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Original article

Untethering physiolysis for delta phalanx (longitudinally bracketed diaphysis) combined with free fat interposition graft

Physiolyse ablative pour phalange delta (pont cartilagineux collatéral) associée à une greffe libre d'interposition de tissu adipeux

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ABSTRACT

We report the results of physiolysis of the epiphyseal bracket combined with free fat grafting for the treatment of delta phalanx. Thirteen cases (five patients) were included. Mean patient age was 6.6 years (range, 4–9). The patients underwent physiolysis in which the epiphyseal bracket was cut and replaced with a free fat graft. The angle between the long axis of the proximal and distal phalanges and the ratio between the width and length of the affected middle phalanx were evaluated on plain radiographs. The range of motion in the fingers was also evaluated. The mean follow-up period was 42.2 months (range, 25–61). The mean correction angle was 17.1° (range; 13–23). The mean width-to-length ratio of the affected phalanx was improved from 0.6 to 0.47. The range of motion was maintained at the previous level. Physiolysis by untethering the bracketing epiphysis and free fat grafting can alleviate the angulation of clinodactyly, especially in growing children. It also allows catch-up growth in the middle phalanx.

RÉSUMÉ

Nous rapportons les résultats de la physiolyse du pont cartilagineux collatéral associée à une greffe libre de tissu adipeux dans le traitement de la phalange delta. Treize cas (cinq patients) ont été inclus. L'âge moyen était de 6,6 ans (extrêmes 4–9). Les patients ont subi une physiolyse pendant laquelle le pont cartilagineux collatéral a été coupé et une greffe de graisse libre a été réalisée. L'angle entre l'axe longitudinal des phalanges proximale et distale et le rapport entre la largeur et la longueur de la phalange moyenne affectée ont été évalués sur de simples radiographies. L'amplitude des mouvements des doigts a aussi été évaluée. La durée moyenne de suivi était de 42,2 mois (25 à 61 mois). L'angle moyen de correction était de 17.4° (11 à 25°). La moyenne du rapport de la largeur à la longueur de la phalange affectée a été améliorée, passant de 0,6 à 0,47. L'amplitude des mouvements a été maintenue au niveau préopératoire. La physiolyse par ablation du pont cartilagineux collatéral et libre greffe de tissu adipeux peut diminuer l'importance de la clinodactylie, en particulier pendant la croissance de l'enfant, avec l'avantage d'un rattrapage secondaire de la croissance dans la phalange.

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1. Introduction

Clinodactyly is a term used to describe a finger or toe deformity in the frontal (coronal) plane. Among various factors, delta phalanx has often been described as a cause of clinodactyly, which usually appears in the middle phalanx of a finger [1]. Since Jones described delta phalanx and the disappointing results of splinting, various surgical techniques have been introduced. They encompass open wedge osteotomy with and without bone graft [1,2], closing wedge osteotomy [3], reverse wedge osteotomy [4], and physiolysis with or without fat interposition [1,5–10]. After Vickers reported favorable results of physiolysis with fat grafting [8], many reports on this surgical procedure have been published on the delta phalanx [7,11]. Our focus was on removing the angular deformity and restoring the length of the affected middle phalanx by resecting the epiphyseal bracket.

The purpose of this study was to evaluate the clinical and radiological outcomes of physiolysis of the continuous epiphysis combined with free fat grafting to treat angular deformities due to delta phalanx.

2. Materials and methods

2.1. Patients

We retrospectively reviewed the medical records and radiographs of patients who underwent surgery for clinodactyly due to delta phalanx (Fig. 1). Patients who underwent physiolysis and free fat interposition grafting for delta phalanx were included in this study. Delta phalanx or a triangular shaped bone other than the middle phalanx was excluded. Patients who underwent other procedures such as osteotomy or bone grafting were also excluded. Five patients (13 cases) were reviewed for this study. The surgery had been performed between 2008 and 2014. Institutional review board approval was obtained. The surgical indication was progressive angular deformity of the finger due to a delta phalanx at every 6 months of follow-up. If the patients complained of a functional problem such as difficulty in playing a musical instrument, the digits with the delta phalanx were also indicated for surgery (Fig. 2). Mean age of the patients was 6.6 years (range, 4–9). Other demographics are given in Table 1.

2.2. Surgical technique

The technique is similar to that of Vickers [8] but with a smaller incision. Under general anesthesia, a midline incision was made at the side with the bracket of the physis. Taking care not to damage the dorsal branch of the proper palmar digital nerve, the bracket was exposed by incising the periosteum. The surface of the physeal bracket resembled a white cartilaginous cap. The midpoint of the physeal bracket was marked using fluoroscopy. A number 15 scalpel blade was used to remove a segment of the cartilaginous portion until the diaphysis of the middle phalanx was reached (Fig. 3). A small amount of free fat was harvested from the hand or medial aspect of forearm and inserted into the space where the cartilage had been removed (Fig. 4). The excised cartilaginous portion was sent to pathology. Skin suture using 5-0 nylon was

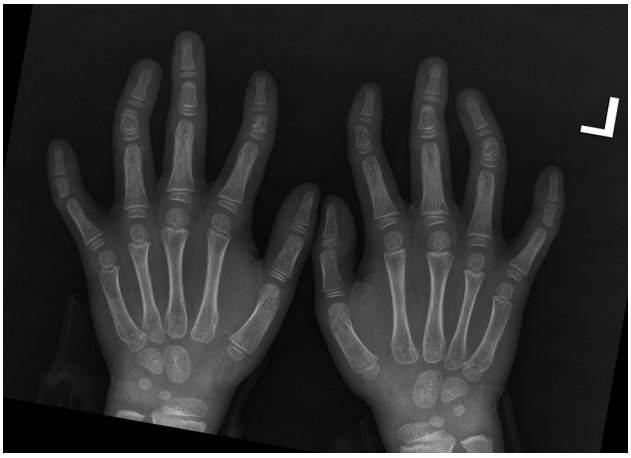

Fig. 1. Anteroposterior plain radiograph of a 9-year-old boy with multiple clinodactyly deformities caused by delta phalanx in the middle phalanx.

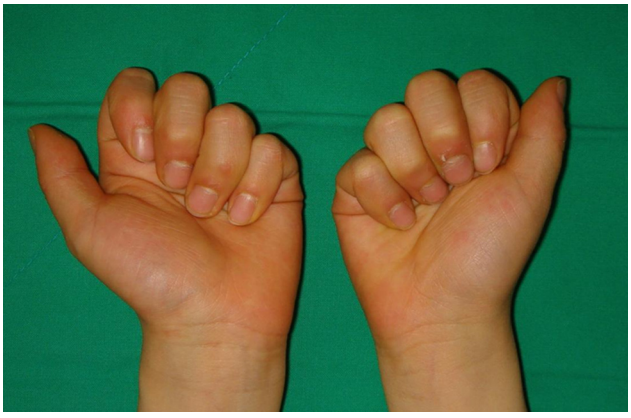

Fig. 2. Multiple delta phalanx deformities leading to mild scissoring during flexion. The boy complained of difficulty playing the piano.

Table 1
Patient demographics and results.

Patient No.	Sex	Age (years)	Follow-up (months)	Involved finger	Preop deviation angle	Postop deviation angle	Preop width-to-length ratio	Postop width-to-length ratio
1	M	4	61	R5	34	11	0.57	0.51
				L5	28	12	0.55	0.47
2	M	9	60	R2	27	10	0.7	0.47
				R4	28	11	0.58	0.37
				L2	28	10	0.55	0.41
				L3	19	5	0.57	0.38
				L4	34	15	0.64	0.44
3	M	8	35	R5	34	12	0.56	0.46
				L5	31	12	0.58	0.48
4	M	6	30	R5	24	10	0.76	0.59
				L5	21	8	0.7	0.64
5	F	6	25	R5	25	9	0.49	0.43
				L5	22	9	0.5	0.43

F: female; L: left; M: male; R: right.

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