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Methods of Wound Management in Dentistry: An Insight into Wound Closure -A Literature Review

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ABSTRACT:

Introduction : Wound management is an important aspect of surgery. Wounds ranging from tiny and simple incisions or longer and deeper incisions are treated by the professionals. Wound closure techniques have progressed substantially, and now include anything from basic sutures to sticky compounds.

Aim: The aim of this review is to provide an insight for various materials available for wound closure and comparison of the newer materials to the ones which have been tested over time.

Conclusion: To conclude there have been various studies on sutures as it has been present since the time immemorial and has been tested over time for its strength and other properties whereas other materials such as cyanoacrylates are comparatively new to dentistry and are under constant research.

KEY WORDS: Primary intention; Secondary intention; Cyanoacrylate; Suture.

INTRODUCTION

Wound management is an important aspect of surgery [1,2]. Wounds ranging from tiny and simple incisions or longer and deeper incisions are treated by the professionals. Wound closure techniques have progressed substantially, and now include anything from basic sutures to sticky compounds. Primary Intention, Secondary Intention, and Tertiary Intention are the three types of wound closure strategies to consider [3,4]. Sutures [5], staples [6], sticky strips of tape, or surgical glue [7] can be used to close a wound \properly with Primary Intention when it is a full thickness flap. Such wound closure could result in a low risk of infection, as well as a low chance of wound edges separating (dehiscing) due to tension on the incision line [8]. The goals of wound management are to avoid infection, achieve hemostasis, and provide a better cosmetic outcome [6].

TYPES OF WOUND HEALING

1.Healing by Primary Intention

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It is stated that tissues that are approximated by surgical sutures or tapes heal by primary union, or by first intention, with the least amount of tissue loss. Such injuries heal with a tidy, little scar [9]. It is safe to do primary closure on wounds other than head and neck wounds up to 19 hours following the wound. As long as an infection is not already present, wounds on the face and scalp can often be closed whenever they are discovered [9]. Neutrophils start to develop at the incision margins and move toward the fibrin clot within 24 hours.In 24-48 hours, the epidermal continuity is restored. On day 3, macrophages predominantly take the place of neutrophils. On day 5, granulation tissue has filled the incisional space and neovascularization is at its peak. Fibroblasts continue to multiply and accumulate throughout the second week. At the end of the first month, the scar is covered by an intact epidermis and is made up of cellular connective tissue free of inflammation.

2.Healing by Secondary Intention

When there is more extensive loss of cells, or surface wounds that create large defects, the reparative process is more complicated. Granulation tissue grows in from the margins to complete the repair. These wounds heal with an ugly scar [9]. This is referred to as healing by secondary intention. It differs from primary healing in several respects, i.e. in secondary healing:

- Inflammatory reactions are more intense.
- Much larger amounts of granulation tissue are formed.
- Wound contraction is much more.

3.Healing by Tertiary Intention

After 4-6 days, secondary healing (the third intention) follows primary wound healing. When the secondary intention process is purposefully stopped and the wound is mechanically closed, this happens. Usually, this happens after the granulation tissue has developed.

COMPLICATIONS IN WOUND HEALING

Three main categories—delayed or non-healing, inadequate healing, and uncontrolled healing—can be used to group wound healing issues.

The first condition is a persistent wound that refuses to heal, which may be caused by a disruption in the body's regular physiological repair mechanisms. It may be caused by an abnormally prolonged inflammatory phase without progressing to the proliferative phase, which is frequently observed in wounds like infected wounds or lower extremity venous ulcers. The failure of neovascularization, epithelization, or even an interruption in wound contraction may also be to blame.

The second broad complication may be caused by an improper inflammatory phase, which results in poor proliferation and inadequate collagenization, or inadequate polymerization, collagen cross-linking, defective collagen synthesis due to genetic predisposition, or even in some metabolic states or drug use, which are frequently observed in patients receiving steroid therapy and in patients with uncontrolled diabetes mellitus. It might also result from a poor proliferative phase that stops maturation, as in the case of a venous ulcer, as a result of localised nutritional imbalance, a lack of oxygen for healing, and edema. The wound is prone to recurrence and easy breakdown.

The third category includes uncontrolled collagenization, which can result in keloids, hypertrophic scars, and severe scarring.

METHODS OF WOUND MANAGEMENT

1. SUTURES

Sutures are the gold standard for initial wound closure [6].Sutures are divided into two categories: absorbable and non-absorbable. Non-absorbable sutures are favoured because they have a high tensile strength and are not dissolved by the

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body's chemicals throughout the healing process [10]. Non-absorbable sutures are used to close superficial wounds, but absorbable sutures can be used to close deeper wounds in a multiple layer closure [11,12]. Absorbable sutures help to minimise stress and better approximate wound boundaries.This will reduce the danger of wound dehiscence and produce a more aesthetically pleasing result [11]. Synthetic sutures have a tendency to retain their "memory." That is, they tend to keep the shape of the packaging. This could make manipulating the suture during wound closure more challenging [13].

Many different materials, some of which are still in use today, have been employed as suture materials throughout history, including gold, silver, iron, and steel wires, dried animal intestines, animal hair (for example, horse hair), silk, tree bark, and plant fibres (for example, linen, and cotton). Different synthetic biomaterials, including polydioxanone and poly (lactic-co-glycolic acid), have been used as suture materials recently[14].

In an effort to personalise and enhance the functional outcome of sutures, there has been a recent increase in the development of innovative sutures with extra features, such as those modified with antibacterial agents, bioactive molecules including DNA, medicines, antibodies, proteins, and silver[14].

2. CYANOACRYLATE

Tissue adhesives are a relatively new addition to clinical practice [15]. They are especially useful because they're rapid and painless [16]. Skin [17,18], breast [19,20], cardiac [21], gastrointestinal [19,20], head and neck [22], hepatic [23], neurological [24], orthopaedic [25], paediatric [26], thoracic ([26]), bone [27], dental [22], and vascular surgery [28] are all common applications for tissue glues. They generate less wound inflammation than sutures, have a reduced infection rate, and are simple to remove [29]. These tissue adhesives' principal adhesion methods include molecular bonding, mechanical coupling, and thermodynamic adhesion. The most widely accepted theory is molecular bonding. In a nutshell, hydrogen bonding, capillary forces, van der Waals forces, static electric force, and covalent bonds generate interatomic and/or intermolecular forces between the molecules at the tissue's surface and the molecules of adhesive [16,30,31].

TYPES OF CYANOACRYLATES

Different acrylate monomers, such as methyl, ethyl, butyl, and isopropyl, can be used to create cyanoacrylate adhesive. These molecules are diverse sizes, and as a result, the physical characteristics of the adhesives they produce vary. The smallest molecule, methyl, appears to function best on rubber and metal parts whereas ethyl tends to work best on plastic ones. The monomers can be altered or improved in many ways to change or enhance their characteristics as adhesives. As surface conditions have a tendency to stabilise the adhesive and delay the cure, they can be hardened with rubber or manufactured to have low odour, resilience to thermal cycling, or decreased susceptibility to those circumstances[32].

When applied topically, butyl and octyl cyanoacrylate are not harmful to tissue, in contrast to short-chain cyanoacrylates (methyl, ethyl).Over cyanoacrylates with shorter chains, 2-OCA has a number of potential advantages thanks to its longer side chain. For instance, 2-OCA is more flexible and makes a stronger binding than butyl cyanoacrylate. Its volumetric break strength is four times more than the latter's. In the United States, it is currently often used for wound closure due to its improved strength and flexibility and decreased risk of tissue toxicity. Currently, it is among the top brands of bandages sold in the US[32].

3. STAPLES

Surgical staples are an efficient method for fast wound closure and are even associated with less infection rates compared to common surgical sutures. Staples made of stainless steel show less reactive tissue reactions compared to surgical sutures. Staples seem to be less susceptible to infections by microorganisms because of less skin penetration. Staples are easy to apply yet it still requires great care in use especially in ensuring the eversion of the wound edges. All together staples are more expensive than other surgical closure techniques. According to the scar formation and the cosmetic outcome the results can be compared to surgical sutures, when properly used and removed. A very good indication is the use of staples for wound closures on the scalp.

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4. TAPES / STRIPS

This method splints the wound edges together. The porous paper tapes ensure proper apposition and splints the wound and they can also provide additional reinforcement for the sutures. They can be used with and without sutures. Adhesive strips are not appropriate for many types of wounds. Another important fact for the functional and aesthetic result of wound healing and the final scar is the suturing technique that is used by the surgeon. There are, for example, simple sutures or everting interrupted sutures, simple running sutures, mattress sutures, subcuticular sutures and many more.

SUTURE VERSUS CYANOACRYLATE

Over time cyanoacrylate has proven their efficiency as time taken for its application is less , so faster treatment results in better patient compliance. Post op care and maintenance is less in patients who are treated with cyanoacrylates so overall cost of the treatment reduces. In comparison to sutures, the mean time for wound closure was shown to be substantially shorter in TAs. Safta[33] discovered that TAs often took 45 s to 1 minute as opposed to 4-6 minutes for sutures. Oladega[34] kept track of the intervals between the first and last sutures or TA drops that were applied. Sutures took 355.4 seconds to complete, while TAs took 191.9 seconds (P 0.001). TAs are more expensive than suturing materials on an individual basis, however Shivamurthy et al.[35] find that the overall cost is comparable because there is less postoperative upkeep required with TAs than with sutures.when cyanoacrylates are contrasted with sutures With TAs, the amount of time needed for wound closure was greatly reduced. In contrast to sutures, which took 222±1.17 s, TAs took 78 1.17 s, according to Sahu et al.[36] .Amin et al. and Pronio et al. both discovered that when staples and cyanoacrylate were compared, TAs had higher patient satisfaction. This was examined by Amin et al.[37] at 3 months after surgery (P = 0.017), and the better patient acceptance rate was linked to the ability to shower right away after surgery. According to Pronio et al [38] evaluation of patient satisfaction on day 7, the TA group had perfect outcomes to the group's 15.7 percent's detriment (P 0.001). Yang et al.[39] used the evaluation questionnaire created by Amin et al.[37] to measure patient satisfaction. After the first month, 18 patients with TAs reported less pain (P< 0.001).TAs are noticeably more expensive than staples in terms of their base cost. However, Amin et al.[37,40] discovered that because TAs don't require wound dressings, additional visits, or special tools for removal, their overall costs are comparable to those of staples.

Furthermore, unlike the usage of TAs, which peel off over time and do not require removal, there is some level of patient concern associated with staple removal.

CONCLUSION

To conclude there have been various studies on sutures as it has been present since the time immemorial and has been tested over time for its strength and other properties whereas other materials such as cyanoacrylates are comparatively new to dentistry and are under constant research.Tissue adhesives are being used now in clinical research as they are faster to apply and ease of handling and do not require a second visit to remove them. Many in-vivo and clinical research have produced compelling evidence supporting the feasibility, safety, and efficacy of all cyanoacrylate adhesive types utilised in intra- and extraoral operations.

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