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## NOTABLE NOTES

### Kraissl Lines—A Map

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An unavoidable and often unsightly complication of elective surgery is the inevitable scarring that follows.<sup>1</sup> Placing elective surgical lines of incision in favorable locations minimizes the aesthetic and functional loss due to scar contracture. In 1861, anatomist Karl Langer applied the research of Dupuytren to develop a full-body map of elliptical lines arranged from similarities observed in tissue distortion of cadavers. Langer concluded that scars resulting from induced wounds were shaped by their regional collagen orientation.<sup>2</sup> Swiss physician Emil Kocher, MD, later recommended the topographical "Langer lines" as a guideline for surgical incisions.<sup>2</sup> It was soon realized, however, that Langer lines deviated from wound deformation in live patients.

In 1938, American surgeon Herbert Conway, MD, noted widening in the lower portion of abdominal scars that followed Langer lines and proposed that skin elasticity in living patient varied from that of cadavers.<sup>2</sup> Columbia University professor of surgery Jerome P. Webster, MD, observed that such discrepancies posed a more favorable resolution when the incisional direction was along natural skin fold lines of the living patient.<sup>2</sup>

Plastic surgeon Cornelius Kraissl, MD, further demonstrated the benefits of surgical incisions that followed the plane of tissue folds as a means to minimize scarring. The eponymous Kraissl lines are notable not for their design novelty, but for their applicability to in vivo surgery. In 1949, Kraissl and Conway proposed that skin creases in live patients represented the effect of adaptation to muscle contraction. Because skin itself cannot shorten, folds are consequently formed perpendicular to the direction of muscle pull.<sup>3</sup> Since scar tissue will follow the skin's orientation, fibrosis in the plane of movement will routinely interfere with adherent structures, setting the stage for subsequent deformity.<sup>2</sup>

Kraissl superimposed the orientation of wrinkle lines in patients with muscular anatomy and contrasted such illustrations with the original lines of Langer. Despite many similarities, Kraissl noted that key differences lay in the regions of the face and abdomen. Today, it is clear that most discrepancies ultimately fall in Kraissl's favor with regard to surgical desirability.<sup>2</sup> This is illustrated by scar minimization using incisions that mirror natural creases: horizontal Kraissl lines in mid-forehead brow-lift, oblique lines in inguinal hernia repair, and curved horizontal lower abdominal incisions in lower-segment cesarean deliveries.<sup>3</sup> In contrast, Langer lines suggest a vertical incision in both the brow-lift and hernia repair, while a V-shaped lower abdominal incision was preferred for cesarean deliveries.<sup>3</sup>

Langer lines serve their greatest instructive value at points coincident with Kraissl lines.<sup>2</sup> Modern teaching now generally recommends that wrinkle-line incisions be followed. Langer's original contributions may be why the terms "Langer" and "skin" lines are used synonymously in the lexicon of many medical publications, inadvertently subverting Kraissl's later contributions.

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