Objective Assessment of Skin Defect in Syndactyly Repair

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Abstract

Background: Syndactyly, as one of the most common congenital hand abnormalities, requires surgical repair according to various approaches.

Case Report: We report a 28-year-old man with simple syndactyly in his third web.

Conclusions: The common concern is about skin defect coverage, and we illustrated in a mathematical objective survey, if distance between to phalanxes' center was more than 1.5 times diameter (each of phalanxes), then there would not necessary to use skin graft.

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Introduction

Syndactyly is the most common congenital hand anomaly with an incidence of one per 2,000 to 2,500 live births (1). It is classified as incomplete (soft tissue only not extending to the tip), complete (soft tissue only, extending to the tip), complex (with distal bone union), and complicated (with more than distal bone fusion only). According to Hohendorff et al., the average digital diameter for the fingers are 16 mm (11-22 mm) for the thumb, 15 mm for the index (9-22 mm) and middle (10-21 mm) fingers, 14 mm (10-20 mm) for the ring, and 13 mm (8-19 mm) for the little fingers (2).

In these anomalies, the aim is to separate digits from each other, cover the resulted defects in both sides, and create webs between them. Different solutions have been presented. Skin graft, as full/partial thickness skin graft, is a common choice. However, complications and morbidities have obliged surgeons to consider local flaps like dorsal metacarpal island flap for creating web (3), or the double volar flap technique for coverage (4). In these approaches, surgeons have tried to overcome skin graft usage in order to decrease morbidities, and improve aesthetics. This viewpoint calculates the resultant defect mathematically, and gives a basic threshold for taking graft.

Case Report

We present a case of simple syndactyly for more evaluation, a 28-year-old man (Figure 1). According to Hohendorff et al. results, neighbor digits, especially in children, have same diameters (2).

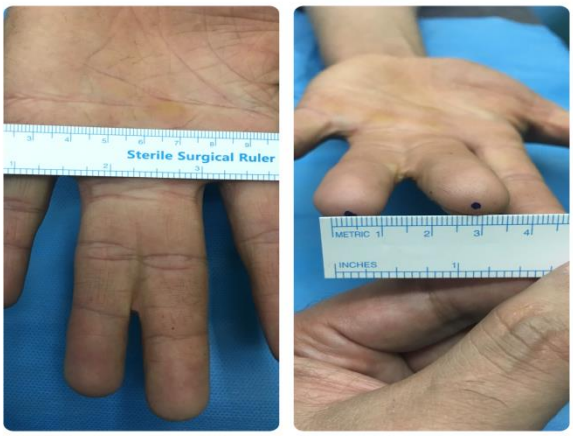

Figure 1. Simple syndactyly in a 28-year-old man in his third web

Phalanges look like as a cylinder (Figure 2-A), and we are familiar with geometrical laws of cylinders, as we know $S = L \times P$. S is the surrounding surface area (mm^2), L is length (mm) and P is cross-sectional periphery of the circle (m). Moreover, there is $P = 2 \times \pi \times R$, in which, P is periphery of the circle and R is the radial of the circle [half of circle`s diameter (d)]. Assuming the phalanges as cylinders, R can be

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their radial length, and L equals to each phalange`s length. The resultant defect after separation is divided into two semicircles. So, defect equals $2(2 \times \pi \times R)/2 = 2 \times \pi \times R$. Thus, $C + D = 2 \times \pi \times R$.

C and D shown in the figure 2-B, are anterior and posterior distances between two centers and also, C equals D, so, $2 \times C = 2 \times \pi \times R \rightarrow C = \pi \times R$ or $C = 3.14 \times (d/2)$. This means that if distance between two centers is more than 1.5 times of the phalange's diameter, the available tissue can cover defects, and there will be no need for skin graft.

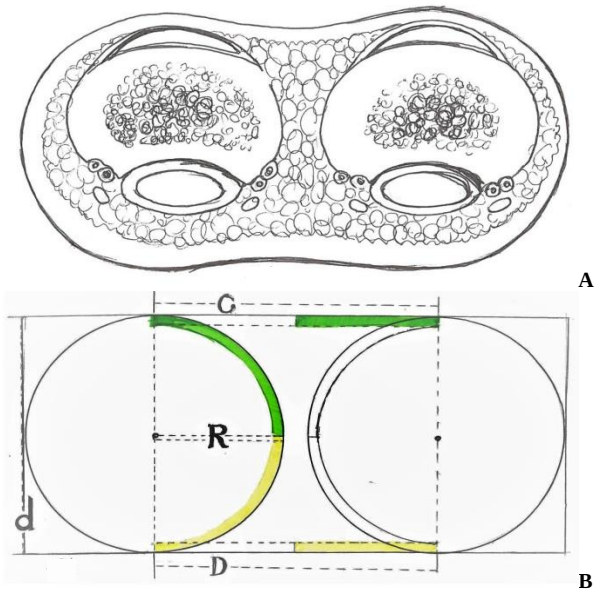

Figure 2. A) Cross-sectional view of syndactyly. Assuming phalanges as cylinders in each finger, mathematical rules of geometric objects can be applied. B) The relationship of defect and diameter. This schematic model shows how we can achieve surface of required area by calculating radius. C and D are distance between two phalanges' centers, d is diameter of each phalange, and R is the radius of each phalange which equals d/2.

These cross-sectional parameters can multiply the length of each digit (L), and calculate the surrounding surface area. In other words, available tissues to cover defect is the common skin on the web, and it can easily fill the defect when we are able to fill two semi-cylinders' surface area of both digits.

Discussion

Attempts to separate digits have led to numerous approaches. The best ones require the least skin grafts as coverage. Besides, conditions like burned scars can create webbing like syndactyly which should be corrected.

Coverage of the resultant defect in syndactyly correction is the concern of many authors. The main differences between these techniques are the geometric form of the web flap, the incisions to separate the fingers, and the number and position of the skin grafts needed (5). Metacarpal flaps can be used as web donor sites, but for phalanges, tissue from fused tissues are needed. Tension sutures can compromise distal vasculature, and requires opening the wound and taking full thickness skin graft.

Conclusion

Briefly, if the distance between two phalanges` center is more than 1.5 times of the phalange's diameter, there will be no need for skin graft, leading to easy preoperative measurement and avoiding unwanted tense sutures or prepped for graft harvesting.

Conflict of Interests

Authors have no conflict of interests.

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