

# Clarifying the role of skin tension lines in dermatological surgery

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### Abstract

Skin tension lines are fundamental guidelines in surgical procedures for determining optimal incision placement to enhance healing and minimize visible scarring. This paper delves into the historical development and practical implications of Langer lines and relaxed skin tension lines. Utilization of relaxed skin tension lines enhances the precision of incisions and closures by considering facial muscle tension, an aspect not addressed by Langer cleavage lines. Relaxed skin tension lines more accurately reflect skin dynamics, underscoring the importance of patient positioning. Additionally, Cornelius Kraissl played a significant role in highlighting the alignment of scars with wrinkle lines. The interchangeable use of relaxed skin tension lines and Langer lines often leads to confusion within the field. Clarifying their distinct origins and criteria is crucial for the optimization of surgical outcomes.

### Introduction

In dermatological surgery, skin tension lines serve as guidelines for incisions aimed at achieving optimal healing and minimal scarring. Over time, numerous skin maps have been established as incision guidelines, enhancing our understanding of skin properties and various pathologies.<sup>1</sup> However, the distinction between relaxed skin tension lines (RSTL) and Langer lines is not consistently emphasized in clinical practice, as these terms are often used interchangeably and incorrectly.<sup>1</sup> Recognizing the difference between RSTL and Langer lines is critical in determining the most ideal surgical markings.

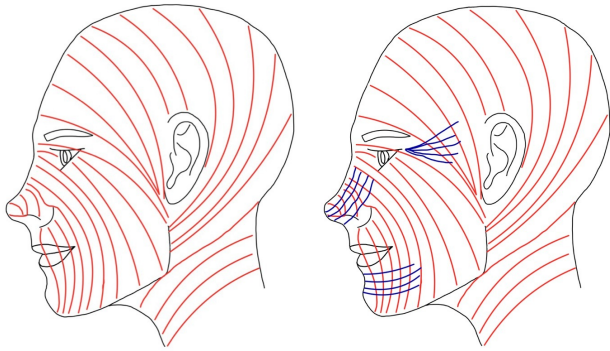
### Discussion

Karl Langer introduced Langer lines to map tension lines in 1861.<sup>1</sup> His method involved puncturing cadaveric skin, causing elliptical-shaped openings, and subsequently connecting the long axes of these perforations.<sup>2</sup> These lines indicated the orientation of the underlying collagen, providing insight into the tension required for wound closure.<sup>3</sup> This aligned with the direction of the skin disruption relative to the collagen fibrils.<sup>3</sup> More specifically, in 2007, Dehn et al observed that, according to Langer's experiments, when the skin is deformed parallel to the long axis of collagen fibers, wound closure tends to more closely approximate the skin prior to the disturbance.<sup>3</sup> This stands in contrast to the wound disrupting fibers perpendicularly, resulting in a larger lesion.<sup>3</sup> Notably, Langer's research was initially done on cadavers in rigor mortis and tension lines changed with position, not truly representing lines of relaxed tension in a living patient.<sup>2</sup> <sup>4</sup> Albert Borges illustrated this by suggesting that, if a cadaver's elbow was flexed and Langer's experiment was performed, the tension lines on the anterior surface would not align longitudinally as described by Langer, rather transversely.<sup>2</sup> In 1962, Borges discovered relaxed skin tension by pinching the skin of a living individual into furrows (**Figure 1A**).<sup>4</sup> Langer lines intersect Borges' described RSTL at nearly a right angle, for example on the face and feet.<sup>2,5</sup>

In 1951, Cornelius Kraissl further contributed to this topic when he determined that scars are less prominent when aligned with wrinkle lines that run perpendicular to muscle action (**Figure 1B**).<sup>4</sup> However, only some individuals have well-defined wrinkle lines on the face and even when present, they are only sometimes aligned with RSTL. Therefore, it was concluded that RSTL serve as the best guide for facial incisions.<sup>4</sup> Relaxed skin tension lines and wrinkle lines are more consistently aligned on the rest of the body, as stated by Albert Borges, who suggested the use of wrinkle lines on the torso and extremi-

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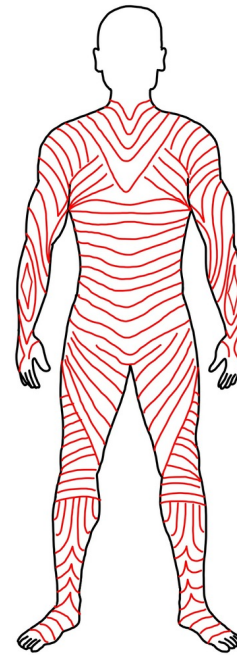
**Figure 1. A)** Relaxed skin tension lines on the face (left). **B)** Relaxed skin tension lines with superimposed Kraissl Wrinkle Lines (right).

ties as his lines on the body are congruent with Cornelius Kraissl's (Figure 2).<sup>4</sup>

The confusion surrounding the interchangeable use of RSTL and Langer lines can be attributed to their origins and the criteria used for their identification. Langer lines were established from cadavers in rigor mortis and were not originally intended for incision planning.<sup>4</sup> Instead, they were created to further investigate Guillaume Dupuytren's observations regarding the variations in the distortions of skin wounds across the body.<sup>6</sup> In contrast, RSTL derived from pinching relaxed skin was established to produce the most aesthetically pleasing scar and optimize wound closure.<sup>2</sup> Understanding the nuances of these skin tension lines is essential in achieving the best results for effective healing and scar cosmesis. In addition to its importance in surgery, RSTL also play a significant role in certain skin pathologies such as the linear spread of basal cell carcinoma, which is an important consideration in biopsies and treatment.<sup>7</sup>

## Conclusion

Acknowledging the distinction between RSTL and Langer lines is pivotal for better understanding variations in skin



**Figure 2.** Relaxed skin tension lines on the body.

tension across the body. Although Langer lines provided insight into tension patterns of the skin, RSTL offer a more accurate representation of the skin's response to movement and expression, particularly in the face. Recognizing the differences in these guidelines can allow for a more comprehensive approach to surgical planning. Clinicians should always mark the patient in an anatomic position, whether seated or standing, to identify the best RSTL most accurately for the procedure.

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## Potential conflicts of interest

The authors declare no conflicts of interest.

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