The Shape of Your Wound Can Affect Healing

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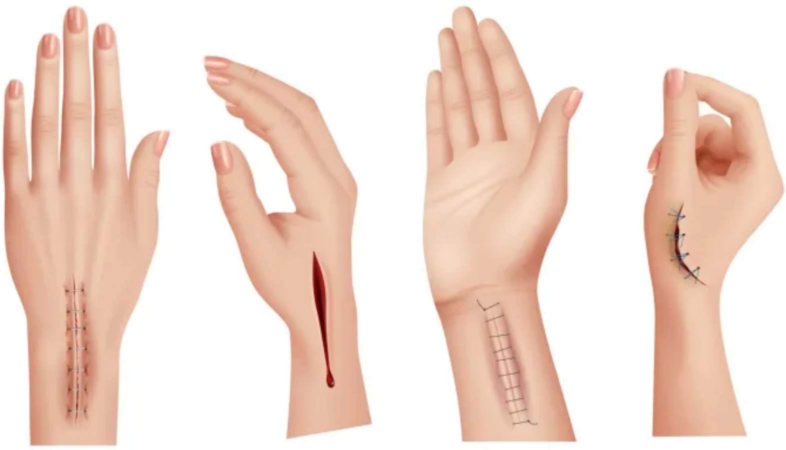
Recently published research uncovered that wavy wounds heal faster than straight wounds due to certain cell dynamics and movement patterns.



Wound healing—the process of repairing destroyed or damaged tissues—is of special interest to the medical community. Studying the process of healing is essential to reducing the negative outcomes of surgery, such as infections and scarring, as well as promoting faster healing. Since the discovery of the famous Langer's lines—lines on the human body where cuts tend to heal faster and result in less scarring—in the late 19th century, significant progress has been made in wound management and research. For instance, surgical incisions are now created either in a linear or zig-zag pattern corresponding to the Langer's line. However, recent studies have found that linearly shaped wounds have significantly different dynamics and properties from other wound shapes, especially circular wounds. As a result, linear wounds tend to heal slower than wavy wounds, but the reason behind this phenomenon is unclear.

Pioneering this investigation is a team of researchers from Nanyang Technological University (NTU) in Singapore. Spearheaded by Lead Investigators Professor K Jimmy Hsia and Assistant Professor Huang Changjin from the NTU School of Mechanical and Aerospace Engineering (MAE), their paper published in the *Proceedings of the National Academy of Sciences* (PNAS) reveals that the difference in wound healing efficiency lies in the movement of the freshly made cells near the wounds. In wavy wounds, these cells tend to move in a swirling manner, whereas cells near straight wounds tend to move in a straight line that is parallel to the wound edges.

To close a wound, the outermost cells of the body have to move to form a bridge between the two wound edges. Using advanced cell imaging methods on synthetic wounds that mimic human skin, the researchers found that there is a difference in the mechanism of bridge formation in wavy and straight wounds. Wavy wounds tend to induce surrounding cells to move in a swirly, vortex-like manner. These complex cell movement patterns then promote the surrounding cells to extend in the direction perpendicular to the gap edges and connect with similar cells on the opposite side, thus forming the bridge. In contrast, surrounding cells in straight wounds move parallel to the wound edges. This lack of movement perpendicular to the wound edges hinders the formation of the bridge.

The difference in cell dynamics and movement patterns has a significant influence on the efficiency and speed of wound healing. By observing the healing progress of the synthetic wounds over a period of approximately three days, the researchers discovered that the healing of wavy wounds occurs nearly five times faster than that of straight wounds.

Overall, their detailed and quantitative investigation sheds light on the cellular and molecular mechanisms underlying the wound-healing process. In addition, this new understanding of the effects of wound size and geometry on wound healing contributes to the emerging field of mechanobiology—an interdisciplinary field focusing on the physical properties of cells and their effects on development and physiology. For instance, the new understanding of gap closure will help to deepen current knowledge on tissue repair and embryogenesis. Lastly, the researchers believe that the findings of the study will be useful in developing better wound management techniques in clinical practice. [APBN]

Source: Xu et al. (2023). Geometry-mediated bridging drives non-adhesive stripe wound healing. *Proceedings of the National Academy of Sciences*, 120(18), e2221040120. https://doi.org/10.1073/pnas.2221040120 (https://doi.org/10.1073/pnas.2221040120)