

## Art of Suturing Techniques

Anil Melath<sup>1</sup>, Jilu Jessy Abraham<sup>2\*</sup>, Nanditha Chandran<sup>3</sup>, Prithi S<sup>4</sup>, Prudhvinath Chowdari E<sup>4</sup> and Arjun MR<sup>3</sup>

<sup>1</sup>MDS, Principal & HOD Department of Periodontics, Mahe Institute of Dental Sciences, Chalakkara, Mahe- 673310, India

<sup>2</sup>MDS, Assistant Professor, Department of Periodontics, Mahe Institute of Dental Sciences, Chalakkara, Mahe- 673310, India

<sup>3</sup>MDS, Reader, Department of Periodontics, Mahe Institute of Dental Sciences, Chalakkara, Mahe- 673310, India

<sup>4</sup>Final Year Student, Mahe Institute of Dental Sciences, Chalakkara, Mahe- 673310, India

### \*Corresponding author

Jilu Jessy Abraham, M.D.S., Assistant Professor, Department of Periodontics, Mahe Institute of Dental Sciences, Chalakkara, Mahe- 673310, India.

**Received:** July 01, 2023; **Accepted:** July 26, 2023; **Published:** July 31, 2023

### Introduction

Suturing is necessary and important event in both oral and general surgeries [1]. The term 'Suture' describes any strand of material utilized to ligate blood vessels or approximate tissues without the necessity of a mechanical support [2]. Moreover, Surgical Suture is nothing but isolating the healing centre, promoting the circulation process, controlling haemostasis stabilising the tissues and the requested position. Various methods & materials used for precise flap placement [3, 4].

Suturing materials have important implications in tissue repair. A Suture should have high tensile strength, knot security and easy to handle. Inadequate Suturing may result in flap skipping, exposed bone/necrosis, pain and delayed wound healing [5].

The aim of this study is to re-examine and to summarize the different Suture threads origin characteristics and their interaction on the tissues, to obtain better wound healing.

### History

The first evident of Sutures goes way back to 30,000 BC where eyed needles were used for surgery and to tie wounds after the trauma according to fossilized remains of Neolithic skulls.

By the time 1600 BC Greek Surgeon, Galen of Pergamon noted that he has used Silk or Catgut (which is made from the twisted intestines of sheep or horses) to Suture together the gladiators who has injured skin, muscles and Tendons. Similar type of Sutures was used up to 20th Century.

The Egyptian records show that the first historical evident of sutures is at 150 AD.

At 1887, the manufacturing of first used Sterile Sutures happened which were made up of either catgut or Silk.

At early 1920s, 'Mer sutures' were developed by Scottish Pharmacist 'Merson' which were eyeless needles with a single strand of material attached to the butt of the needle. This method greatly reduces tissue damage by pulling two strands through skin.

In 1969, remains 'Polypropylene' sutures were invented. Still as one of the best for cardiac bypass surgery. The usage is also easy.

In 1974, Vicryl Sutures were introduced into the market which are naturally absorbed into the skin. It is also strong and pliable.

In 1979, a coated version of Vicryl sutures were introduced. This has an advantage of knots sliding down more easily when a Suture is being tied.

In 1982, PDS II Sutures made Debut which were made of Polydioxanone which were designed to close fascia under the skin.

In 1993, Monocryl sutures were delivered to the market. This has a specific advantage of even more skin closure and prevents wound edges from separating. It has high initial strength.

In 1998, topical skin Adhesives were introduced. In 2003, coated Vicryl plus antibacterial Sutures were introduced [6].

### Armamentarium

- \* Suture needle
- \* Suture material
- \* Needle holder
- \* Suture Scissors.
- \* Adson's forceps or tissue holding forceps [4].

#### Suture needle

Parts: Needle eye, Needle body, Needle point.

#### Needle eye

\*Can be closed or swaged. Shape of eye may be round, oblong or square.

\*They are traumatic and sometimes atraumatic.

\*Expensive, but sterile [7]

#### Needle body

\*Widest portion of needle

\*Referred to as needle grasping area.

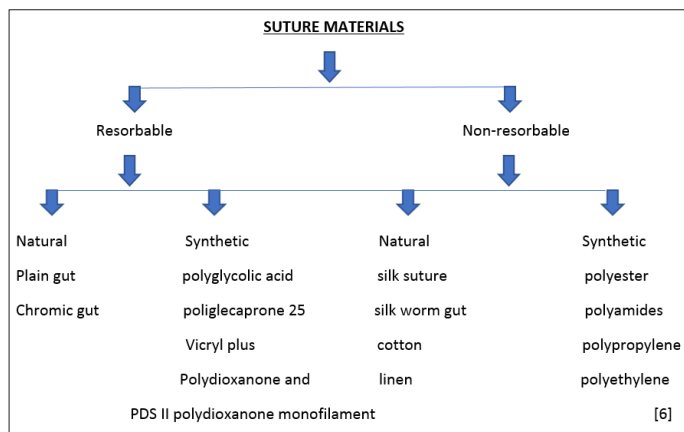
\*Half circle curved needles are commonly used in oral surgical procedures [8].

*Needle Point.*

\*Extreme tip of the needle, it can be cutting, round or blunt.

\*Blunt point has rounded end and is useful in friable tissue suturing like parotid/lacrimal duct, etc.

\*Round/tapered needles used for suturing soft and non-keratinized tissues such as muscle, fascia and neural sheath [9].



## Techniques and Types

The main aim of a Suture is to minimise or eliminate dead space in skin and sub cutaneous tissues. Lower the tension that causes wound separation. It also involves with correct wound placement in order to relax tension lines. The technique which is used to close the traumatized area depends on the force and direction of tensions of wound, The thickness of the tissue and anatomic considerations. The types mentioned below

*Knot tying* is significant to tie knots while using monofilament nylon sutures because of the risk of Separating out. If the knot starts to slip after the first two throws by increasing the frictional force needed to unravel the knot by pulling it in the corresponding direction rather than pulling it in 90° [10-12].

*Simple interrupted Suture* is the most popular suturing technique of wound closure used in cutaneous surgery. To place a simple interrupted suture, The needle enters one side of the wound and penetrates well into the dermis of the sub cutaneous tissue. This technique can be used for the wounds with uneven thickness by changing the angle and the depth of needle used. Then the needle is passed through the subcutaneous tissue to the opposite site of the wound and is placed closer to the wound edge • So that the final configuration of the suture is flask shaped.

## Advantages

- o They are easy to place.
- o Possess greater tensile strength
- o Less probability to cause wound oedema and Impaired circulation

## Disadvantage

- o They tend to leave a set of crosshatched linear scars which resembles railroads
- o If not placed correctly, they would cause wound compression [12,14].

Vertical Mattress suture is the best available suturing techniques to ensure of wound and to reduce the wound tension. It is started at 0.5-10cm lateral to the wound Margin. It is inserted to the depth of the wound ensuring the closure of dead space. The needle is

then passed to the deep tissue to the opposing wound edge, where it comes out of the skin on the opposing side equidistant to the insertion. It is then reversed and the skin is penetrated again on the side where the suture just exited but closer to the wound edge.

## Advantages

- o Maximising wound eversion.
- o Reducing dead space.
- o Minimizing tension across the wound.

## Disadvantages

- o Time consuming
- o Improper technique may cause wound inversion, uneven tension and increased Scabbing [10, 12].

Near Far vertical Mattress Suture is a modification of standard vertical mattress suture [10,13]. It should begin near the wound edge (1-3mm) Passing needle into the deeper aspect of the opposing side and exit through the epidermis wide to the insertion (0.5-1.0cm). Reverse the needle and re-entry skin near the wound edge (1-3mm) of the side just excited and repeat the same procedure exciting wide to the initial preparation. It is desirable for tissue expansion and wound closure which is under tension.

Horizontal Mattress suturing technique helps in minimizing the wound tension, closing the dead space and facilitating wound edge eversion [10-13]. It Penetrates the skin 5-10mm from the edge of the wound the needle is then passed dermally or Subcutaneously towards the opposing wound edge where it enters at the same level in the Subcutaneous or dermal tissue. Exit the opposing side of the wound through the epidermis at equidistant. Re-entry the skin on the same side at the sooner distance from the wound edge but laterally. The needle is then passed dermally to the side of former preparation.

## Advantages

- o Useful for wounds under high tension.
- o It may also be used. as a stay Stich to temporarily approximate wound edges.

## Disadvantages

- o May cause hypoxia, Necrosis and poor healing.
- Running suture*, this technique is useful over eyelids ears and the dorsa of hands or can be used to secure the edges of full or split thickness skin graft [10-13]. The primary advantage of this technique is its relative care and speed of placement. Initially place a Simple intercepted Suture at one end of the wound. This is tied but is not cut. Simple sutures are placed down the length of the wound, repenetrating the epidermis and passing dermally or subcutaneously. It is important to space each interval of the running Suture entirely. It is terminated by placing a single knot as it exists the skin at end of incision.

There are also different types which includes:

- o Running horizontal mattress
- o Running sub cutaneous
- o Running Sub cuticular

## Advantages

- o Useful for long wounds in which wound lesion has been minimized with properly placed deep.
- o Useful in full split thickness skin graft
- o Less chances of scarring when compared to interrupted sutures.

## Granny Knot

A granny knot consists of two simple throws, with one throw

beginning with the instrument between each strand of suture and the other beginning with the instrument outside of the strand of suture. Hold two ends of the laces and that should be joined together and hold them. Put the leftover the right lace, similar to an overhand knot. Pull the ends of the laces towards one another. Then pull the left lace over the right place. Finally, pull both ends and make sure that it is strengthened.

### Advantages

The main advantages of the Granny knot are that it is quite easy to tie. Then, it is the basis of the surgeon's knot, which makes it widely used by surgeons

### Disadvantages

The disadvantages of the Granny knot are related mainly to its strength. It is not so secure as other knots, can easily become undone and may even slip when they are overloaded. When there is an excessive tightening of the Granny knot it might jam, so it is better to consider it prior to using it for holding heavy weights.

### Significance of Suturing

- \* Approximating tissues without tension while minimizing ischemia is the purpose of suturing
- \* Balance must be struck b/w size of suture and maintenance of tissue re approximation.
- \* More often silk and synthetic sutures are employed.
- \* Due to limited physical characteristics of gut sutures, it cannot be used routinely.
- \* For bone augmentation procedures, monofilament Sutures can be done. This is done to prevent 'wicking' and it reduces the inflammatory response and permits longer retention.
- \* For guided tissue regeneration procedures Gore-Tex (Flagstaff, Arizona) can be done.
- \* To avoid slippage completed knot must be tight, firm and tied.
- \* Knots can be placed in incision lines to avoid wicking of bacteria.
- \* The end of the knot should be 2-3mm.
- \* To avoid breakage, excessive tension to finer gauge materials and jerking motion can be avoided.
- \* To avoid necrosis the suture should not be tied so tightly.
- \* Adequate traction is done on one end to avoid loosening the first loop.
- \* To prevent slippage granny knots and coated and monofilament Sutures require additional throws for knot security.
- \* For the removal of encaustic necrotic debris, blood and serum from about the sutures, the area Should be swabbed with hydrogen peroxide.
- \* A sharp suture scissors can be used to cut the loops of individual or continuous sutures about the teeth.
- \* To remove the sutures cotton pliers can be used. The location of the knots should be noted to be removed first so that unnecessary entrapment under the flap can be avoided.
- \* Primary intention healing is achieved.
- \* Suturing reduces postoperative pain
- \* Suturing provides support for the tissue margins till the healing process is completed.
- \* Suturing permits proper flap position
- \* Suturing maintains haemostasis.
- \* Suturing Provides adequate tension of wound closure without any dead Space, but it is loose enough obviate tissue to ischemia and necrosis [14, 15].

### Principles of Suturing

Ethicon (1985) recommends the following principles for knot tying:

1. The completed knot must be tight, firm, and tied so that slippage will not occur.
2. To avoid wicking of bacteria, knots should not be placed in incision lines.
3. Knots should be small and the ends cut short (2-3 mm).
4. Avoid excessive tension to finer-gauge materials because breakage may occur.
5. Avoid using a jerking motion, which may break the suture.
6. Avoid crushing or crimping of suture materials by not using hemostats or needle holders on them except on the free end for tying.
7. Do not tie the suture too tightly because tissue necrosis may occur. Knot tension should not produce tissue blanching.
8. Maintain adequate traction on one end while trying to avoid loosening the first loop.
9. The surgeons knot and square knot strength, although generally not needing more than two throws, will have increased strength with an additional throw.
10. Granny knots and coated and monofilament sutures require additional throws for knot security and to prevent slippage. Coated Vicryl will hold with four throws-two full square knots.

### Post and Pre-Suturing Precaution

#### Pre-Suturing Precaution

- \* Soak Sutures for a full 10 minutes completely immersed in povidone iodine 10 % solution, then rinse in sterile saline / water.
- \* Monofilament Suture can be Soaked in povidone iodine 10% solution with no risk of HIV or Hepatitis B.
- \* Povidone iodine does not affect needle Sharpness.

#### Post suturing Precaution:

- Protect the stitches.
- Clean the area.
- Keep the area dry as directed.
- Elevate your wound.
- Limit activity [16].

Sutures should be removed as a traumatically and cleanly as possible. Ethicon (1985) recommends the following principles for Suture Removal:

1. The area should be swabbed with hydrogen peroxide for removal of encrusted necrotic debris, blood, and serum from about the sutures.
2. A sharp suture scissors should be used to cut the loops of individual or continuous sutures about the teeth. It is often helpful to use a no. 23 explorer to help lift the sutures if they are within the sulcus or in close opposition to the tissue. This will avoid tissue damage and unnecessary pain.
3. A cotton pliers is now used to remove the sutures. The location of the knots should be noted so that they can be removed first. This will prevent unnecessary entrapment under the flap [5].

### Complications

1. Dehiscence
2. Infection without dehiscence
3. Suture reactions
4. Ligature loop failure.
5. The wicking effect (spread of the infection among the multifilament sutures and the presence of bacteria within the suture interstices)



6. Additionally placing adjacent square knots next to each other of different tensions can result in inappropriate tissue deformation and can lead to watertight wound formation(27)

### Recent advances

In 1998 topical skin adhesives were introduced.

In 2003 coated Vicryl plus antibacterial sutures are introduced. coated Vicryl plus antibacterial sutures has antibacterial property as the name indicates.

In 2006, INSORB, subcutaneous absorbable stapling device, became commercially available

In 2009 Covidien introduced V-LOC unidirectional barbed suture with a first loop. Ethicon has now introduced its own version of the barbed suture, the Stratafix found in both unidirectional and bidirectional.

In 2011,2012 and 2014 Ever point cardiovascular needles, Stratafix knot less tissue coated devices and Dermabond prineo skin closure systems were introduced respectively [17-19].

### Conclusion

Management of soft tissues is a supreme Priority for surgeon in any of the extra or intra oral surgical or invasive surgical procedures for aesthetics. Sutures not only perform their primary function of wound closure but they afford other benefits such as antimicrobial properties and more recently elimination of the surgical knot with barbed suture and replacement of skin sutures with adhesions Proper soft tissue handling during various suturing techniques can ensure optimal tissue healing and high aesthetic result [20,21]. The success of technique sensitive surgeries depends on the clinician's knowledge and skills to close the wound and achieve optimal healing. The innovation in suturing materials decreases the potential for postoperative infections [22-26].

**Conflict of interest:** Nil

### References

1. S, Banglmair R, Matta JM, Tan mast M (2010) Material properties of common suture materials in orthopaedic surgery. Iowa Orthop J 30: 84-88.
2. Miguel GS Andrade, Ruben Weissman, Silvia RA Reis (2006) Tissue reaction and surface morphology of absorbable sutures after in vivo exposure. Journal of Materials Science: Materials in Medicine 17: 949-961.
3. Minozzi F, Bollero P, Unfer V, Dolci A, Galli M (2009) The sutures in dentistry. Eur Rev Med Pharmacol Sci 13:217-26.
4. Galli M (2004) Suture and technique Dei nodi. Ed. Techno dental Gennaio 2004.
5. Edward S Cohen, Atlas of cosmetic and reconstructive Periodontal surgery 2nd edition Harry Dym atlas of minor oral surgery.
6. J and J, DNA by Hallie levies October 5, 2016.
7. Lee H Silverstein, Gregori M Kurtzman, Peter C Shatz (2009) Suturing for optimal soft tissue management. Journal of oral implantology 35: 82-90.
8. K A Selvig, G R Biagiotti, K N Leknes, U M Wikesjö (1998) Oral tissue reaction to suture materials. International Journal of Periodontics restorative dentistry 18: 474-487.
9. Wound closure biomaterials and devices, Chu-Chi-Chang, J Anthony von Fraunhofer and Howard P Geisler. <https://www.taylorfrancis.com/books/edit/10.1201/9780203733653/wound-closure-biomaterials-devices-chih-chang-chu-anthony-von-fraunhofer-howard-geisler>
10. Resident's corner, suturing and sutural techniques Mohan H et a. bio-online. Org. (not found)
11. Borges AF. Technique of wound sutures.
12. Swanson NA Basic technique of wound sutures.
13. R L Moy, B Waldman, D W Hein (1992) A review of sutures and suturing techniques. J Dermatol Surg Oncol 18: 785-795.
14. Ethicon wound closure manual. Somerville, NJ Johnson and Johnson. <https://www.ethicon.com/na/epc/search/platform/wound%20closure?lang=en-default>
15. Mangram AJ, Horan TC, Pearson ML, Jarvis WK (1999) Guideline for prevention of surgical site infection, 1999 Hospital infection control practices advisory committee Effect control Epidemiol. Am J Infect Control 27: 97-132.
16. Devendra Singhal, Deepa D, Bhavna Jha Kukreja, Akanksha Singh, Sandeep Swarnka, et al. (2018) Suturing in periodontics A review. TMU J Dent 5: 19-22.
17. Mackeen AD, Schuster M, Berg Hella V (2015) Suture versus staples for skin closure after caesarean A meta-analysis. American journal of obstetrics and Gynaecology 212: 6 e1-10.
18. Wang ZX, Jiang CP, Cao Y, Ding YT (2013) Systematic review and meta-analysis of triclosan – coated sutures for the prevention of surgical-site infection. British journal of surgery 100: 465-473.
19. Tulandi T, Einarsson JL (2014) The use of barbed suture for laparoscopic hysterectomy and myomectomy A systematic review and meta – analysis. Journal of minimally Invasive gynaecology 21: 210-216.
20. Textbook of oral and maxillofacial surgery [5th edition] Neelima anil malik.
21. Sutures and needles WWW.modiyalan.edu.iq/uploads.
22. White RD Jr, Shugas DA, Shafer DM, Lakshmi DM, Buckley MJ, et al. (2003) Recovery after third molar surgery. Clinical and health related quality of life outcomes J. oral maxillofacial drug 61: 535-544.
23. Knut N Leknes, Knut A Selvig, Olav E Bøe, Ulf M E Wikesjö (2005) Tissue reactions to sutures in presence and absence of anti-infective therapy. J Clinical periodontal. 32: 130-138.
24. Edward S Cohen (2007) Atlas of cosmetic and reconstructive periodontal surgery 1-457. [https://books.google.co.in/books/about/Atlas\\_of\\_Cosmetic\\_and\\_Reconstructive\\_Per.html?id=\\_4002SyMTgUC&redir\\_esc=y](https://books.google.co.in/books/about/Atlas_of_Cosmetic_and_Reconstructive_Per.html?id=_4002SyMTgUC&redir_esc=y)
25. Matalon S, Kozlov sky A, Kfin A levantosky S, Manzor Y, Slutzky H (2013) The effect of commonly used sutures on inflammation inducing pathogens – an invitro study. J craniomaxillofacial surgery. 41: 593-597.
26. Cohen's ES textbook. [1994] suture and suturing. In atlas of cosmetic reconstructive periodontal surgery.
27. Granny Knot (2003) Survival World <https://www.survivalworld.com/knots/granny-knot/>.

**Copyright:** ©2023 Jilu Jessy Abraham, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.