

PURPOSE: Deformity of the digital web space is commonly encountered and can be congenital or acquired. Its correction requires an understanding of the normal anatomy, which is poorly understood and understudied. The challenge to re-create a web space normal in appearance and function are equally difficult. The purpose of this study is to introduce previously unreported ligamentous structures of the digital web space.

METHODS: Forty web spaces were dissected in twenty cadaveric hands. Select H&E, Trichrome and Elastin stains were obtained, with a particular interest in the 2nd through 4th web spaces. Anatomic observations were made and correlated with intraoperative findings as they relate to burn reconstruction and congenital syndactylies.

RESULTS: The digital web space is formed by a relatively large, three-dimensional inclined triangle extending from the distal palm to the dorsal metacarpophalangeal joints. The appearance of the web space topographically (Fig.1), its gross and histologic anatomy (Fig.2), and its functional demands are completely interdependent. The dynamically changing planes and contours of the web space are the result of a complex subcutaneous endoskeleton consisting of dense fibrous attachments between the palmar and dorsal skin along its whole length and width. These fascial bands extend into the fingers in continuity with Cleland's and Grayson's ligaments (Fig.3 a,b) tethering the skin to the phalangeal periosteum, tendon sheaths and joint capsules. The tethers are so strong that one can lift the hand by holding onto them, yet they are flexible enough to allow for finger abduction, adduction and return to a resting concave posture. Dorsal tethers, at the level of the MP joints, anchor the proximal apex of the triangular web.(Fig.4)

DISCUSSION: The digital web space is important for hand function, as evidenced by the critical first web space, the depth, contour and pliability of which are prerequisites for the normal functioning of the thumb. The remaining web spaces in turn allow for the independent mobility of the fingers, in particular finger abduction to allow for a wide grasp. Merely recreating an hourglass shaped skin envelope does not suffice in reconstituting a normal web space. In this study, a deeper and more structural anatomy of the web space is identified. Preserving this normal anatomy, if possible, can help maintain or recreate a web space more normal in appearance, and more functional in use.

Burn scar syndactyly results from predictable scar, wound and graft contraction over time. (Fig.5) Graft seams and incisions that bridge dynamic planes of motion contribute to this deformity. The web must be treated separately from the dorsal hand and fingers. With deep 2nd and even 3rd degree burns, conservatively debriding the webs leaving the subcutaneous endoskeleton to epithelialize secondarily will usually preserve a normal web space. (Fig.6) This is how most burns of the palm are treated. The web space can be considered an extension of the palmar glabrous skin, with well delineated fascial attachments to the underlying skeleton.

Congenital syndactyly repairs (Fig.7) are prone to recurrence from secondary wound, scar and graft contraction. Re-creation of a normal web involves the release of abnormal tethers (Fig.8) and deliberate placement of flaps and grafts to avoid predictable contractures. Surgical scars from incisions, flap and graft seams (Fig.9) create anchoring and border tethers that define the appearance and function of the web. Interestingly, in congenital syndactylies similar fascial anchors and ligamentous structures are identified as presented in this poster. They are however more disorganized. Excision of these abnormal web space fascial elements is critical in preventing web creep and syndactyly recurrence.

CONCLUSION: The digital web space is more than skin and fat. A newly described ligamentous framework defines its shape and function. Preserving or re-creating this anatomy permits reconstitution of normal web space appearance and function.



Fig. 1

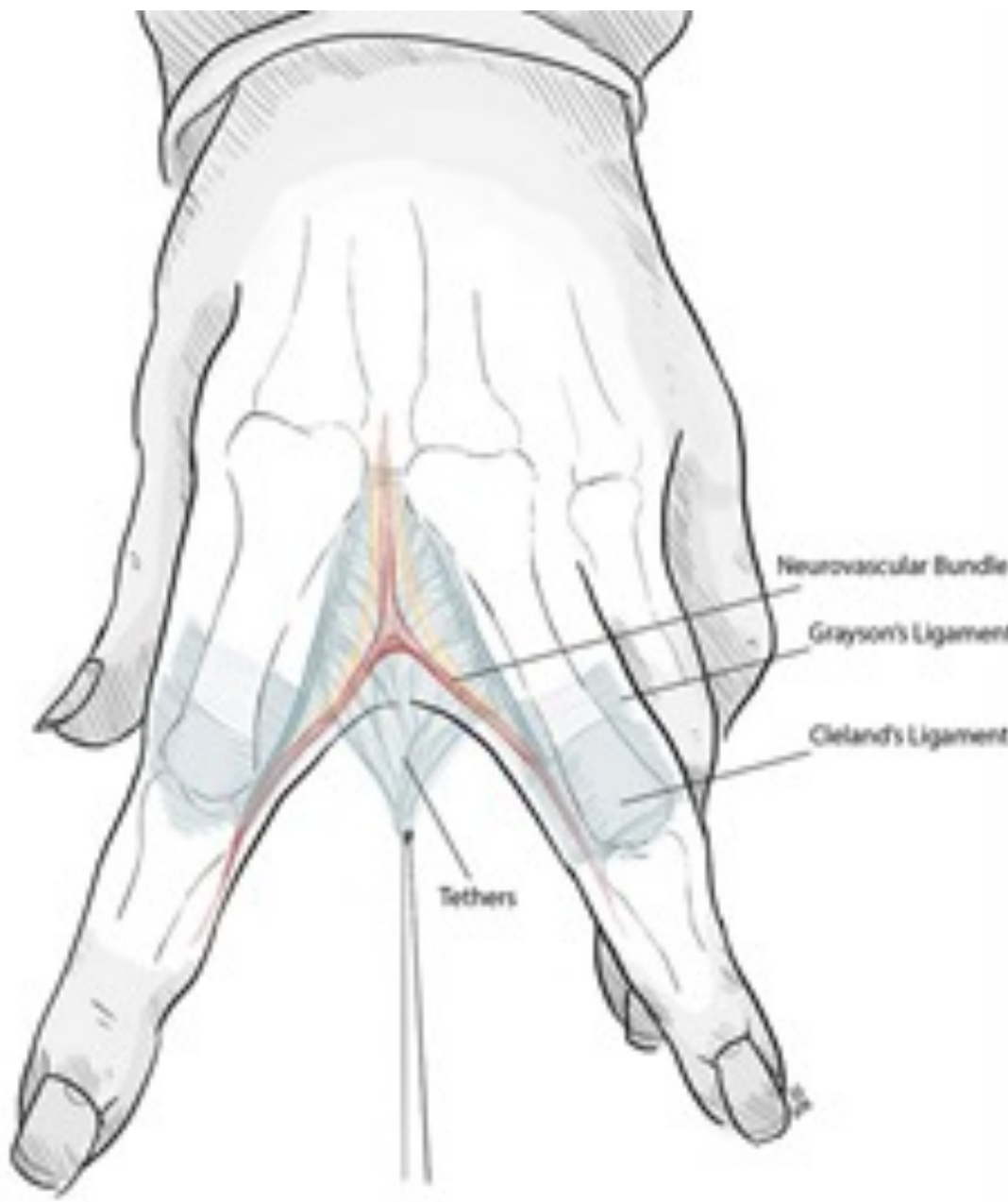


Fig. 3a

Fig. 3b

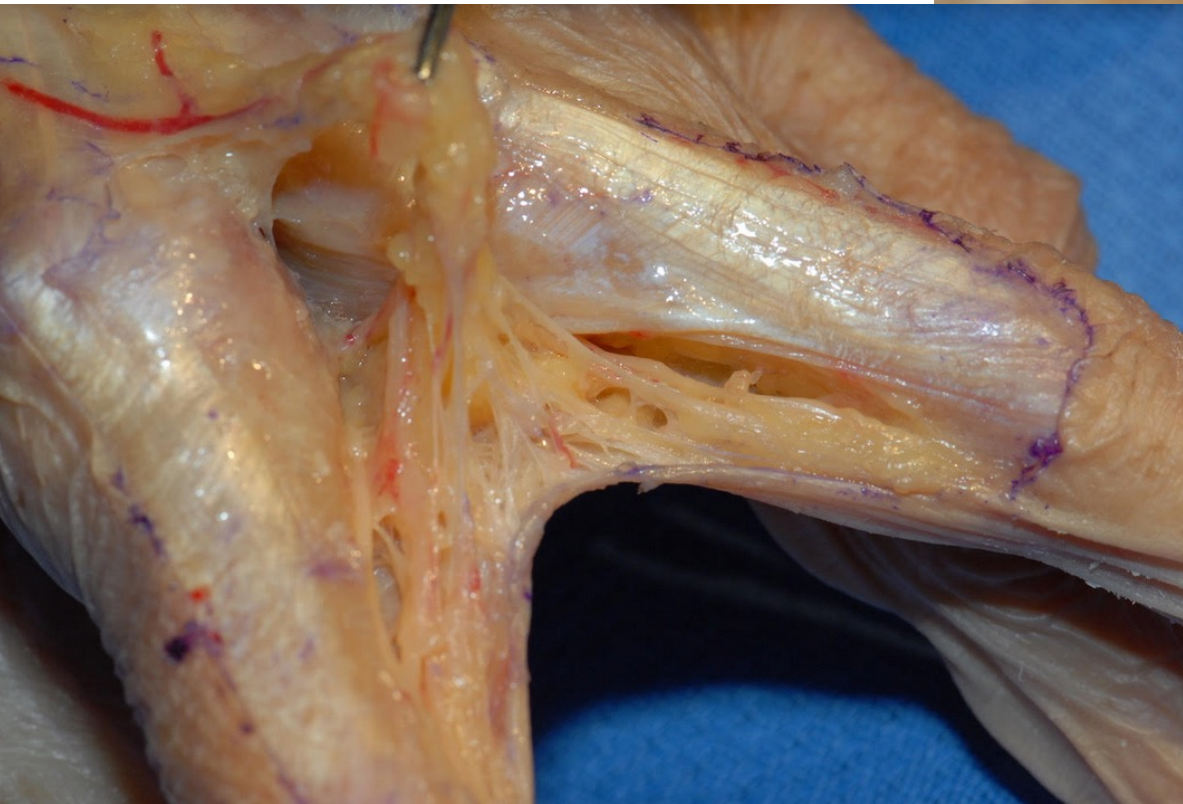


Fig. 4



Fig. 5



Fig. 6



Burn Scar Syndactyly Prevention: a) Avoid bridging dynamic planes of motion
b) Leave open to heal secondarily i.e. no grafts to webs



Fig. 7



Fig. 8



Congenital Syndactyly Repair: a) Re-create the normal tether conformation with graft and flap seams, and b) Interrupt the predictable line of secondary contraction across the web and IP joints.

Cinderellalayer.com

References
Fudem G, Dowlatshahi AS, Francalancia S website: Cinderellalayer.com
Yuan F, Zhong L, Chung KC. Aesthetic Comparison of Two Different Types of Web-Space Reconstruction for Finger Syndactyly. Plast Reconstr Surg. 2018 Oct;142(4):963-971
Braun TL, Trost JG, Pederson WC. Syndactyly Release. Semin Plast Surg. 2016 Nov;30(4):162-170
Browne EZ Jr, Teague MA, Snyder CC. Burn syndactyly. Plast Reconstr Surg. 1978 Jul;62(1):92-5
Fufa DT, Chuang SS, Yang JY. Postburn contractures of the hand. J Hand Surg Am. 2014 Sep;39(9):1869-76
Kalliainen LK, Schubert W. The management of web space contractures. Clin Plast Surg. 2005 Oct;32(4):503-14

