

Facial Skin Lines

Ali AlHamdi MBChB, MSc

Dept. Surgery and Interventional Science, University College of London, Royal Free Hospital, Pond, St, London NW3 2QG

Abstract

Throughout ages, skin lines had been examined by anatomists and surgeons with a great controversy about the consistency of each. None of them is considered to be the gold standard for surgical incisions. Furthermore, skin lines are not often fully understood and being misquoted over and over in literatures. Various methods had been adopted; from a simple pinch to 3D scan computerized models. Different explanations had been given for the causes of formation and variation of those lines.

Keywords: Skin lines, Langer's lines, tension lines.

List of Abbreviation: RSTL: Relaxed skin tension lines, SHO: Senior House officer

Introduction

Over a long time, skin lines were the interest of surgeons as well as the anatomists for elective incisions to achieve the best aesthetic scar. Throughout a century, thirty six differently named lines had been described as guidelines⁽¹⁾ none of them is consistent but the Relaxed Skin Tension Lines (RSTL) by Borges may be the best and the most popular one. Wide range of techniques had been used to determine those line from simple stab on cadaveric tissue to 3D scans models⁽²⁾. Despite the fact that resulted lines share a common pattern in the most areas in the face, but areas of controversy still exist. In other words, when several lines are applied at a specific region of the face they will cross other lines pattern in right angles rather than being parallel.

Techniques used to determine skin lines

Karl Langer (1819 to 1887), a professor of Anatomy at Joseph's Academy in Vienna⁽³⁾

conducted extensive investigations on fresh cadavers by puncturing the skin using a round awl (Fig. 1). The resulted holes were elliptical rather than circular, an explanation had been given that was due to the action of the underlying muscle which was been repeated over and over in literatures⁽⁴⁾.

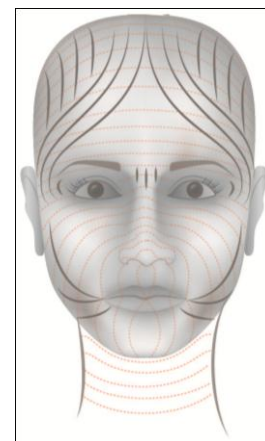


Fig. 1. Langer's line

Eventually, Langer was not the first scholar who noticed this property of the skin but Guillaume Dupuytren (1834), who is well known for his contracture, precisely described

this phenomena when he encountered a patient with multiple suicidal stabbing wounds on the chest with a round tool, he got the same pattern of ellipses rather than circles⁽⁵⁾.

A year later, Langer performed a second set of experiment on the extremities by marking a 3cm circular template on the flexor aspect of a flexed elbow and stated that skin relaxed longitudinally while after excision of that circle the skin retracted transversely⁽⁶⁾.

Cox , during his MD study in England 1941, re-examined the cleavage lines using pointed marlinespike again on cadavers but choosing only average body build people to overcome profounder factors⁽⁷⁾ (Fig. 2).

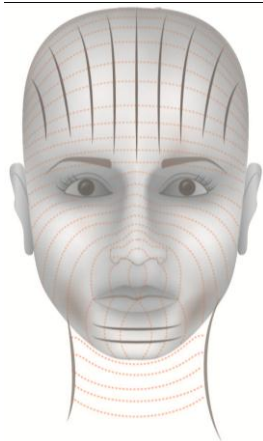


Fig. 2. Cox's Lines

At 1947 Rubin, from the Kings Country Hospital in Brooklyn, used a police device, like that used for finger print (coloured material is swiped on skin then stamped on white paper), to determine the tension lines of the skin⁽⁸⁾ (Fig. 3).

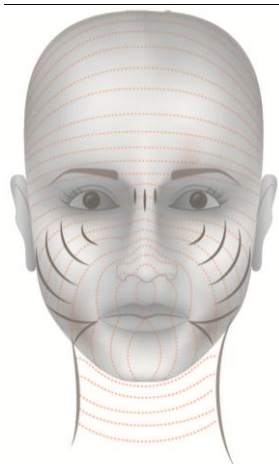


Fig. 3. Rubin's Lines

The photography and sketching were the methods used by Kraissl, from New York, how took a photograph for an old man after contraction of facial muscle, the wrinkles were exaggerated and composite sketch was achieved⁽⁹⁾ (Fig. 4).

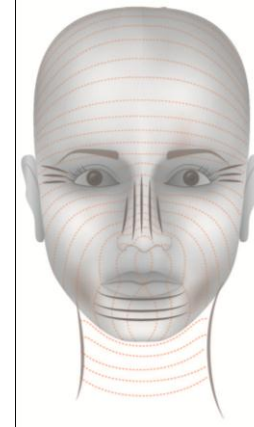


Fig. 4. Kraissl's lines

Straith et al in 1961, from Detroit, presented a paper on subcuticular suture with depiction of skin tension lines but no explanation had been given about the method they used to produce that scheme of lines⁽¹⁰⁾ (Fig. 5).

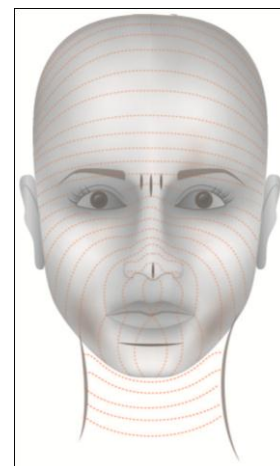


Fig. 5. Straith's Lines

With the repetition of Langer second set experiment, Bulacio, from Argentina 1961 and 1974 presented what he named new procedure while he use the same principle of Langer's second experiment when drawing extension lines from holes in skin of fresh

cadavers or holes made by flaps and grafts ⁽¹¹⁾ (Fig. 6).

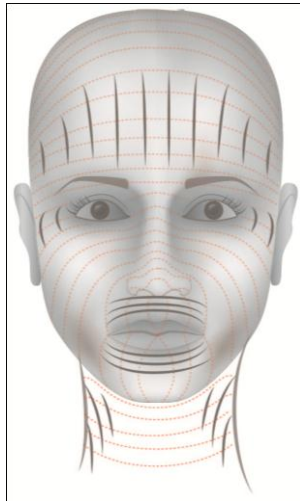


Fig. 6. Bulacio's Lines

Finally, in 1984 Broges described simple method to determine the Relaxed Skin Tension Lines (RSTL) by pinching skin and observing the formed furrows and ridges rather than furrows formed by muscle contraction and joint mobilisation which might give false lines depending on degree and direction of mobilization and muscle contraction ⁽¹²⁾ (Fig. 7).

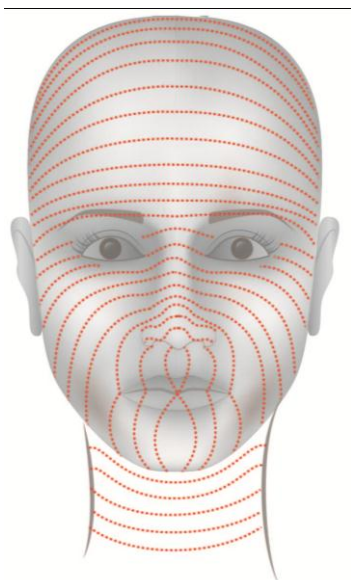


Fig. 7. Borge's Relaxed Skin Tension Lines

Sarifakioglu et al in 2004 describe new skin lines called them "sleep lines" which are

affected by position of sleep and pillow type and referred as "buried pillow" but these line should not be confused with line followed for surgical incision as they are perpendicular to RSTL and Langer's lines ⁽¹³⁾.

Skin lines were considered to be a static feature of the skin till Bush et al conducted a research on 175 punch skin excisions on the face and neck which revealed significant differences in the degree of rotation of Langer's lines on facial expression by comparing long axis of each wound in relation to the previously marked vertical line preoperatively ⁽¹⁴⁾.

Furthermore, dynamic skin tension lines had been estimated by 3D scansmodel based on the kinematic analysis of skin with computational automatic identification, it is less invasive, repeatable and claimed to be less erroneous measurement ⁽²⁾.

Result and Discussion

Huge debate about the Langer's lines which are drawn in almost all books of plastic surgery. Furthermore, "Langer's lines" and "RSTL" might be used interchangeably by mistake. A search by librarians at the Royal College of Surgeons of Glasgow revealed that original Langer's lines were falsely redrawn in various textbook, in addition to that, his work was not well translated from German to English ⁽³⁾. Further dilemma was merged that Langer did not perform his work as a guide for surgical incisions. Moreover, his line cannot be called as "relaxed line" because the tissue he used was cadaveric in rigor mortis which is never relaxed ⁽¹²⁾.

Going over through these lines, they share a common pattern in most area of the face while other areas show 90 degree crossing between them.

If we take Borges lines as a background, we can elicit the "Anti-RSTL" in table 1 and fig. 8.

Table 1. Anti-RSTL areas

Lines type	Anti-RSTL areas
Langer's lines	Scalp, forehead, lateral to the eyelids, glabella and middle of the cheeks.
Cox's lines	Scalp, forehead and chin
Rubin's lines	Glabella, middle and lower cheeks
Kraissl's lines	Nose, crow's feet and chin
Straith's lines	Columella, glabella and mentolabial fold
Bulacio's lines	Forehead, lower crow's feet, upper and lower lips upper neck
Sleep lines	Forehead, crow's feet, nasolabial fold and glabella

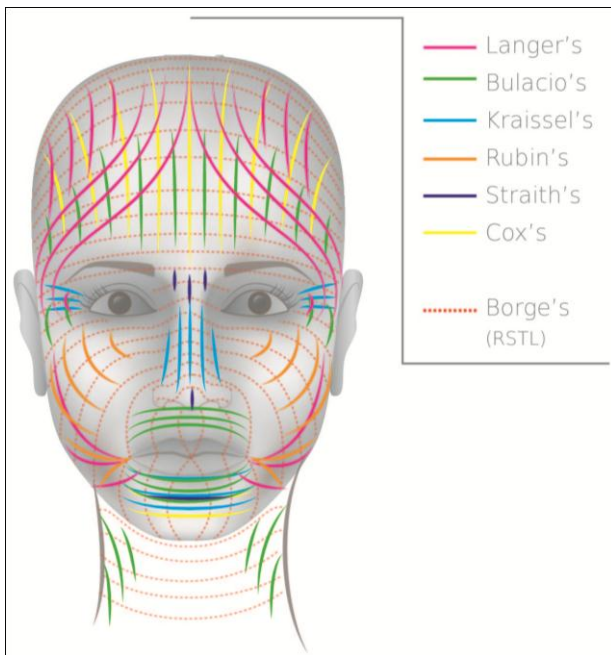


Fig. 8. Areas of right-angle cross of Borges' line with other lines.

In conclusion, various methods had been used over more than a century to determine these lines, the simplest and most applicable one is that adopted by Borges as simple pinch of the skin. Among the diversity of the directions of the skin lines, none of them is consistent guidelines for surgery but the most preferred and acceptable lines are Borges' (RSTL) and Kraissl's lines⁽¹⁵⁾. While Langer's line are often misquoted, the response of plastic surgeons showed different compliance to follow guidelines of "gold standard" for consultants and registrars from those who were SHO⁽¹⁶⁾. Explanations had been given for the cause of the formation of those lines ,the well-known widely accepted is the action of the underlying

muscles which run perpendicular to the lines⁽¹²⁾. Another explanation had been made after examining skin under scanning electron microscope revealed that skin tension lines are formed by the interrelation between elastic and collagen fibres as well as fixed attachments between collagen fibres while Langer claimed that there was no elastin in the skin during his investigations⁽¹⁷⁾. Furthermore, "sleep lines" are claimed to be related to the position of the head regardless skin structure and muscles action⁽¹³⁾.

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E-mail: ali.alhamdi.13@alumni.ucl.ac.uk

Tel.: + 447582021084