A guide to removing sutures

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Abstract

This article provides an overview of the wound healing process, outlining the four distinct phases of the healing cascade: haemostasis, inflammation, proliferation, and maturation. The different types of closure method are described and, specifically, the various types of surgical suture that can be used for wound closure, as well as the strengths and limitations of each. The article explains aspects of patient care that need to be considered such as obtaining informed consent, and the importance of nurses maintaining appropriate clinical skills. It concludes with a step-by-step outline of best practice on how to remove sutures.

Wound healing is the process by which the body replaces and restores damaged tissue (Greaves et al, 2013) and enhanced mechanisms such as regeneration and tissue repair are initiated to help the healing process. It is a normal biological process that follows precisely programmed and highly regulated phases (Wallace et al, 2023). In general, wound healing is described as having four distinct phases: homeostasis, the defensive and inflammatory phase, the proliferative phase, and finally the maturation phase. These phases are collectively referred to as the healing cascade and work together to promote the healing of wounds (*Figure 1*). For a wound to heal effectively all four phases must occur in the proper sequence and time frame (Coloplast, 2023). However, as the healing process involves a complex interaction of physical, chemical and cellular events, a multitude of factors can interfere with one or more phases of the process, leading to improper or impaired wound healing.

Figure 1. The wound healing cascade

Tissue regeneration

The body is capable of regenerating certain types of cells, such as epithelial cells, and this is the most effective method of healing because the regenerated tissue retains the same functionality and appearance as previous tissue.

Tissue repair

This is a complex process that can result in visible alterations to the repaired area as the body repairs damaged or destroyed dermal or subcutaneous tissue. Consequently, during this process, the repaired tissue loses its specialised function and original structure, leading to scarring and changes in the skin's appearance.

Primary, secondary and tertiary intentions

It has been identified that there are three ways that wounds heal: primary intention, secondary intention, and tertiary intention, depending on the wound type and cause. Cook et al (2020) suggest that the healing process is essentially the same in each, although the times scales may differ.

Primary intention

Surgical incisions with minimal tissue loss can heal quickly through primary intention with the use of sutures, staples, or clips (Curr and Fordham-Clarke, 2022). This type of healing is uncomplicated, with minimal scarring and no tissue deficit; however, the time to heal will depend on a patient's overall health status. The initial union of wound edges takes 7–10 days and the maturation stage can take up to 2 years.

Secondary intention

When there is tissue loss, wounds heal through a process described as secondary intention, which involves granulation and epithelialisation. The body produces granulation tissue to fill in the tissue deficit before forming scar tissue. The healing time frame is usually significantly longer than through healing by primary intention.

Tertiary/third or delayed intention

This involves intentionally keeping a wound open to allow for swelling or infection to resolve. It is a form of delayed primary intention: it will result in more scarring than when a wound heals by primary intention, but less increased scar tissue formation than occurs in wounds that heal by secondary intention. Healing by third intention will also be faster than by secondary intention (Mitchell and Llumiguisin, 2021).

Types of closure methods

Various skin closure methods are available, each tailored to a specific type of wound and clinical situations. Sutures are the most traditional method, providing strong wound closure and typically requiring removal by a health professional, although absorbable sutures dissolve naturally over time and do not require removal.

Clips, or staples, are often used for ease of application and quick removal, typically requiring special tools and professional intervention. Adhesive strips, such as Steri-Strips, are beneficial for small, low-tension wounds and are generally removed by soaking and gently peeling off. Conversely, tissue adhesive, or glue, is beneficial for small or superficial wounds, providing a non-invasive option that naturally dissolves over time and does not require removal.

Finally, there are also advanced wound closure systems that combine several techniques to optimise healing, such as negative pressure wound therapy, which uses a vacuum dressing to promote wound closure and may not require traditional removal methods.

What are sutures?

Surgical sutures, also known simply as sutures or stitches, are medical devices used to close wounds and incisions created during surgical procedures or in the event of injuries (Thomas, 2015). They are a crucial part of wound management and play a significant role in facilitating the natural healing process of tissues for wounds closed via primary intention, because they enable the edges of a wound or incision to be brought together, allowing for proper alignment of tissue layers, and to reduce the risk of foreign materials and bacteria entering the body (Raftery et al, 2016). Sutures assist in holding the tissue in place, in order to support the body's natural healing mechanisms, providing stability and reducing tension on the wound, thus leading to superior scar formation. Their use can also be beneficial for haemostasis, which is especially important in surgical procedures and for patients where blood loss needs to be minimised.

Suture materials come in a range of sizes, shapes and materials, catering to various types of wounds and procedures (see *Table 1*). Selecting the appropriate surgical suture is necessary to attain ideal wound closure and recovery. When selecting the suture material surgeons take into account multiple factors, including the nature of the surgery, the incision placement, the patient's medical background, and their own and the patient's preferences.

Table 1. Summary of suture types, their strengths and limitations

Type	Strengths	Limitations
Monofilament	• Smooth surface area reduces colonisation by microorganisms • Minimises friction and tissue irritation • Easier to handle • Have minimal capillarity	• Reduced knot security • Limited tensile strength • Not always suitable when more manipulation of tissues is required • Often more expensive

Table 1. Summary of suture types, their strengths and limitations		
Type	Strengths	Limitations
Multifilament	• Enhanced tensile strength • Provide better knot security • Enhanced durability • Greater hand flexibility in tight spaces • Suture memory	• Increased risk of infection • Tissue irritation • The smooth texture and single-strand construction also reduce tissue reaction and inflammation, resulting in minimal capillarity, which can help prevent infection transmission. Capillarity is the reaction that can occur when there is an alteration in surface tension, and this has the possibility of causing either an increase or decrease in the material's ability to absorb liquid • Increased visibility within the wound
Natural: absorbable and non-absorbable	• Biocompatibility • Reduced infection risk • Absorbability • Soft and pliable • Less tissue trauma	• Premature suture breakdown or delayed absorption • Delicate and more challenging to handle • Tensile strength variability • Allergic reactions • Limited longevity • Non-absorbable sutures need to be removed
Synthetic: absorbable and non-absorbable	• Uniform tensile strength, flexibility and handling characteristics • Absorbance versatility • Reduced tissue reaction • Knot security • Long shelf life	• Risk of infection • Potential tissue irritation • Non-absorbable sutures need to be removed

Table 1. Summary of suture types, their strengths and limitations		
Type	Strengths	Limitations
	• Resistance to biological enzymes	

Sources: Byrne, 2019; Li et al, 2023

Monofilament sutures

These consist of a single strand of material, giving them a smooth texture, with fewer crevices and apertures for microorganism colonisation. The smooth texture and single-strand construction also reduce tissue reaction and inflammation, resulting in minimal capillarity (alteration in surface tension that may cause liquid in the absorbent material to rise or fall, which can help prevent infection transmission). Many surgeons find this type of suture easy to handle and manipulate (Byrne, 2019). However, they may have slightly lower knot security and tensile strength than other types of suture, making them less suitable for high-tension areas, such as in the shoulders, scapula, skull and other major joints (Raftery et al, 2016). Using monofilament sutures in tight spaces can also be challenging, and they are generally more expensive than braided sutures.

Multifilament sutures

These are composed of multiple strands often braided together, offering unique characteristics and additional tensile strength. As such, they are often used in orthopaedic or cardiovascular surgeries, where sutures need to withstand significant forces without breaking. Due to their robust construction, textured surface and interlocking strands, multifilament sutures offer greater durability, are less likely to fray or unravel, and often provide better knot security (Thomas, 2015). They are also more flexible, easier to manipulate, and have suture memory, meaning that they tend to retain their shape and are less prone to curling or kinking.

Consequently, the use of this suture type is critical in demanding procedures due to their ease of use, predictability, and durability. However, they are often associated with greater surgical site infections because the textured surface of these sutures is ideal for bacteria to adhere to and multiply. Multifilament sutures can also wick fluids along their length, potentially transmitting infection, or fluids through the suture track (Raftery et al, 2016). Braided sutures can be problematic in delicate tissues or when they need to remain in place for a long time due to their rough surface, which may cause more tissue irritation and inflammation. Because they are more visible, they can also cause cosmetic issues for certain surgical procedures where scarring or aesthetics are important.

Natural sutures

These are typically derived from biological sources and are generally well tolerated by the body because they are made from biological materials such as animal tissues, plant fibres and metals (Byrne, 2019). They tend to cause minimal tissue reaction, reducing the risk of inflammation or adverse reactions, and many natural sutures are absorbable, eliminating the need for their removal and or additional healthcare intervention (Li et al, 2023). Many are soft and pliable, which is ideal for delicate surgeries, and their smooth surface can also cause less tissue trauma and reduce the risk of microorganism adherence.

However, the rate of absorption of this suture type can be unpredictable, potentially leading to premature suture breakdown, and delayed absorption and wound healing. From a kinaesthetic perspective, due to their delicate construction, these sutures can be more challenging to handle, especially when wet, as they may become more prone to fraying or breaking. Natural sutures often have variable tensile strengths, with some being weaker than their synthetic counterparts and, although this is a rare reaction, some individuals may be allergic to some of the proteins found in these sutures.

Synthetic sutures

As the name suggests, these are made from manufactured materials such as nylon, polyester, polypropylene and polyglycolic acid. Consequently, their consistent structure and surface texture makes them less prone to tangling or fraying, simplifying the suturing process and offering uniform tensile strength, flexibility, and handling characteristics (Li et al, 2023). The smooth texture and single-strand construction also reduce tissue reaction and inflammation, resulting in minimal capillarity, which can help prevent infection transmission. Capillarity is the reaction that can occur when there is an alteration in surface tension, and this has the possibility of causing either an increase or decrease in the material's ability to absorb liquid.

As with natural sutures, they are available in both absorbable and non-absorbable forms, providing versatility for different clinical needs, which makes them suitable for a wide range of applications.

Because synthetic sutures are made from inert manufactured materials, they generally cause minimal tissue reactions and typically have a longer shelf life than natural sutures, making them more convenient for keeping in stock cupboards and for surgical planning. However, although these sutures are generally resistant to bacterial colonisation because of their smooth surface, there is still a slight risk of infection, especially if a wound is not properly cleaned and cared for. Some individuals may also experience mild tissue irritation or allergic reactions to synthetic suture materials.

Informed consent, patient preparation and pain management

Where possible, informed consent should be obtained. This will include ensuring that patients are aware of the reasons for the removal of the sutures, of the associated risks and complications, and details of the removal procedure and aftercare (Lister et al, 2021). Providing this level of information will not only safeguard that the patient can provide valid consent, but it will also assist in building rapport and a trusting therapeutic relationship, which could help reduce their fears and anxieties.

The timing of suture removal depends on a range of factors, including surgeon instructions, the suture material used, the comorbidities of the patient and their location on the body (Curr and Fordham-Clarke, 2022). Sutures on areas with increased vascularity such as the face are usually removed at 3–5 days, but it may be a longer time to their removal on, for example, the head and scalp due to the thickness of the skin and the presence of hair follicles. Similarly, areas with more tension and are prone to movement, such as joints within the limbs, will require a more extended period of 10–14 days for adequate healing (Thomas, 2015; Mohan and Winter, 2017). Removing sutures at the earliest opportunity minimises scarring and reduces the risk of suture marks and tissue reaction (Ogawa, 2020).

It is also important to consider not only the patient's comfort, but also the potential to increase their pain: thus, appropriate multimodal approaches to pain assessment and management need to be considered to minimise the risk of harm. This can include the use of pharmacological and non-pharmacological approaches, such as distraction therapy and non-opioid analgesics (Ford, 2019).

How to remove sutures

To carry out the procedure, additional equipment is required (*Figure 2*), all of which should be checked before the procedure.

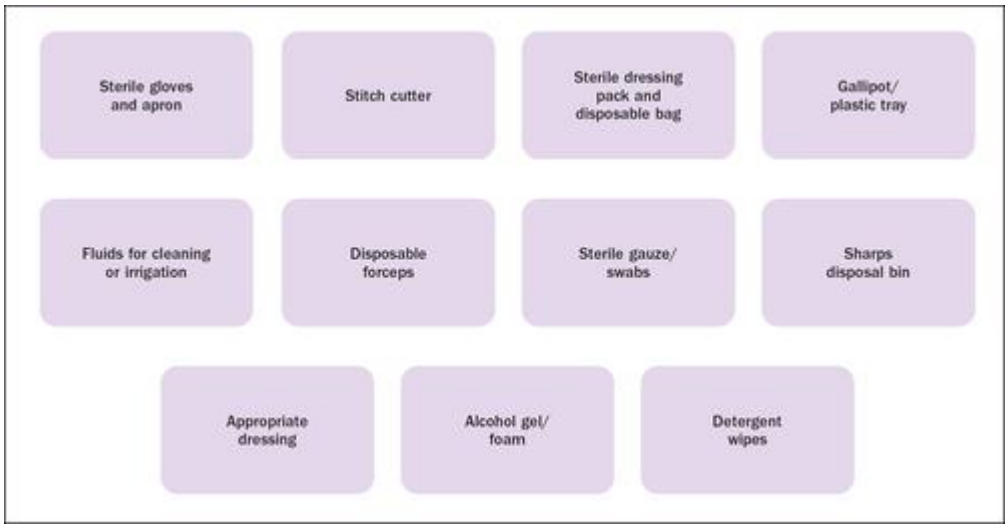

Figure 2. Equipment required to remove sutures (adapted from Lister et al, 2021)

1. Before carrying out a clinical skill, you must communicate with your patient, and provide them with the relevant information to gain informed consent. This will also give you the opportunity to talk about the patient's previous experiences of suture removal, to ascertain whether they have any allergies to dressings, assess for potential complications, and to physically prepare them and the environment before collecting the equipment
2. Decontaminate your hands using the appropriate handwashing technique
3. Next, ensure that the surfaces you are using are cleaned in line with local policy
4. When gathering the equipment required for the clinical skill, take the opportunity to examine its expiry date, as well as the external packaging for perforations, tears, decolourisation, moisture and other signs of contamination (*Figure 3a*)
5. Disposable single-use plastic aprons must be worn when carrying out the clinical procedure. These may be colour-coded and often used for specific tasks, with colours varying from trust to trust. Torn or otherwise damaged aprons must not be used
6. Remove the sterile/dressing pack from its outer packaging, and place it on a clean, dry, flat work surface. Using your fingertips and touching the outer surface of the paper only, open the pack and lay it flat to create a sterile field
7. Taking care not to contaminate the sterile field carefully open the dressing and other equipment required onto the opened dressing pack (*Figure 3b*)
8. Decontaminate your hands again by applying alcohol hand gel and allow to dry before donning the sterile gloves
9. Once gloves have been donned, you may begin the procedure

10. Before you remove any sutures a full assessment of the wound must be undertaken, to judge whether to remove all of the sutures (*Figure 3c*). If any sign of suture line separation is visible, it may be possible to remove alternative sutures, with the view to removing more at a later date
11. Assessment of the wound will include skin integrity, uniform closure of the wound line, condition of the wound edges, colour, exudate, signs of inflammation and odour. If there are obvious signs of infection, follow local policy
12. If needed, clean the wound with 0.9% sodium chloride to remove dried exudate and blood
13. Explain to the patient that they may feel tugging and pulling, but that this should not be painful
14. Hold the forceps in your non-dominant hand and the scissors/blade in the dominant hand (*Figure 3d*)
15. Grasps the knot of the suture with the forceps and gently pull it upward, while slipping the blade under the opposite side of the suture, as close to the skin surface as possible (*Figure 3e*)
16. Snip the suture at the end distal to the knot and the suture will release. (Never snip both ends of the suture because there will then be no way to remove it.) It is also important to snip as close to the skin as possible to ensure exposed suture material is not pulled through the skin
17. Still grasping the knot of the suture, and using a smooth continuous action, pull the suture upward and free of the original entry point (*Figure 3f*)
18. Place the removed suture in a gallipot or dressing gauze, depending on the available equipment (*Figure 3g*). (This will allow you to confirm that the number of sutures removed matches the number of sutures inserted.)
19. Repeat the above process, remembering to remove alternative sutures and continually observe the wound response when removing those remaining
20. Once all the sutures have been removed, check the patient's comfort and dress the wound appropriately
21. Dispose of waste, remove personal protective equipment and decontaminate hands using the appropriate technique (Ford and Park, 2018; 2019)
22. Document your care (via paper-based or electronic platforms) according to your trust guidelines and protocols. The documentation should include, as a minimum, your signature and designation, date and time, how many sutures were removed, the condition of the suture line and the surrounding skin, signs of infection, and any other post-surgical wound complications.

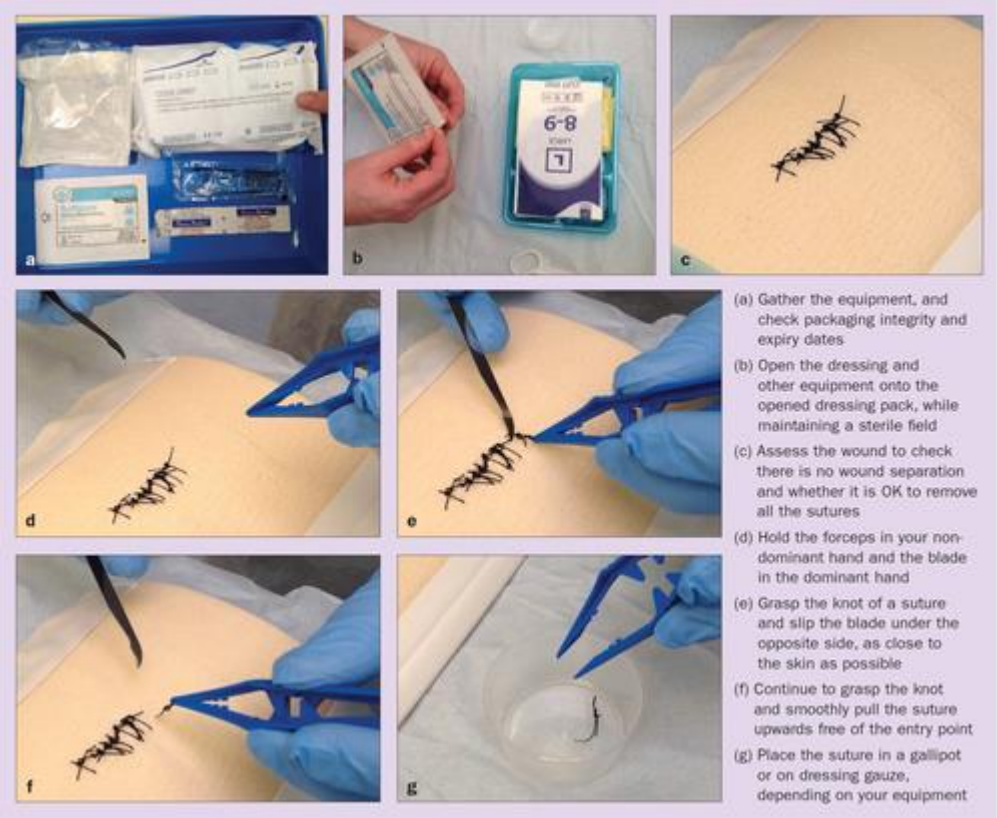

Figure 3. Process of suture removal at a glance

Conclusion

Suture removal is a clinical skill that requires health professionals to have a sound understanding of the underpinning principles, as well as a comprehensive awareness of the technique aligned with the clinical procedure. Therefore, although it is important to review local and national guidelines and the associated literature, it is also vital to use every opportunity to practise this skill in clinical practice, in addition to using alternative education and learning strategies, such as simulation training aids, to maintain contemporary practice (Nursing and Midwifery Council, 2023).

KEY POINTS

- Nurses must employ aseptic non-touch technique to prevent infections during the removal of surgical sutures. This method protects key parts and key sites from contamination, which is crucial for reducing the risk of post-surgical infections and promoting effective wound healing
- It is essential that nurses have a thorough understanding of the different phases of wound healing: haemostasis, inflammation, proliferation and maturation. Knowledge of these stages allows for better wound assessment, timely intervention and

appropriate care, which are critical when managing surgical sites, especially those closed with sutures

- Prior to suture removal, nurses should ensure that patients are adequately informed about the procedure to obtain informed consent. This includes discussing potential risks, the reasons for suture removal, and any post procedure care. Effective communication helps build a trusting relationship with the patient and can alleviate anxiety related to the procedure

References

Byrne M. The surgical suture.. *Aesthetic Surgery Journal* 2019; 39: Supplement_2: S67–S72, Crossref PubMed.

Coloplast. Wound healing: the four stages of wound healing.. 2023. https://tinyurl.com/jc8h4fev (accessed 9 October 2024)

Cook N, Shepherd A, Boore J. *Essentials of anatomy and physiology for nursing practice*. Sage, 2020. ISBN: 978-1526460325

Curr S, Fordham-Clarke C (eds). *Clinical nursing skills: at a glance*. Wiley, 2022. ISBN: 978-1119035909

Ford C.. Adult pain assessment and management. *Br J Nurs.* 2019;28(7):421–423. Crossref PubMed.

Ford C, Park LJ. Hand hygiene and handwashing: key to preventing the transfer of pathogens.. *Br J Nurs.* 2018;27(20):1164–1166.

Ford C, J Park L. How to apply and remove medical gloves.. *Br J Nurs.* 2019;28(1):26–28.

Greaves NS, Ashcroft KJ, Baguneid M, Bayat A. Current understanding of molecular and cellular mechanisms in fibroplasia and angiogenesis during acute wound healing.. *J Dermatol Sci.* 2013;72(3):206–217.

Li Y, Meng Q, Chen S, Ling P, Kuss MA, Duan B, Wu S. Advances, challenges, and prospects for surgical suture materials.. *Acta Biomater.* 2023;168:78–112.

Lister SE, Hofland J, Grafton H, Wilson C (eds). *The Royal Marsden manual of clinical nursing procedures*. 10th edn. Wiley-Blackwell, 2021. ISBN: 978-1118746677

Mitchell A. Assessment of wounds in adults.. *Br J Nurs*. 2020;29(20):S18–S24.

Mitchell A, Llumigusin D. The assessment and management of hypergranulation.. *Br J Nurs.* 2021;30(5):S6–S10.

Mohan H, Winter DC. *Minor surgery at a glance*. Wiley-Blackwell, 2017. ISBN: 978-1118561447

Nursing and Midwifery Council. Standards framework for nursing and midwifery education.. *Part 1 of standards for education and training*. 2023 (updated from 2018). http://tinyurl.com/yb6q332w (accessed 9 October 2024)

Ogawa R. Ideal wound closure methods for minimizing scarring after surgery (in Chapter VIII). In: Téot L, Mustoe TA, Middelkoop E, Gauglitz GG (eds). *Textbook on scar management: State of the art management and emerging technologies*. Springer, 2020: 185–191. ISBN: 978-3030447656

Raftery AT, Delbridge MS, Wagstaff MJD, Bridge KI. *Churchill's Pocketbooks: Surgery*. 5th edn. Elsevier, 2016. ISBN: 978-0702063091

Thomas RK. *Practical medical procedures at a glance*. Wiley-Blackwell, 2015. ISBN: 978-1118632857

Wallace HA, Basehore BM, Zito PM. Wound healing phases.. Updated 12 June 2023. *StatPearls*. https://www.ncbi.nlm.nih.gov/books/NBK470443 (accessed 9 October 2024)