOR MINOR SUPERFICIAL LACERATED WOUNDS IN HEALTHY PAEDIATRIC AGE GROUPS

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Abstract
Aim: This study aims to examine the advantages and disadvantages of using sutures vs cyanoacrylates (surgical glue) for minor superficial lacerated wounds in healthy paediatric age groups. **Methods:** Participants of this research fall in the age group of 1 to 16 years. There was no chronic medical condition present in the patients. All the participants had had superficial regular clean forehead (including eyebrows) wounds less than 3 cm. All suturing procedures were performed under subcutaneous local anaesthesia. Proline suture 5-0 was used to suture the wound. Wound closure with surgical adhesive (cyanoacrylates) was completed without any anaesthesia. **Results:** A total of 48 patients were part of this study. Feedback by the patients illustrated that all patients who had the procedure of suturing felt the pain during the procedure while among the group treated with surgical glue, some patients reported the feeling of pain or a burning sensation. Infection signs were most evident in the suture-treated group. Wound healing and scar formation periods were slightly higher with suture application when compared with the usage of surgical glue on wounds. Overall, most of the patients were satisfied and comfortable with treatment by the application of surgical glue (cyanoacrylates). **Conclusion:** Tissue adhesives are gaining popularity day by day, and currently, critical evaluation of these adhesives is imperative to evaluate their advantages, disadvantages and effectiveness in comparison with present materials and methods.
Keywords: *Tissue adhesives, surgical glue, cyanoacrylate, suture, paediatric patients*

Introduction

Wound healing is an essential physiological phenomenon in the body and is performed by several cell types and their products (1). At the very early stage, the body tries to restore the lesion by local aggression in the form of inflammation. Finally, the body repairs the wound by replacing particular structures through regeneration and collagen deposition, which is comparable to the phenomenon of proliferation and subsequent differentiation of previously present stem cells or cells in the tissue (2). Depending upon the cell types injured, repair and regeneration can occur in the same tissue after a lesion, implying that these mechanisms do not mutually interfere or terminate themselves (3).

Tissue repair and regeneration phenomena occur after the lesion's initiation, whether due to a particular pathological condition or because of trauma. A wound is developed by the numerous stimuli that interrupt the integrity of the functional tissue. Stimuli are of diverse types; for example, they can be chemical, electric, physical or thermal, as well as internal or external. Furthermore, the lesion can destroy particular organelles or intact cells (3).

After an injury, growth factors cause cell proliferation to repair the tissue. Hence it is a collection of vigorous variations that involve blood cells, solvable mediators, parenchymal cell proliferation and development of extracellular milieu. Cutaneous wound healing exhibits the basic principles of healing and repair used in the majority of the tissues (4).

Biochemical and cellular episodes in the wound healing can be categorised into distinct phases. These start with the inflammatory stage, followed by cell proliferation and the production of certain elements utilised for the formation of the extracellular matrix; finally, there is the remodelling of the repaired tissue (5). These stages do not mutually exclude themselves but rather overlap over time (4).

Appropriate surgical wound closure is the prerequisite of healing by primary intention requiring close approximation of wound edges using a suitable procedure. Due to reasons such as inappropriate evaluation of the wound, traumatic or faulty surgery or inappropriate post-operative care, many complications can hinder the healing process (6).

Generally, wounds face a challenge in the form of infection or reinfection during healing, and it is especially true in the

case of superficial exposed wounds where many microbes present in environment attack the wound surface (7).

A well-planned surgery requires adequate immobilisation of the healing site, which the surgeon can attain by using the appropriate wound closing method along with suitable material such as tissue adhesives or sutures (8).

Usage of surgical sutures dates back to ancient times, and varied materials such as hairs from the human body to (currently) silk have been tried to attain hassle-free wound closure. Despite the use of sophisticated suturing techniques and materials, sometimes closure of the wound is unsatisfactory and can have complications such as granuloma formation and fistulation due to inadequate suturing material. Furthermore, the drawbacks associated with these materials include capillary action in the twisted or braided suture and cutting through the inflammatory and parenchymal tissues while suturing. Such issues can enhance the risk of infection (8).

Additionally, the possibility of delayed or early resorption, in the case of absorbable suture, can lead to wound reinfection or wound dehiscence. The need to remove the suture in the case of non-absorbable material exerts further inconvenience to the patient (9).

Surgical expertise, such as exact control over the application of force on the suture and the highest clinical judgment, is required to manipulate the margin of tissues with suture materials. Moreover, lethal contagious diseases such as hepatitis and AIDS are a constant risk for infection transmission via needle prick. Such issues have introduced easier methods of wound closure such as tissue adhesives which minimise the effort, tissue tears and risk associated with needle prick (9).

Tissue adhesives are gaining popularity day by day, and currently, critical evaluation of these adhesives is vital to evaluate their advantages, disadvantages and effectiveness in comparison with present materials and methods.

Cyanoacrylate possesses most of the properties necessary for tissue adhesives. These tissue properties were discovered in 1959 (10). Its benefits include immediate haemostasis, rapid adhesion to soft and hard tissues and bacteriostasis. In surgical applications, cyanoacrylates have been used to repair incisions, lacerations, mucosal grafts, vessels, skin and other organs (11). In contrast with methyl and ethyl cyanoacrylates, isobutyl and butyl cyanoacrylates are non-toxic and non-carcinogenic for the body.

This study aims to examine the advantages and disadvantages of using sutures vs cyanoacrylates (surgical glue) for minor superficial lacerated wounds in healthy paediatric age groups.

Methodology:

This study was conducted at Yobe State University Teaching Hospital (YSUTH), Damaturu, Yobe State, Nigeria from February to August 2020.

In the eligibility criteria, participants of this research fall in the age group of 1 to 16 years. There was no chronic medical condition present in the patients. All the participants had had superficial regular clean forehead (including eyebrows) wounds less than 3 cm. There was no or minimal bleeding in the wounds.

Forty-eight patients took part in this study. Patients were categorised as male or female. The study used three age groups, i.e., toddler, preschool and school-age (ages 1 to 3, 3 to 6 and 6 to 16 years, respectively). Surgeons followed strict aseptic conditions while performing wound closure procedures. All suturing procedures were performed under subcutaneous local anaesthesia. Proline suture 5-0 was used to suture the wound. Wound closure with surgical adhesive (cyanoacrylates) was performed without any anaesthesia.

Ethical Considerations

Prior approval by the research ethics committee of the university was obtained to conduct this study. Participants (or their guardians) took part in this study as volunteers, and all participants signed written informed consent. The data were obtained and analysed anonymously, and all the collected information was kept secure and confidential.

Results:

A total of 48 patients were part of this study. Among them, about 60 per cent (29 patients) were male, and about 40 per cent (19 patients) were female. Three age groups were formed; that is, toddler, preschool and school-age (1 to 3, 3 to 6 and 6 to 16 years, respectively). Results showed that approximately 48 per cent of participants were 1 to 3 years old (toddlers), about 33 per cent were between 3 and 6 years (preschool) and 19 per cent were 6 to 16 years old (school age).

In our research, about 46 per cent of participants were treated by suturing with Proline, and the remaining 54 per cent had the application of surgical glue (cyanoacrylates) to the wound as a tissue adhesive.

Patient feedback showed that all patients who had their wounds sutured felt pain during the procedure while among the group treated with surgical glue, only 35 per cent of patients reported pain or a burning sensation upon the application of cyanoacrylate.

Approximately 15 per cent of the patients in the group treated with surgical glue showed signs of infection on day 3 post-application, which is less than with the suture-treated group (in which 18 per cent of patients had infection signs by day 3). Similarly, on day 7 and day 14 post-treatment, no one had infection signs and symptoms in the surgically treated group, whereas about 5 per cent of the patients treated with suture exhibited signs of infection on day 7 post-treatment.

Wound dehiscence was most frequent in the surgical-glue-treated group, which shows a mild disadvantage of surgical glue over suture application. However, on day 14 post-

treatment, there was no wound dehiscence in any patient. About 23 per cent of patients in the surgical-glue-treated group showed wound dehiscence on day 3 after treatment, which later fell to only 8 per cent of patients on day 7 post-treatment. In the patient group having suture application, only about 1 per cent had wound dehiscence on day 3 after the procedure.

Our data suggest that the wound healing and scar formation period was slightly high with suture application when compared with the usage of surgical glue on wounds. About 86 per cent of patients in the suture group showed scar formation on day 3 after suture, while on day 7 and day 14 post-procedure wound healing was evident in all the participants of this group. In contrast, about 73 per cent of patients in the group treated with surgical glue showed wound healing and scar formation on day 3 after the procedure, and approximately 92 per cent of the group members were healed at day 7 after application. On day 14 post-treatment, all group members having the application of surgical glue were healed and showed scar formation. These results showed that on day 14 post-treatment, there was no difference between these treatments and all participants showed signs of healing (i.e., scar formation).

In terms of the satisfaction of the participants, patients belonging to the surgical-glue-treated group were more satisfied with treatment than the suture-treated group. The degree of satisfaction was measured at three levels; that is, not satisfied, satisfied and very satisfied. In the surgical-glue-treated group, more participants (about 58 per cent) showed a higher level of satisfaction than the suture-treated group, of whom only about 41 per cent reported they were very satisfied. About 27 per cent of patients in the suture-treated group stated that they were not satisfied with the application of suture while only about 19 per cent of patients in the surgical-glue-treated group identified themselves as not satisfied. Overall, most of the patients were satisfied and comfortable with treatment by the application of surgical glue (cyanoacrylates).

Discussion:

Appropriate wound isolation and approximation of wound edges can enhance the healing process after wound closure. Sometimes, contamination of a wound occurs during the post-operative period, which delays the process of epithelialisation and granulation. All these issues lead to the failure of surgery and cause discomfort and pain.

Clinical evaluation of our research showed that the wound healing and scar formation period was slightly longer with suture application when compared with the usage of surgical glue (cyanoacrylates) on wounds. This scarring can be due to trauma and irritation caused by the suture material. Furthermore, coagulation of blood in the braided suture can also act as a source of contamination, whereas margin adhesion with surgical glue leaves no space. Hence, isolation of wound edges from blood coagulation is an extra benefit with the usage of surgical glue. Previously an antimicrobial effect has also been reported for cyanoacrylates (12, 13). It produces a bacteriostatic effect against gram-positive bacteria (13, 14).

The suturing process always remained painful even with mild anaesthesia. In our study, all patients reported it as painful, and our results are in accord with previous literature where surgical suture was constructed with a polymeric drug-delivery layer for persistent, local pain relief (15). Our data show that a small number of patients felt a burning sensation upon the application of surgical glue; previous literature also reported the mild burning effect of cyanoacrylates (16). This effect can be due to the hypersensitivity of some patients towards cyanoacrylates.

In terms of the satisfaction of the participants, patients belonging to the surgical-glue-treated group were more satisfied with treatment than the suture-treated group. Overall, most of the patients were satisfied and comfortable while being treated with surgical glue (cyanoacrylates). As suggested before (17), most of the tissue adhesive can serve to boost the satisfaction level in patients.

Conclusion:

Tissue adhesives are gaining popularity day by day, and currently, critical evaluation of these adhesives is needed in order to evaluate their advantages, disadvantage and effectiveness in comparison with more traditional materials and methods.

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