Distraction - A Minimally Invasive Technique for Treating Camptodactyly and Clinodactyly

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Abstract

Camptodactyly and clinodactyly are relatively common congenital anomalies affecting about 1% to 2% of the general population. Though functional impairment is uncommon other than in very severe cases, patients affected do present very often for correction. The kind of surgeries available is as diverse as the aetiology of the conditions. It ranges from simple release of the flexor digitorum sublimis (FDS) to more complex small muscle transfers, rebalance etc. In this short series a relatively easier, minimally invasive technique of distraction has been used to correct these deformities with gratifying results.

MJAFI 2004; 60 : 227-230

Key Words : Common deformity; Minimally invasive procedure; Patient satisfaction

Introduction

Camptodactyly (the congenital or developmental antero-posterior flexion deformity of the proximal interphalangeal joint of the fingers unrelated to trauma, systematic disease or neurological abnormality) and clinodactyly (radio-ulnar deviation of the fingers) are relatively common conditions found in about 1% - 2% of the population [1]. Both are complex conditions characterized by abnormal intrinsic and other muscle anatomy in case of camptodactyly and an abnormal middle phalanx in clinodactyly [2]. Standard treatment for the conditions has been complicated open surgery with release, re-insertion / transfer of tendons, different types of wedge osteotomies etc.

The relatively minimally invasive technique of distraction has been successfully applied in treating 11 cases of camptodactyly and clinodactyly. Though the series is small it represents a change in the concept of management of these conditions.

Material and Methods

There were 8 cases of camptodactyly, all congenital or developmental (5 unilateral and 3 bilateral), and 3 cases of clinodactyly (2 unilateral and one bilateral) [Table 1].

Camptodactyly

The youngest patient was a 6 year old girl, the oldest a 44 year old father of a soldier. The commonest digit affected was the little finger in 6 cases, the ring in 1, and unusually the middle finger in 1 case.

Other than in two children, the distractors were applied under a digital block by the passing of two K-wires in radio-ulnar plane through the middle and the proximal phalanx. On table distraction straightening was achieved by 10% to 15% without compromising the vascularity of the finger. Subsequently, distraction was started from the next day and done at the rate of 1mm per day till complete straightening was achieved in 2-4 weeks. The operating surgeon did the initial distraction. The patient / relatives were then trained to open the distractor at home and only come for weekly / bi-weekly review in out patient department (OPD). Once completely straightened, the distractors were maintained in place for 4 weeks. Following removal of the distractor, splintage was maintained for 4-6 weeks. Active mobilization with night splintage was then done for 4 weeks.

Clinodactyly

Of the 3 patients, both the adult patients (females aged 18 years and 19 years respectively) had presented for cosmetic correction for the deviated little fingers. Though the fingers were small in comparison to the other hand, simple soft tissue

Table 1

	Ages				Sex		Side	
	0-10	10-20	20-40	>40	M	F	Unilateral	Bilateral
Camptodactyly	2	4	1	1	7	1	5	3
Clinodactyly	1	2	-	-	1	2	2	1

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differential lengthening on the ulnar side was adequate to correct the deformity.

In the 10 year boy with a bilateral deformity and the classical delta phalanx an opening osteotomy was performed on the radial aspect of the middle phalanx. Then 0.8 mm K-wires were passed through the middle phalanx proximal to the osteotomy, and the distal phalanx as there was not adequate length in the middle phalanx to get a purchase with the K-wire. Differential distraction was then done on the radial aspect. Distraction was done again at the rate of 0.5mm twice a day till adequate straightening and lengthening was achieved. The distractors were then maintained in place for 6 weeks till callostasis and bony consolidation was complete. The distractors were then further retained for two weeks, removed and followed by splintage to the fingers for 4 weeks. This was followed by active mobilization and night splintage for 4 weeks.

Results

Camptodactyly

The results of distraction for camptodactyly have been extremely gratifying. 100% straightening was achieved in all patients who completed treatment (Fig 3). Subluxation of the proximal interphalangeal joint (PIP) took place in one initial case where the axis of distraction was not in the correct plane. Early detection and re-insertion of the K-wires corrected the subluxation and the deformity. Following active and passive physiotherapy good function returned in the finger. Due to the anatomical abnormality caused by the chisel shaped head of the proximal phalanx and the broadened or indented base of the middle phalanx on straightening the finger, in some patients the PIP joint used to look swollen and deformed.

The only recurrence took place in a 44 year patient due to poor compliance with post-operative splintage. It was then realized that splintage after removal of the distractors had to be rigorously followed especially in adults. In the follow up of the other patients, the longest being for over 2 years, there has been no recurrence.

Clinodactyly

The result of distraction in the teenagers with cosmetic deformity was extremely gratifying as the aim of cosmetic and functional correction was achieved and the patient satisfaction level was high.

In the boy treated with wedge osteotomy and distraction the results were gratifying (Figs 4,5,6,7). Functional results were good - the major advantage was that the length of the digit was increased unlike in a closing wedge osteotomy where there is shortening. Callostasis achieved was good and in the follow up done for over 6 months there has been no recurrence or growth deformity.

Complications

There were relatively very few complications. Subluxation took place in one of the earlier cases, but was easily corrected. Thickening and swelling of the PIP joint due to ossification of the collateral ligaments took place in one case. With good physiotherapy the function in the digit was not impaired.

There were no pin tract infections as the selected patients were intelligent enough to maintain good local hygiene.

Discussion

“Camptodactyly” was coined in 1846 by Tamplin to describe a flexion deformity of the PIP joint of the little finger in an antero-posterior direction [3]. Though documented studies show it to account for 5% of congenital hand anomalies and 1% of general congenital anomalies [1, 2], the true incidence is probably higher as contractures of less than 20% are rarely symptomatic and hence not recorded. Though initially used to describe the deformity for the little finger it is now used to describe the deformity in all fingers [4, 5]. Functional impairment in this condition is rare, other than in the very severe cases. Aetiologically the condition has been postulated to be due to a dynamic imbalance caused by abnormal intrinsic anatomy. An abnormal lumbrical insertion is the commonest cause [6]; shortening of the FDS in other cases [6,7]; the central slip of the extensor tendon has been implicated by some authors [8]. As numerous and conflicting the aetiologies are, so too the myriads of surgical treatment advocated. Splinting was advised for the very young and where the deformity is less than 60° and reducible [9,10,11]. Surgery ranges from the simple release of the FDS [6] or a tight lumbrical [7] to more complicated procedures of release of collateral ligaments and rebalance with tendon transfers [6-12]. Most of these procedures involve complicated and delicate surgeries including skin cover with full thickness graft (FTGs) for defects created. Results from the procedures reported, range from good to poor [6-12], the best results having been where FDS was independent, contracture was less than 45°, and the PIP was not clinically fixed.

There is no reported literature on the use of distractors for treating camptodactyly. Though our series using this innovative technique is a short one, the results have been very gratifying.

“Clinodactyly” or radio-ulnar deviation of the digits is a common congenital anomaly of the hand with a reported incidence of 19.5% in a non-Caucasian population [2]. It is reported in about 1% of normal newborns and 10% of abnormal newborns [13]. The most commonly affected digit is the little finger; the proximal phalanx of the thumb is the second most common site of occurrence. An inherited disorder with a dominant trait [13,14], the condition is usually bilateral [13,14]. It usually results from an angulated short tubular bone - the “delta” phalanx - the middle phalanx commonly as the middle phalanx is the last bone in the hand to ossify [14,15]. However, not all cases of clinodactyly are caused by bony abnormalities; some involve soft tissue deficiencies only. Even in more severe

Fig. 1 : Camptodactyly of the middle finger

Fig. 2 : Straightening as obtained on the table under digital block after application of the distractor

Fig. 3 : On completion and removal of distraction

Fig. 4 : Bilateral clinodactyly of the little finger

Fig. 5 : X-ray of opening wedge osteotomy and distraction in progress

Fig. 6 : Correction in progress

Fig. 7 : Correction in progress

cases functional limitations are rare and surgery is usually indicated for cosmetic reasons. Hence treatment is delayed till the child is at least over 6 years and co-operative [15,17]. Mild clinodactyly needs no treatment other than reassurance.

In more severe cases treatment described has so far been surgical, by way of an opening wedge osteotomy [15,16,17]; closing wedge osteotomy [14,15]; a reverse wedge osteotomy [18]; or resection of the bracket and interposition of an H-graft [19] or a fat graft [20].

There are no reports of treatment of this condition with the use of external fixation and distraction devices without open surgery. In this short series where only distraction was done for two young teenagers the ultimate cosmetic result achieved was good and the patient satisfaction level was high. In the young boy where distraction and bony callostasis of a wedge osteotomy was achieved the results were gratifying - for unlike in a closing wedge osteotomy where the digit length is shortened, here digit lengthening was achieved.

Though this series is small, distraction as opposed to open surgery has been successfully used to treat camptodactyly and clinodactyly. It is a relatively minimally invasive procedure; majority of cases can be operated under regional anaesthesia (digital blocks), and treatment can even be done on an OPD basis. There is thus considerable saving of hospital resources by way of operation room time, general anaesthesia, and hospital bed occupancy. The distractors are re-utilisable as only the K-wires are expendable. The procedure being simple, intelligent patients are easily trained to do the distraction at home and come only for OPD follow-up.

There is no need to emphasize on the elimination of the complications of open surgery such as injury to the neuro-vascular bundles, wound infections, and graft loss where split skin graft (SSG) / FTG is needed. The cosmetic and functional results with distraction are highly satisfactory. The aim of this paper is to offer distraction as an easy, minimally invasive procedure for the treatment of camptodactyly and clinodactyly.

References

1. Littman A, Yates JW, Treger A. Camptodactyly - A kindred study. *JAMA* 1968;206:565.
2. Flatt AE. The care of congenital hand anomalies. 2nd ed., St.Louis: CV Mosby Company, 1994:207-17.
3. Tamplin RW. Lecture on the nature and treatment of deficiencies, London; Longman, Brown, Green, Longman and Roberts, 1846.
4. Courtemanche AD. Camptodactyly: Aetiology and management. *Plastic Reconstr Surg* 1969;44:451-4.
5. Swanson AB. A classification for congenital hand malformations. *J Hand Surg* 1983;8:693-702.
6. Mc Farlane RM, Curry GI, Evans HB. Anomalies of the small muscles of the hand in camptodactyly. *J Hand Surg* 1983;9:531.
7. Mc Farlane RM, Clausen DA, Pote AM, Botz JS. The anatomy and treatment of camptodactyly of the small finger. *J Hand Surg* 1992;17A:35-44.
8. Smith RT, Kaplan EB. Camptodactyly and similar atraumatic flexion deformities of the PIP joints of the fingers. *J Bone and Joint Surg* 1968;50A:1187-1203.
9. Millesi H. Camptodactyly. In: Littler JW, Cramer LM, Smith JW, editors. Symposium on Reconstructive Hand Surgery, St. Louis, CV Mosby, 1974:175-7.
10. Hori M, Nakamural, Inone G et al. Non operative treatment of camptodactyly. *J Hand Surg* 1987;12:1061-3.
11. Benson LS, Waters PM, Kamil NL et al. Camptodactyly: Classification and results of non-operative treatment. *J of Paed Orthop* 1994;14:814-9.
12. Miura T, Nakamura R, Tamura Y. Longstanding extended dynamic splintage and release of abnormal restraining structures in camptodactyly. *J Hand Surg* 1992;17B:665-72.
13. Hersch AH, DE Marinis F, Stecher RM. On the inheritance and development of clinodactyly. *Am J Human Genet* 1953;5:257.
14. Wood VE, Flatt AE. Congenital triangular bones in the hand. *J Hand Surg* 1977;2:179-93.
15. Wood VE. Clinodactyly. In: Green DP, editor. Operative Hand Surgery, 4th ed, New York: Churchill Livingstone 1993:423-7.
16. Jones GB. Delta Phalanx. *J Bone Surg* 1964;46B:226-8.
17. Smith RJ. Osteotomy for 'delta phalanx' deformity. *Clin Orthop Rel Res* 1977;123:91.
18. Carstam N, Theander G. Surgical treatment of Clinodactyly. *Scad J Plast Reconstr Surg* 1975;9:199-202.
19. Burgess. Use of an H-graft in the treatment of delta phalanx. *J Hand Surg* 1988;13A:297.
20. Vickers D. Clinodactyly of the little finger: A simple operative technique for reversal of growth abnormality. *J Hand Surg* 1987;12B:335.

1. Littman A, Yates JW, Treger A. Camptodactyly - A kindred