

Treatment of hand burn sequelae. A case report

Gerardo Elías Luján Álvarez M.D.
Grecia Pavlova Salazar Gutiérrez M.D.
César Enrique Pedraza Falcón M.D.
Lourdes Montserrath Brito Piñan M.D.
Francisco Alberto Montaña
Vasquez del Mercado M.D.
Gonzalo Santos González M.D.
Bárbara Alejandra Niño Robles M.D.
Elda Vivian Landeros Rosales M.D.
José Emiliano González Flores M.D.
Daniela Fernanda Estrada Mercado M.D.
Miguel De Hoyos Riebeling M.D.
Ricardo Alonso Beltrán Mejía M.D.
Mario Ramírez Gómez M.D.

Mexico City, Mexico

Case Report

Plastic Surgery



Background: The Z-plasty concept and technique have been in existence for centuries, with its origins uncertain but likely dating back to the early 1800s. The "Z-plastic method" gained prominence at the turn of the century through McCurdy's articles. Berger's 1904 description is credited with the first recorded example of the contemporary Z-plasty, which is characterized by equal extremities and equal angles. The flap's adaptability is primarily due to this characteristic. Borges' 1973 description is considered the contemporary cornerstone for Z-plasty.

The classical Z-plasty consists of two constant features: three incisions of equal length, two extremities and a central incision, and two angles of equal degree. The scar is reoriented along the limb incisions following closure, and the new central incision is located within relieved skin tension lines. Straightforward excision is more effective for wounds less than 40 degrees from the relaxed skin tension lines than Z-plasty. The length of the original scar also increases following a Z-plasty, which is beneficial for surgeons who wish to alleviate scar contracture.

A well-defined plan is the foundation of every successful surgery, and the optimal outcome for a fundamental Z-plasty is achieved by mentally rearrange flaps and outline the incisions preoperatively while adhering to the principles previously discussed. The scar would be diminished by a straightforward excision and primary closure, but it would not be redirected or camouflaged.

Keywords: Z-plasty, reconstructive surgery, burn sequelae

The precise origin of the Z-plasty concept and technique is uncertain; however, it is highly probable that it has been in existence for several centuries. However, the initial documentation does not appear until the early 1800s, when Fricke and Horner describe single transposition flaps. Serre and Denonvilliers later praised the technique, but the geometry they described was not identical to the Z-plasty we know today. The subject, which was referred to as the "Z-plastic method," gained prominence at the turn of the century as a result of a series of articles published by McCurdy from 1898–1924. Berger's 1904 description is credited with the first recorded example of the contemporary Z-plasty, which is characterized by equal extremities and equal angles. This served as a foundation from which variations emerged, with the linked or multiple Z-plasties, as proposed by Morestin in 1914, being the most notable. Subsequently, Limberg enhanced our comprehension of the flap's dynamics, which persist to this day: the flap functions as both a rotational and advancement flap. The flap's adaptability is primarily due to this characteristic. Borges' 1973 description is regarded as the contemporary cornerstone for Z-plasty. Additionally, he offers a concise yet comprehensive analysis of the developmental history. Davis and

Basic technique

Two constant features comprise the conventional standard Z-plasty. Initially, there are three incisions of equal length: two extremities and a central incision. Secondly, the extremities form 60-degree angles with the central incision, resulting in two angles of equal degree. In an ideal scenario, the central incision should be parallel to or through the long axis of the scar. Alternatively, the central incision may be the fusiform defect, and the scar may be entirely excised. Raising the resulting triangular skin openings in the subcutaneous plane enables the ends to be transposed with respect to one another, resulting in the shared side of the triangles touching the skin of the limb incision. This leads to the formation of a new, central incision that is perpendicular to the original central incision. Please be advised that the orientation of the extremities of the Z-plasty has not been significantly altered.

It is regarded as the classical Z-plasty against which the majority of variations are considered. The scar is reoriented along the limb incisions following closure, and the new central incision is located within the relieved skin tension lines. This concept is a critical component. Therefore, if a scar is initially located along relaxed skin tension lines, a Z-plasty

will result in an aesthetically unappealing outcome, as the new central incision would be perpendicular to the relaxed skin tension lines. In that scenario, a straightforward scar excision with primary closure would be the most suitable course of action.

In reality, straightforward excision is a more effective treatment for wounds that are less than 40 degrees from the relaxed skin tension lines than Z-plasty. Following a Z-plasty, the length of the original scar also increases, which is a beneficial characteristic for surgeons who wish to alleviate a scar contracture. The flap size and, consequently, the length of the scar are contingent upon the angle and the length of the incisions. Geometric calculations of this relationship have been incorporated into numerous studies; however, the majority of these studies have discovered that the precision on paper frequently does not correspond to the same clinical outcome.

This is believed to be a result of the unpredictable character of epidermis dynamics. In general, the resultant scar increases in length as the central incision increases (assuming a constant angle). Using the classic 60 degree Z-plasty, the ultimate scar length will be 7/4 times, or almost twice, the original length. For instance, a 2cm incision will result in a 3.5cm scar. This is a useful formula to remember. Furthermore, as the angles between the extremities increase (assuming a constant limb length), the resulting scar also increases.

If the surgeon so desires, it may be feasible to accomplish a scar lengthening of up to 200% by adjusting both the limb length and angle breadth. Serial Z-plasties may be implemented to achieve additional length in the event that it is required (e.g., for neck scar flexion contractures).

A well-defined plan is the foundation of every successful surgery. The same is true for a fundamental Z-plasty. The optimal outcome will be achieved by taking the time to mentally rearrange flaps and outline the incisions preoperatively, all while adhering to the principles previously discussed. The scar would be diminished by a straightforward excision and primary closure, but it would not be redirected or camouflaged. It is crucial to bear in mind that the limb incisions remain unaltered following flap rotation, and the final central limb is most effectively represented by establishing an imaginary line between the extremities of the limb incisions.

Conclusion

The classic Z-plasty is illustrated in terms of its history, concepts, techniques, and commonly used variations. The surgeon can only completely appreciate the true versatility of this technique by comprehending the fundamentals of the traditional Z-

plasty. As shown in this case, is a good technique for treating scars and flanges.



Figure 1. Upper: Burn sequelae in a 3-year-old girl. Flange on radial edge of wrist. Middle: Postoperative wound. Lower: 6 month after surgery

References

1. Hove, C. R., Williams III, E. F., & Rodgers, B. J. (2001). Z-plasty: a concise review. *Facial plastic surgery*, 17(04), 289-294.
2. Hudson, D. A. (2000). Some thoughts on choosing a Z-plasty: the Z made simple. *Plastic and reconstructive surgery*, 106(3), 665-671.
3. Borges, A. F., & Gibson, T. (1973). The original Z-plasty. *British Journal of Plastic Surgery*, 26(3), 237-246.

4. Polichetti, C., Greco, T., Inverso, M., Maccauro, G., Forconi, F., & Perisano, C. (2022). Retro-malleolar Z-plasty of flexor hallucis longus tendon in post-traumatic checkrein deformity: a case series and literature review. *Medicina*, 58(8), 1072.
5. Chung, K. C. (2021). *Operative techniques: hand and wrist surgery*. Elsevier Health Sciences.

Gerardo Elías Luján Álvarez
UMAE Hospital de Traumatología
“Dr. Victorio de la Fuente Narváez”
Mexico City, Mexico