Assessment of surgery for the underdeveloped thumb

Many congenital conditions result in an underdeveloped thumb. Classical thumb hypoplasia is part of the spectrum of radial longitudinal deficiency. Thumb duplication, even when accompanied by one clearly dominant thumb, presents with some deficiencies of both when they are compared with a normal thumb. The thumb of symbrachydactyly is underdeveloped, particularly that of the more severe types. Cleft hand complex, so often accompanied by synpolydactyly, may have, in simpler cases, first web deficiency and, in more complex cases, partial or complete thumb absence. The ‘clasped thumb’ of arthrogrypotic children, thumb absence in ulnar dimelia and the abnormal development of a triphalangeal thumb or the radial digit of a five-fingered hand are other examples of conditions in which the thumb is underdeveloped.

This begs the question as to what determines normal thumb function. The characteristics of a normal thumb are its size, shape, stability and mobility. After surgery external scars are present, as are other biological responses. Furthermore, assessment of these characteristics demands consideration of the appearance of nail, pulp and shape; measurement of length and width; the presence of deformity within bone or at the joint[s]; stability and rotation at interphalangeal, metacarpophalangeal (MP) and carpometacarpal (CMC) joints; measurement of strength through assessments of various forms of pinch and gross grip of objects of different diameters; and testing of sensibility. Although the thumb is said to provide for 40%–50% of hand function, the status of the fingers must also be considered. To achieve dexterity of pinch to the index or middle finger, and incorporation of the thumb into power grip activities requires mobility and stability of the radial two fingers for the former and preferably four digits of mobility, stability and strength, unaffected by stiffness or absence, for the latter.

How do we best assess thumb function after surgery? Six of seven articles dealing with congenital hand anomalies in this issue detail outcomes following reconstructive surgery of the thumb. Remarkably, different assessment criteria are utilized to describe thumb function in each, possibly because different parameters of measurement may be more appropriately applied to specific conditions and are less applicable for other conditions, e.g. a greater emphasis on distal joint function in type 2 or type 4 thumb duplications as against a need to better assess CMC joint function following pollicization.

Al-Qattan [2016] addresses the problem of severe flexion contractures and instability of the proximal interphalangeal joint of an index finger to be pollicized. That these factors do not prevent pollicization is a point well made. His assessment of thumb function following surgery is simple and practical, but differs in turn from the assessment processes utilized by de Kraker et al. [2016] in their assessment of surgical reconstruction of grade 2 and grade 3A thumb hypoplasia, which differs from the outcome assessment for radial polydactyly used by Djikman et al. [2016] from the same department. This modifies the assessment chart of the Japanese Society for Surgery of the Hand (JSSH). It is impressive in intent and content. It increases the weight of aesthetic outcome measures and subjective patient opinion. However, whether this chart improves the ability to define a successful reconstruction is unclear. The decision to decrease the relative importance of measurement of MP joint deviation is questionable. The last article is in conflict with He and Nan [2016], who devote their article to revision surgery for post-operative failures, in which MP joint deviation reflects a failure to realign the skeleton axially or correct soft tissue deforming forces, and is one of the main indications for revision surgery.

MP joint instability is an important outcome measurement in the article of de Kraker et al. [2016]. Failure to correct MP joint instability will affect the quality of function at the CMC joint, particularly motion in palmar abduction and opposition, no matter which opposition transfer is used. Interestingly, their transfer of flexor digitorum superficialis failed to provide MP joint stability by their definition in 60% of grade 3A thumbs.

Although some are critical of comparison with a normal opposite thumb, the worth of this is emphasized in the article of Engelhardt et al. [2016] in which the range of ulnar and radial deviation on stress testing in normal MP joints is very broad. A normal opposite thumb, when present, gives indication of the normal parameters for that particular patient. The
instability of the grade 3A thumbs reported by de Kraker et al. (2016), albeit in three of five patients only, was 33° (range 31°–34°). Is this of clinical relevance given that a thumb with 30° of deviation is considered to be stable? The question of clinical relevance, even when statistical significance is present, also arises when considering differences in hand function of patients with 107% of normal little finger abduction strength following an flexor digitorum superficialis opposition transfer. Perhaps this is less important functionally than the 20% loss of grip strength following flexor digitorum superficialis transfer, even if not of statistical significance in this study. In these instances, statistical significance in isolation may not be helpful in an analysis of functional outcome.

One deficiency of most current outcome measures lies in their failure to incorporate the pre-operative status of the thumb characteristics detailed above. The ability to create a thumb with a high functional and aesthetic score at any post-operative assessment is dependent upon the quality of the digit to be reconstructed.

A pre-operative severity of grading of radial dysplasia by Vilkki allows realistic assessment of surgical outcomes following reconstruction of wrist and thumb, and is a guide for all of us (Vilkki, 2014). A modification of Blauth’s classification of thumb hypoplasia attempts to better define the pre-operative status of patients with similar deficiencies, allowing post-operative comparison of like with like (Tonkin, 2014). The difference between the characteristics of grades 2 and 3A of de Kraker et al. (2016) is less than clear as they fail to document extrinsic anomalies, the main distinction made by Manske and McCarroll between these grades (incidentally, in 1992 not 1978) (Manske and McCarroll, 1978, 1992). The modified classification includes the information gained at pre-operative assessment and at the time of surgery, when assessments of alignment, instability and passive ranges of motion are more reliable. The ability to assess active motion and strength, is, of course, very difficult, if not impossible pre-operatively, given the age of the children.

The search for optimal assessments of hand and thumb function in the paediatric hand is also relevant to the excellent results presented following toe-to-hand transfer in the contribution by Nikkhah et al. (2016). Their motor assessment is defined by the ability to achieve fine grip, small grip, large grip and a comparison of total active and total passive ranges of motion, which they acknowledge differ significantly. These measurements are pertinent, but all who deal with the condition of unilateral symbrachydactyly marvel at the functional ability of the child who has not undergone surgery. Our assessment of this condition should include comparisons between age-matched groups, unoperated and operated, who begin with similar deficiencies.

This editorial may raise questions without providing answers. Nevertheless, the variation in methods of outcome measurement of thumb function suggests that consistency and efficacy of current methods are less than ideal. Perhaps it would be appropriate to consider whether it is possible to apply a standard global assessment of thumb function to all congenital conditions affecting the thumb. From this, it may be possible to agree upon those parameters which best reflect the thumb anomalies pertinent for assessment of each particular condition. Thumb function assessments should compare pre- and post-operative measurements where practical, and include comparison with normal thumb function and appearance, the opposite thumb when appropriate or documented normal population values when not.

References


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