

Suture Materials in Dental Surgeries: A Review

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ABSTRACT

Surgical sutures are used for securing and restoring active or trauma-induced wounds by binding tissues together to facilitate the wound-healing process. A wide range of sutures are used in dental practice. The main type includes absorbable and nonabsorbable suture materials. Recently, the production of newer suture materials is increasing depending on its wound-healing properties and its ability to approximate wounds. This article describes and reviews the characteristics of suture materials, its types, and uses in various management. It also discusses about recent and emerging suture material patterns.

Keywords: Physical properties, Suture materials, Tensile strength, Wound healing.

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INTRODUCTION

Suturing is a necessary and important event in both oral and general surgeries. Suture materials have important implications in tissue repair. A variety of suture materials provide primary wound closure following oral surgical procedures. Sutures may be divided into absorbable and nonabsorbable and categorized as monofilament and multifilament variants. There are different forms of intraoral materials that include nylon, silk, cotton, polyglycapron,¹ polyactacid, and polyglycolic acid. The selection of a suitable suture material shall be based on patient characteristics, wound cut, tissue, and anatomical location.² Certain materials can interfere with optimal wound healing and cause excessive scar formation. The optimal suture should have high tensile strength, knot security, and easy to handle.³

CHARACTERISTICS OF AN IDEAL SUTURE

Sutures used in dental surgeries are distinct from other areas of the body due to consistency variations, presence of saliva, increased levels of vascularization and speech, and chewing and swallowing functions.⁴

Ideal suture material should:

- Provide strong usability for the handling
- Should not trigger significant tissue reactions
- Provide strong tensile strength
- Neither cut through tissue
- Be sterile
- Be nonelectrolytic
- Be nonallergenic, and
- Be inexpensive.

PHYSICAL CHARACTERISTICS OF SUTURE MATERIALS

Physical properties include configuration, diameter, capillarity and absorption of fluid, tensile strength, knot strength, elasticity, memory, plasticity, tissue reaction, and antibacterial properties.

Configuration

The suture configuration is dependent on the amount of material strands used for producing it. Suture material can be monofilament

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or multifilament. A suture of multifilament is twisted or braided in form. Expressed sizes with zeros such as 3-0, 4-0, 5-0 and 6-0 plus zeroes suggest a smaller scale.

Tensile Strength

A material's resistance to friction is the highest stress it can withstand without breaking. Implantation and tying of the suture material will decrease its resistance to tensile. Dry, unused, absorbable suture loses 4 to 13% of its initial strength after soaking in sodium chloride for 24 hours.⁵

Plasticity, Elasticity, and Memory

Plasticity is the suture's ability to retain its new shape and length after it has extended. Elasticity is the suture's ability to preserve its original shape and function. Memory is the capacity of a suture material, after deformation, to return to its original form.

Tissue Reaction

Various suture material can cause varying degrees of tissue reaction. Proteolysis degrades natural materials, resulting in more inflammatory response, while hydrolysis absorbs synthetic materials, resulting in minimal reaction.

Antibacterial Properties

Bacterial colonization in suture materials has been documented in various studies. Braided sutures are particularly susceptible to the absorption and retention of fluid and bacteria. Such materials may be more reactive, which can promote infection during or shortly after the surgery. To prevent the bacterial contamination, the antimicrobial biocide like triclosan is used.⁶

SUTURE MATERIAL

A suture is a thread of material used to connect vessels and reapproximate the bruised or incised tissue. Linen, horse hair flax silk, worm intestinal kangaroo tendon, umbilical tape, ligament, cotton, iron wire, bark fibers, stainless steel, gold, and silver are used traditionally as suture materials.

Sutures are graded as absorbable or not, natural or synthetic, and monofilament or braided. Most sutures come in standard 18–27-inch lengths. Some manufacturers provide 8–9-inch and 10-inch long sutures.⁷

ABSORBABLE SUTURE MATERIALS

The suture materials are known as absorbable suture material when it loses its tensile strength 60 days after placement. Surgical intestine or catgut is the only natural absorbable suture available. Synthetic braided materials include polyglycolic acid (Dexon) and polyglactin 910 (Vicryl, Ethicon) monofilaments including polydioxanone, polytrimethylenecarbonate, polyglactone (Monocryl), glycomer 631 (Biosyn), and polyglyte 6211 (caprosyn).

Additionally, the surgical gut is made of twisted fibers from the collagen of the intestines of sheep, cattle, or goats. There are three types of gut, they are plain, chromic, and they absorb quickly (ethicon). Plain gut only maintains tensile strength for 7–10 days and is absorbed completely for 70 days. The tensile strength of the chromic gut is sustained for as long as 10–21 days, and complete absorption occurs at 90 days. Fast absorbance loses tensile strength within 5–7 days, and complete absorption occurs in 2–4 weeks.⁸

The first synthetic absorbable suture, polyglycolic acid, was used during 1970. It has tensile strength, retaining 60% on day 7, 35% on day 14, and 5% at 28 days. Complete absorption occurs in 60 to 90 days. It is useful for wounds that have an elevated chance of infection. Polydioxanone was the first available in 1982. At 14 days, it loses its tensile strength by 74%, at 28 days 58%, and a week 64%. Complete hydrolysis takes place within 180–210 days, and it is used in contaminated wounds or wounds with higher risk of infection. Polymethylene carbonate (maxon) was introduced in 1985. It maintains 84% of its power by day 14, 54% by day 28, and 30% by week 6. Polyglactone (monocryl) was introduced in 1993. It has the highest tensile strength of all absorbable sutures; 20–30% is retained at 14 days, and complete hydrolysis occurs in 90–120 days. The antibacterial form is also available (monocryl plus antibacterial ethicon).^{9,10}

NONABSORBABLE SUTURE MATERIAL

The suture that cannot be damaged by living tissue is called nonabsorbable suture and mostly used in percutaneous closures. Natural materials include surgical steel, silk, cotton, and linen. Synthetic is the mostly used in dermatologic surgery. Silk was first commonly used as a suture material in the 1890s. It came from the

larvae of the silkworms. While silk is designated nonabsorbable, it slowly degrades in tissues over 2 years.¹¹

Nylon was launched in the year 1940. This was the first synthetic suture available and was widely for wound closures. It is mostly used as percutaneous suture due to its low tissue reactivity.

Polyester is a synthetic braided suture that has similar features to braided nylon. It is expensive and seldom used to close the skin but instead on deep tissues such as tendons or fascia. In 1962, polypropylene was introduced as synthetic monofilament. The strength of friction is lower than the other sutures. With a buried suture, it is an excellent alternative with long-term dermal support. Polybutester is a newest monofilament nonabsorbable synthetic suture. It has unusual elastic properties that can treat wound edema.²

RECENT AND DEVELOPING TRENDS

Recently, sutures with the same additional properties such as modified antimicrobials and bioactive molecules such as DNA, drugs, antibodies, proteins, growth factors, and silver have grown in order to enhance the functional results of the suture. The modern sutures contain antimicrobial sutures, drugs-eluting, stem cell-seeded, and smart sutures. Smart suture includes shape memory suture, elastic suture, and electronic sutures.¹² They are designed to resolve complications of postoperative wounds including infection, scars, pain, and inflammation. These suture developments carry tremendous potential in tissue engineering, regenerative medicine, and minimally invasive surgery.

CONCLUSION

Surgical sutures play a critical role in wound treatment as a therapeutic tool. When selecting a suture material, the span of the suture must remain and the relationship between the suture and the adjacent tissue should be taken into consideration.¹³ The development of suture material has shown dentists improvement in sutures designed for particular surgical procedures. The recent improvement in suture material not only removes some of the problems faced during surgical closure but also decreases the risk of postoperative infections. Dentists must be aware of the physical characteristics of the suture material and select appropriate suture material for different wounds.¹⁴ The knowledge with the principles outlined in this article and the clear application of the demonstrated surgical skills improve the surgical procedures and also allow for improved wound healing, postoperative satisfaction, and successful surgery.

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