Nonoperative Treatment of The Boutonniere Deformity: Is There a Difference in Outcomes?

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INTRODUCTION: Conservative treatment is a mainstay for management of Boutonniere deformities. However, the optimal nonoperative treatment protocol remains controversial. Hence, we aimed to evaluate the impact of nonsurgical treatment methods on finger motion.

METHODS: This was a retrospective study of patients with a Boutonniere deformity that were treated nonoperatively by board-certified hand surgeons. Conservative treatments included hand therapy, dynamic and/or static orthotic wear, and a home exercise program. Other data points of interest included pre- and post-treatment digit range of motion (ROM), mechanism and chronicity of injury, and associated fractures. Based upon active ROM at the proximal interphalangeal joint (PIP), digits were graded as Poor, Good, or Excellent both pre- and post-treatment. Then, a change in ROM grade was calculated. Standard statistical analyses (ANOVA, student's t-test, chi-squared test) were performed to evaluate the treatment modalities and changes in ROM grade.

RESULTS:

A total of 111 digits from 106 patients were included. Overall, the small finger was the most commonly affected digit (45%). Traumatic injury was the most common mechanism (86.5%), whereas inflammatory arthritis (4.5%) made up a minority. There were 14 digits with associated fractures of the proximal (1.8%) or middle (10.8%) phalanx. All digits but one received an orthotic. 93 digits (83.8%) received more than one treatment type. Average total treatment length and follow-up was 14.6 weeks, and average number of therapy sessions was 9.3 per digit.

Pre-treatment, there were 63 Poor, 29 Good, and 19 Excellent digits, with average total arc of motion of 47.3, 78.4, and 84.2 degrees, respectively (P<0.01). Post-treatment, there were 28 Poor, 34 Good, and 49 Excellent digits, with average total arc of motion of 57.0, 81.4, and 98.4 degrees, respectively (P<0.01). 49 digits had no change in ROM grade after treatment, 37 with one grade of improvement, 18 with two grades of improvement, and seven with one grade worse of ROM. Across these four cohorts, there were no statistically significant differences in patient demographics, digit affected, mechanism, or associated fracture (P>0.05). Notably, there also were no differences in type or length of conservative treatment between the cohorts (P>0.1), nor were there differences in presence of residual PIP extensor lag, post-treatment digit pain, or other associated symptoms (P>0.1).

DISCUSSION AND CONCLUSION:

Common nonoperative treatment methods for Boutonniere deformities include hand therapy, dynamic/static orthotics, and home exercises. Improvement in digit ROM was not associated with a particular type or length of conservative treatment. However, one to two grades of ROM improvement can be achieved and involves a dedicated course of orthotic-wear and usually hand therapy.

Table 1: Numerical cutoffs and descriptive definitions for PIP joint ROM grading

ROM grade	Numerical Cutoffs	Descriptive definitions
Poor	>20° extensor lag AND/OR <60° total arc of motion	"Significant," "rigid," or "fixed" deformity AND/OR "Limited" ROM
Good	≤20° extensor lag BUT ≤90° terminal flexion (e.g. 20 to 90° range) AND ≥60° total arc of motion	"Mild" or "some" deformity
Excellent	<20° extensor lag AND >90° flexion	"Minimal" or "slight" deformity AND/OR "Full" or "normal" ROM

Abbreviations: PIP = proximal interphalangeal, ROM = range of motion

Table 2: Overall Patient Demographics and Bootonniere Statistics

Variable	Average/Proportion (%)
Average Age at diagnosis (years)	44.89 ± 2.03 (SEM)
Gender (F)	35 (33.0%)
BMI (kg/m²)	26.13 ± 0.51 (n = 95)
Digit Affected	--
IF	10 (9.01%)
MF	30 (27.0%)
RF	21 (18.9%)
SF	50 (45.0%)
Thumb	0 (0%)
Mechanism	--
Acute/Subacute Trauma	96 (86.5%)
Unknown cause	9 (8.11%)
Inflammatory arthritis (Psoriatic, Rheumatoid)	5 (4.50%)
Infection	1 (0.90%)
Associated Fracture	14 (12.6%)
P1	2 (1.80%)
P2	12 (10.8%)
Conservative Treatment Measures	
Hand therapy	65 (58.6%)
Average # sessions	9.3 ± 0.79 (n = 47)
Orthotics	110 (99.1%)
Static/Static Progressive only	29 (26.1%)
Dynamic only	15 (13.5%)
Both in sequence	27 (24.3%)
Not specified	39 (35.1%)
Home exercises	87 (80.4%)
>1 type of treatment	93 (83.8%)
1 type only (splint only)	18 (16.2%)
All 3 types	38 (34.2%)
Average length of treatment (days)	102.5 ± 7.42
Residual post-tx PIP joint extensor lag	67 (60.4%)
Pain in Digit	12 (10.8%)

(n = number of digits included in calculations if some entries lacked numerical data)

Abbreviations: SEM = standard error, F = female, BMI = body mass index, kg = kilogram, m = meter, IF = index finger, MF = middle finger, RF = ring finger, SF = small finger, PA = proximal phalanx, PA = middle phalanx, post-tx = post-treatment, PIP = proximal interphalangeal

Table 3a: Pre-treatment ROM values and grading for the PIP joint

Pre-treatment	# of digits	Average ROM (Terminal Extension to Flexion)	Average total arc of motion
Poor	63 (56.8%)	58.3° ± 2.04° (SEM) (n = 53) to 86.7° ± 2.42° (n = 42)	47.3° ± 2.53° (n = 42)
Good	29 (26.1%)	13.3° ± 1.51° (n = 21) to 90.7° ± 2.80° (n = 15)	78.4° ± 2.47° (n = 15)
Excellent	19 (17.1%)	12.9° ± 3.54° (n = 11) to 96.7° ± 1.67° (n = 8)	84.2° ± 1.40° (n = 8)
P-value (**P <0.05**)	--	Extension: **1.93E-12** Flexion: 0.22	**3.42E-11**

(n = number of digits included in calculations if some entries lacked numerical data)

Table 3b: Post-treatment ROM values and grading for the PIP joint

Post-treatment	# of digits	Average ROM (Extension to Flexion)	Average total arc of motion
Poor	28 (25.2%)	29.6° ± 3.04° (n = 26) to 88.7° ± 4.44° (n = 23)	57.0° ± 3.02° (n = 23)
Good	34 (30.6%)	9.09° ± 1.60° (n = 32) to 90.5° ± 0.82° (n = 31)	81.4° ± 1.50° (n = 31)
Excellent	49 (44.1%)	5.22° ± 1.05° (n = 31) to 102.9° ± 1.69° (n = 20)	98.4° ± 2.18° (n = 20)
P-value (**P <0.05**)	--	Extension: **1.82E-13** Flexion: **9.14E-6**	**7.69E-19**

(n = number of digits included in calculations if some entries lacked numerical data)

Abbreviations: ROM = range of motion, PIP = proximal interphalangeal, # = number, SEM = standard error

Table 4: Patient demographics and Bootonniere statistics stratified by Change in PIP joint ROM grade

	No Change	+1	+2	-1	P-value (**P < 0.05**)
Digits by Cohort*	49	37	18	7	
Average Age at diagnosis (years)	47.9 ± 3.14 (SEM)	41.8 ± 3.37	41.7 ± 5.25	51.1 ± 6.04	0.43
Gender (F)	20 (43.5%)	11 (30.6%)	4 (22.2%)	0 (0%)	0.08
BMI (kg/m²)	26.7 ± 0.85 (n = 39)	26.7 ± 0.91 (n = 32)	25.6 ± 0.89 (n = 16)	27.1 ± 1.38 (n = 7)	0.19
Digit Affected*					
IF	5 (10.2%)	3 (8.16%)	1 (5.56%)	1 (14.3%)	0.98
MF	13 (26.6%)	10 (27.0%)	4 (22.2%)	1 (14.3%)	
RF	9 (18.4%)	8 (21.6%)	3 (16.7%)	1 (14.3%)	
SF	20 (40.8%)	16 (43.2%)	10 (55.6%)	4 (57.1%)	
Thumb	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
Mechanism*					
Acute/Subacute Trauma	38 (77.6%)	33 (89.2%)	18 (100%)	7 (100%)	0.26
Unknown cause	5 (10.2%)	4 (10.8%)	0 (0%)	0 (0%)	
Inflammatory arthritis	3 (6.12%)	0 (0%)	0 (0%)	0 (0%)	
Infection	1 (2.04%)	0 (0%)	0 (0%)	0 (0%)	
Associated Fracture	8 (22.2%)	4 (10.8%)	2 (11.1%)	2 (28.6%)	0.82
Conservative Treatment Measures					
Hand therapy	30 (62.2%)	18 (48.6%)	13 (72.2%)	4 (57.1%)	0.29
Average # hand therapy sessions	8.43 ± 0.58	9.85 ± 1.09	10.3 ± 1.86	9.25 ± 2.37	0.82
Orthotics	49 (100%)	36 (97.3%)	18 (100%)	7 (100%)	0.57
Orthotics by type*					
Static/Static Progressive only	16 (32.7%)	10 (27.0%)	2 (11.1%)	1 (14.3%)	0.52
Dynamic only	7 (14.3%)	5 (13.5%)	3 (16.7%)	2 (28.6%)	
Both in Sequence	8 (16.3%)	12 (32.4%)	5 (27.8%)	2 (28.6%)	
Not specified	18 (36.7%)	11 (29.7%)	8 (44.4%)	2 (28.6%)	
Home exercises	39 (79.6%)	33 (62.2%)	16 (55.6%)	5 (71.4%)	0.88
>1 type of treatment	39 (79.6%)	31 (83.8%)	16 (88.9%)	7 (100%)	0.31
Therapy + Orthotics	10 (20.4%)	8 (21.6%)	6 (33.3%)	2 (28.6%)	0.78
Therapy + exercises	0 (0%)	1 (2.7%)	0 (0%)	0 (0%)	0.57
Orthotics + exercises	9 (18.4%)	13 (35.1%)	3 (16.7%)	3 (42.9%)	0.17
Orthotics only	10 (20.4%)	6 (16.2%)	2 (11.1%)	0 (0%)	0.51
All 3 types	20 (40.8%)	9 (24.3%)	7 (38.9%)	2 (28.6%)	0.42
Average length of treatment (days)	92.3 ± 10.1 (n = 40)	101.0 ± 13.7 (n = 27)	115.9 ± 24.1 (n = 16)	148.1 ± 56.6 (n = 7)	0.28
Residual post-tx PIP extensor lag	35 (71.4%)	20 (54.0%)	8 (44.4%)	4 (57.1%)	0.17