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Long-term Effectiveness of Repeat Corticosteroid Injections for Trigger Finger

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Abstract

Purpose—To quantify the long-term success of repeat injections for trigger fingers and to identify predictors of treatment outcomes.

Methods—This retrospective case series analyzed 292 repeat corticosteroid injections for trigger fingers administered by hand surgeons at a single tertiary center between January 2010 and January 2013. One hundred eighty-seven patients (64%) were female, 139 patients (48%) had multiple trigger fingers, and 63 patients (22%) were diabetic. The primary outcome, treatment failure, was defined as receiving a subsequent injection or surgical treatment. Patients without either documented failure or a return office visit in 2015–2016 were surveyed by telephone to determine if they had required subsequent treatment. Kaplan-Meier analyses with log-rank testing assessed the median time to treatment failure and the effect of demographic and disease-specific characteristics on injection success rate while predictors of injection outcome (success vs failure) were assessed with multivariable logistic regression.

Results—Second injections provided long-term treatment success in 39% (111/285) of trigger fingers with 86 receiving an additional injection and 108 ultimately undergoing surgical release. Thirty-nine percent (24/62) of third injections resulted in long-term success, with 22 receiving an additional injection, and 23 ultimately undergoing surgery. Median times-to-failure for second and third injections were 371 and 407 days respectively. Success curves did not differ significantly according to any patient or disease factor. Logistic regression identified that advancing patient age and injection for trigger thumb were associated with success of 2nd injections.

Conclusion—Thirty nine percent of second and third corticosteroid injections for trigger finger yield long-term relief. While most patients ultimately require surgical release, 50% of patients receiving repeat trigger injections realize one year or more of symptomatic relief. Repeat injections of trigger fingers should be considered in patients who prefer non-operative treatment.

Level of Evidence—IV, Therapeutic

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Keywords

corticosteroid; injection; repeat; stenosing tenosynovitis; trigger finger

INTRODUCTION

Corticosteroid injections are the definitive treatment for the majority of newly diagnosed trigger fingers.[1–12] The response to initial corticosteroid injections is well-studied with the percentage of symptom-free patients gradually declining over the first year after injection before plateauing at 45% treatment success by five years.[13,14] Factors impacting the outcome after initial trigger finger injection include symptom duration,[2,3] nodule type,[8] finger involved,[7,9] presence of multiple trigger fingers,[2,9,13,14] sex,[7,14] age,[13] comorbid upper extremity tendonopathies,[13] and diabetes.[15,16]

The chance of long-term success after second and third injections for trigger finger is less precisely understood. Estimates for the chance of symptomatic relief ranges from 23–79% for second injections and from 6–74% for third injections.[2,4,5,9,10,13,17] These wide ranges reflect prior studies reporting these outcomes with secondary descriptive statistics as opposed to being evaluated as a primary research focus.

Based on the available literature, surgeons are unable to counsel patients precisely regarding the risk of symptom recurrence after a repeat corticosteroid injection. Furthermore, the pattern of symptom recurrence over time and the factors impacting treatment success remain unclear. This study was designed to quantify the likelihood of long-term success after second and third corticosteroid injections for trigger fingers. The secondary aim was to identify factors predictive of treatment success. Our working hypothesis was that the success of repeat injections would be less than initial injections and that factors associated with the success of initial injections (i.e., multiple trigger fingers, diabetes) would impact the chance of success with repeat injection.

MATERIALS AND METHODS

Participant Selection

This institutional review board-approved this single-center retrospective case series, which analyzed 289 second and third corticosteroid injections in flexor tendon sheaths to quantify the chance of long-term success of repeat corticosteroid injections for trigger finger. Injections were placed into the flexor tendon sheath through the A1 pulley angled 45º from proximal to distal with 1mL of 40mg/mL Depo-Medrol (methylprednisolone acetate) and 0.5–1.0 mL of 1% lidocaine. The primary outcome, treatment failure, was defined as a subsequent injection or surgical release of the A1 pulley of the affected digit.

Potential subjects treated for trigger finger by one of 7 fellowship-trained hand orthopedic surgeons at a single tertiary center between January 2010 and December 2013 were identified by a search of departmental billing data. The search was conducted using Current Procedural Terminology (CPT) codes 20550 (injection; tendon sheath, ligament), 20551 (injection; tendon origin/insertion), or 20600 (arthrocentesis, aspiration, or injection) and

International Classification of Diseases, Ninth Revision (ICD-9) codes 727.03 (trigger finger) or 727.05 (tenosynovitis; hand, wrist). Inclusion criteria required delivery of a repeat injection for trigger finger during the study period to a patient at least 18 years old. Our database search identified 2176 injections in 1483 patients over the study period.

Medical records were manually reviewed for the patient's age at first injection, sex, injection date, digit injected, symptoms graded according to the Green classification at each injection (Table 1), presence of multiple trigger fingers, and associated co-morbidities with potential relevance to the trigger finger (i.e., rheumatoid arthritis, hypothyroidism, carpal tunnel syndrome, other upper extremity tendonitis, and diabetes [non-insulin-dependent vs. insulin-dependent]) at time of injection. The presence of multiple trigger fingers was defined as more than one symptomatic trigger finger either at or before the time of repeat injection. For patients with return visits for treatment failure, the time to failure and subsequent treatment were recorded. For patients with repeat injections for multiple digits within the three-year period, only the first repeat injection contributed data to the study to ensure independent observations for statistical analyses. In the case of concurrent bilateral injections, a random number generator was used to pick the studied side. This decision minimized bias introduced by the selection of a digit according to duration, severity, side, or subsequent treatment needed. Subjects were excluded if the medical record notes did not specify the digit injected (n=131).

Manual chart review identified 360 eligible patients (Figure 1). Eligible subjects without documented failure who had not been seen in our office in June 2015 or later were contacted by telephone using three attempts with voicemails on separate days. Subjects were excluded at time of the telephone phone call if they were unreachable (N=44), declined participation (N=20), had died (N=0), were unable to give study consent in English (N=2), could not recollect receiving a repeat injection for a trigger finger (N=2), or if they stated that they received a later treatment but could not estimate the date within one month (N=0). Thus, 292 completed follow-up and were included in the final analysis. Follow-up data from telephone calls were collected after patients provided verbal consent for study participation. Patients were queried regarding recurrence of symptoms, dates of any necessary subsequent treatment, the presence of other trigger fingers, and current diabetes status. As patients who experience resolution of symptoms do not schedule routine follow-up visits in our practice, telephone follow-up minimized bias toward a lower estimated chance of treatment success associated with analyzing only patients who returned to the office as study subjects.

Among analyzed patients, 284 patients received second injections and 62 patients received third injections, with 54 patients receiving both during the specified period. The distribution of affected fingers and patient demographic data are detailed in Table 2. Patients with successful injection who contributed data to this study had a minimum follow-up duration of 1.5 years.

Statistical Analysis

Descriptive analyses produced frequencies and percentages for categorical variables and mean (standard deviations) or median values for continuous variables. The median time to treatment failure was determined with Kaplan-Meier analysis. The effect of sex, multiple

trigger fingers, and diabetes on the pattern of injection failure over time were tested with log-rank testing. Participants without treatment failure were censored at the time point corresponding to their most recent office visit or telephone follow-up. Bivariate analyses using chi-square or Fisher's exact test for categorical variables and independent samples t-test for continuous variables determined independent predictors of success. Multivariable logistic regression was used to model the relationship between treatment success and hypothesized predictors of success accounting for other patient characteristics. The presence of multiple trigger fingers (included based on documented impact on success of initial trigger injection) and any other factors that approached significance during bivariate analysis were planned for inclusion in the multivariable logistic regression model for associations with the dependent outcome of treatment failure. A forward stepwise selection procedure was used with an alpha of 0.1 for entry. We assessed model explanatory power and fit using the Nagelkerke R^2 and Hosmer-Lemeshow lack-of-fit test (confirmed $p>0.05$). An unadjusted alpha level of 0.05 for significance was used for all tests.

We chose the inclusive study dates to allow adequate sample size for multivariate testing to determine factors associated with success or failure of injections. Assuming at least a 50% chance of injection failure when planning this study, we determined the study interval to include 40 failures after 2nd and 3rd injections respectively to allow for at least 4 predictor variables in our regression modeling. After data collection, we realized that the cohort of patients receiving 3rd injections comprised small numbers of individuals when categorized by demographic and disease characteristics so multivariate testing was limited to the 2nd injection cohort.

RESULTS

Second Injections

Among the 284 patients who received second injections, 183 (64%) were female, with an average age of 60 years (SD 11). One hundred and thirty one patients (46%) had multiple trigger fingers. Fifty-nine patients (21%) were diabetic, of which 39 had NIDDM and 20 had IDDM. The median time between initial and second injection was 214 days in patients without diabetes and was 235 in diabetic patients (366 days for IDDM, 213 days NIDDM). Digits involved, trigger finger grade, and the presence of selected comorbidities are detailed in Table 3.

Thirty nine percent of patients (111/284) were successfully treated with a second injection. One hundred and seventy three (61%) patients experienced treatment failure, with 86 patients (50%) receiving a subsequent third injection and 87 patients (50%) undergoing surgical release of the A1 pulley as the next treatment. As demonstrated in Figure 2, the median time to treatment failure was 371 days, 95%CI [290, 452]. One hundred and eight (62%) ultimately required a surgical release even after a subsequent injection for symptomatic relief. Median time from injection to last follow-up, defined as either treatment failure or last follow-up if a success, for second injections was 371 days (range 27–2181days). Median follow up for injections deemed successful without subsequent treatment was 1325 days (range 717–2181 days). Sixty nine percent (100/144) of patients requiring telephone follow-up reported treatment success.

Third Injections

62 patients were analyzed for third injections during the study period. Thirty-seven (60%) were female, with an average age of 60 years (SD 10). 34 patients (55%) had multiple trigger fingers. 18 patients (29%) were diabetic, of which 12 were NIDDM and 6 IDDM. Table 4 presents the digits involved, trigger finger grade, and presence of selected comorbidities.

Thirty nine percent (24/62) of patients receiving a third injection did not require further treatment. Thirty eight (61%) patients experienced treatment failure, with 22 patients (59%) receiving a fourth subsequent injection and 16 patients (42%) undergoing surgical release of the A1 pulley as their next treatment. In total, 23 patients (61%) ultimately required a surgical release. Median time to treatment failure was 407 days, 95%CI [222,592] (Figure 2). Median time from injection to last follow-up for third injections was 436 days (range 62–2027 days). Median follow up for injections deemed success without subsequent treatment was 1317 days (range 767–2027 days). Of the 20 patients requiring telephone follow-up, 16 (80%) reported treatment success.

Factors Affecting Treatment Success

Bivariate testing demonstrated that sex, trigger finger grade, diabetes status, the presence of multiple trigger fingers and select comorbidities were not associated with success of second or third injections (Tables 3, 4). Log rank analyses did not reveal any differences in success curves for patients receiving second or third injections according to sex, presence of multiple trigger fingers, or diabetes status. Multivariate logistic regression modeling revealed that for second injections, older patient age at the time of initial injection ($p<0.05$, OR 1.03 95% CI 1.00–1.05) and trigger thumb ($p<0.05$, OR 2.47 95% CI 1.4–4.3) significantly predicted injection success while accounting for time between first and second injection, diabetes, sex and multiple trigger fingers.

DISCUSSION

Our data confirm that 39% of patients who fail a first or second corticosteroid injection for trigger finger may respond to a subsequent steroid injection. Published literature has suggested that repeat injections for trigger fingers offer some benefit but are less effective than initial injections. Clark et al. found a 55% chance of success after one injection improved to 82% with several injections after an average follow-up of 44 months.[4] Reporting similar experiences, Rhoades et al. reported 66% success after one injection and a 72% cumulative chance of success after multiple injections at 25 months[3] while Newport et al. reported a 49% chance of success after an initial injection and a combined success percentage of 77% for patients receiving up to 5 injections with an average follow-up of 35 months.[2] Despite a wide range of follow up duration and ultimate number of injections provided, multiple investigators have confirmed this finding of additional marginal benefit of repeat steroid injections for trigger fingers.[5,6,9,10,11, 13,17,18,] Consistent with these publications, our current study's 39% chance of success after 2nd and 3rd injections yields a hypothetical 82% cumulative success rate after 3 injections when combined with our center's previously reported initial injection success rate of 45% (reference blinded).

The 39% of patients realizing success after second and third injections in this study fall within the wide range reported in the literature for repeat injections (Table 5). Variability in the chances for success among studies may be attributed to variable duration of follow up and methodologic differences. Studies have inconsistently excluded patients with inflammatory arthritis[13] and the corticosteroid type and dose administered varies. Furthermore, the definition of treatment failure is not standard, frequently cited as either symptom recurrence or need for subsequent intervention. Schubert et al., reported a mean duration of relief after second and third injections with 8mg of triamcinolone (300 and 286 days respectively) was completed with an average follow-up of 66 months (range 2–152 months).[10] While our study found a longer median time to failure of 371 and 407 days for a second and third injection, it is unclear if this is attributable to differences in patient demographics or the steroid preparation.

Studies investigating patient and disease factors associated with success of corticosteroid injections for trigger fingers have focused on patients with initial injections or a mixed group of multiple injections, without specific analysis of repeat injections. Factors documented to affect injection success include duration of symptoms < 4 months[3] and >6 months,[2] sex,[7,14] finger type,[7,9] nodular subtype,[8] presence of multiple trigger fingers,[2,9,13,14] younger patient age,[13] and history of upper extremity tendonopathies[13]. Diabetes has also been proposed as a factor related to ultimate need for surgical release,[13,15,16] though this may be partly confounded by an increased presence of multiple trigger fingers. We considered these potential predictors of injection success in our current study. However, our data only indicated that successful 2nd injection is associated with treatment for trigger thumb and that there is a small but significant positive impact of advancing patient age at the time of presentation for injection. We had expected diabetes to predict repeat injection failure. When our data did not substantiate this, we reexamined the time between first and second injection. Median time to second injection in diabetic patients was 235 days (366 days for insulin dependent diabetic patients). This indicates that although diabetes may predict failure of first injections for trigger finger, those diabetic patients receiving repeat injections are a subgroup that realized often prolonged symptom relief before recurrence prompting repeat injection. Presumably, diabetic patients who experienced no initial response, or very brief response, to first injection were more likely to be offered surgery as opposed to repeat injection. This selection bias impacting patients with diabetes may explain why this group experienced relief similar to unaffected patients after second injection. The increased chance of success for injection to the thumb in comparison to other digits was also found in the reports of Marks and Gunther and Castellanos et al..[7,11] While the reason for this is unclear, we hypothesize that this difference may be attributable to the isolated flexor pollicis longus with the thumb flexor sheath versus the other digits where both the flexor digitorum superficialis and profundus must both glide within each flexor sheath.[11]

The relative paucity of published data specifically examining the outcomes after repeat corticosteroid injections for trigger fingers may impact hand surgeon’s practice patterns. While corticosteroid injections remain a physician’s first choice for initial treatment of trigger finger, there is considerable variation as to whether or not providers offer a repeat injection, especially if a patient has already received two injections. A recent online survey of the American Association of Hand Surgeons members (139 respondents) found that only

11% and 13% of physicians reported giving 3 or more injections for trigger thumb and finger, respectively, prior to recommending surgery.[19] This was consistent with a national database study assessing 102,778 records for treatments of trigger fingers finding that only 16% of which received at least 3 injections.[20] Based on a presumed minimal chance of third injection to prevent surgery, a cost-minimization analysis by Kerrigan et al. determined that the optimal treatment strategy for recurrent trigger finger was two steroid injections followed by surgery.[21] This same analysis found that the third injections would have to provide ≥9% of patients with long term relief to be the most cost-effective treatment.[21] Given patients' preference for corticosteroid injections over surgery,[22] Kerrigan's cost-minimization analysis,[21] and this study's 39% success rate for third injections, changes in practice patterns incorporating a three-injection treatment algorithm may be more cost-effective for providers and deliver care in accordance with patient preferences.

Several limitations are inherent to this study's design. We defined treatment failure as a repeat injection or surgery rather than recurrence of symptoms. This should detect clinically relevant symptoms prompting patients to seek care but presumably underestimates the percentage of patients with mild persistent symptoms. We did not control for adjunctive non-operative management such as splinting, therapy, or NSAIDs. These are not specifically prescribed by our providers but are not prohibited. We designed the study to call all patients without a follow-up in the last 6 months to mitigate selection bias. Chart review alone would have disproportionately selected patients with symptom recurrence seeking treatment biasing the study toward a lower estimate of treatment success. Nevertheless, 68 patients, all of whom only received second injections, were lost to follow-up. Assuming that these patients had the same percentage of success as others contacted by phone, a sensitivity analysis incorporating those lost to follow-up would result in an adjusted chance of treatment success after second injections from 39% to 45%. We chose to include patients who had seen an outside provider for their initial injection as this did not detract from analysis of repeat injections (all performed within our division) and more broadly reflects our practice experience, thereby increasing external validity. We could not assess the outcome of four or more injections for any trigger finger as our practice is to avoid that number of injections secondary to the theoretical risk of injection-related tendon damage. Finally, as some patients contributed data to both the 2nd and 3rd injection groups, we did not perform any analysis that would combine these groups so that all injections remained independent events for statistical contrasts.

Second and third injections for trigger finger each provide sustained relief that may prevent the need for surgery. Although the majority of patients ultimately require surgical release we believe our data support our practice of offering up to 3 injections for persistent or recurrent trigger fingers. We offer surgical intervention after failure of an initial injection but inform patients about the expected chance of success associated with repeat injection and honor the patient's desire for either continued non-operative or operative treatment.

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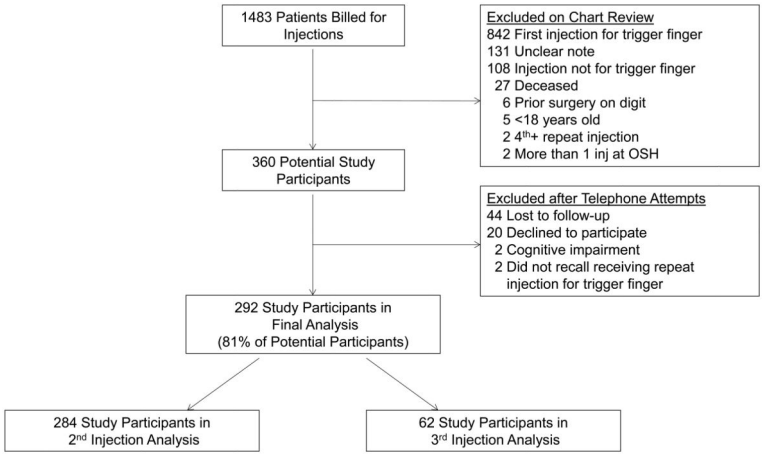

Figure 1.
Flow diagram of participant selection for study.

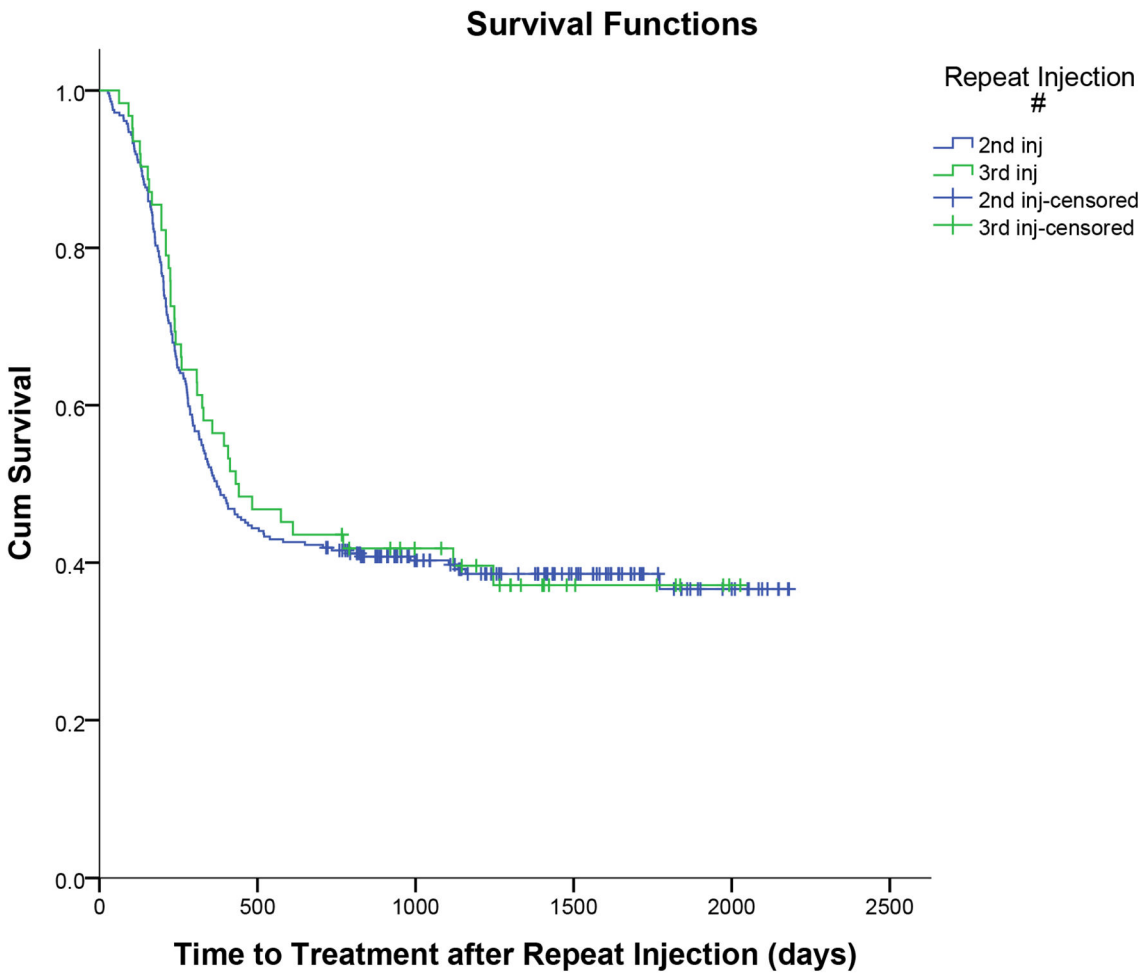

Figure 2.
Kaplan Meier curves for success after 2nd and 3rd injections for trigger fingers.

Table 1

Green classification of trigger finger grade.

Grade I	Pain or tenderness at the A1 pulley
Grade II	Catching, can actively extend digit
Grade III	Locking, requiring passive extension
Grade IV	Locked, unable to passively extend, fixed flexion contracture

Table 2

Baseline population characteristics (all patients).

Variables	Participants (N=292) N (%)
Age at 1st Injection (years), (SD)	60 (11)
Sex, Female	187 (64%)
Affected Digit	
Thumb	79 (27%)
Index	21 (7%)
Middle	104 (36%)
Ring	79 (27%)
Small	9 (3%)
Multiple Triggers	139 (48%)
Diabetes Status at 1st Injection	
None	229 (78%)
NIDDM *	41 (14%)
IDDM **	22 (8%)
Comorbidities	
Rheumatoid Arthritis	11 (4%)
Hypothyroidism	40 (14%)
Carpal Tunnel Syndrome	96 (33%)
Upper Extremity Tendonitis	51 (18%)

* NIDDM – non-insulin dependent diabetes

** IDDM – insulin dependent diabetes

Table 3

Second injection characteristics and bivariate contrasts between successes and failures.

Variables	Participants (N=284) N (%)	Success (N=111) N (%)	Failure (N=173)N (%)	P-value
Age at 1st Injection (years), (SD)	60 (11)	61 (10)	59 (11)	0.09
Time Between 1st and 2nd Injection (days), median (range)	217 (8–5825)	235 (8–1939)	210 (21–5825)	<0.05
Sex, Female	183 (64%)	79 (71%)	104 (60%)	0.06
Affected Finger				<0.05
Thumb	78 (28%)	41 (37%)	37 (21%)	
Index	20 (7%)	8 (7%)	12 (7%)	
Middle	103 (36%)	29 (26%)	74 (43%)	
Ring	74 (26%)	30 (27%)	44 (25%)	
Small	9 (3%)	3 (3%)	6 (4%)	
Multiple Triggers, yes	131 (46%)	44 (40%)	87 (50%)	0.08
Diabetes Status at 1st Injection				0.57
None	225 (79%)	90 (81%)	135 (78%)	
NIDDM	39 (14%)	12 (11%)	27 (16%)	
IDDM	20 (7%)	9 (8%)	11 (6%)	
Comorbidities				
Rheumatoid Arthritis	11 (4%)	4 (4%)	7 (4%)	1.00
Hypothyroidism	37 (13%)	17 (15%)	20 (12%)	0.36
Carpal Tunnel Syndrome	93 (33%)	33 (30%)	60 (35%)	0.39
Upper Extremity Tendonitis	48 (17%)	22 (20%)	26 (15%)	0.29
Green Classification at 2nd Injection (N=242)				0.94
Grade I	83 (34%)	33 (34%)	50 (35%)	
Grade II	147 (61%)	60 (62%)	87 (60%)	
Grade III	7 (3%)	2 (2%)	5 (3%)	
Grade IV	5 (2%)	2 (2%)	3 (2%)	

Table 4

Third injection characteristics and bivariate contrasts between successes and failures.

Variables	Participants (N=62) Mean (SD)/N (%)	Success (N=24) Mean (SD)/N (%)	Failure (N=38) Mean (SD)/N (%)	P-value
Age in years at 1st Injection	60 (10)	58 (9)	61 (10)	0.30
Sex, Female	37 (60%)	17 (71%)	20 (53%)	0.16
Affected Finger				0.53
Thumb	16 (26%)	8 (33%)	8 (21%)	
Index	7 (11%)	3 (13%)	4 (11%)	
Middle	18 (29%)	6 (25%)	12 (32%)	
Ring	20 (32%)	6 (25%)	14 (37%)	
Small	1 (2%)	1 (4%)	0 (0%)	
Multiple Triggers	34 (55%)	13 (54%)	21 (55%)	0.93
Diabetes Status at 1st Injection				0.10
None	44 (71%)	14 (58%)	30 (79%)	
NIDDM	12 (19%)	8 (33%)	4 (11%)	
IDDM	6 (10%)	2 (8%)	4 (11%)	
Comorbidities				
Rheumatoid Arthritis	3 (5%)	1 (4%)	2 (5%)	1.00
Hypothyroidism	8 (13%)	2 (8%)	6 (16%)	0.47
Carpal Tunnel Syndrome	26 (42%)	12 (50%)	14 (37%)	0.31
Upper Extremity Tendonitis	9 (15%)	3 (13%)	6 (16%)	1.00
Green Classification at 3rd Injection (N=43)				0.89
Grade I	11 (26%)	5 (29%)	6 (23%)	
Grade II	24 (56%)	10 (59%)	14 (54%)	
Grade III	4 (9%)	1 (6%)	3 (12%)	
Grade IV	4 (9%)	1 (6%)	3 (12%)	

Table 5

Reported success after repeat injections.

Study	Study Design	Trigger Fingers Analyzed (N)	Definition of Failure	Second Injection Success	Third Injection Success	Duration of Follow-Up¥
Clark et al.[4]	Retrospective	76	Return of symptoms	33%	50%	44 months
Newport et al.[2]	Retrospective	356	No improvement in symptoms	23%	5%§	35 months (11–105 months)
Anderson et al.[5]	Prospective	77	Return of symptoms	59%	----	4.6 years
Benson et al.[17]	Retrospective	109	Return of symptoms	36%	33%	18 months
Rozental et al.[13]	Prospective	124	Surgical release	79%	----	12.6 months (12.1–13.2 months)
Dala-Ali et al.[9]	Retrospective	90	Injection or surgery	44%	6%	1 year minimum
Schubert et al.[10]	Retrospective	577	Injection or surgery	52%	74%	66.4 months (2–152 months)
Castellanos et al.[11]	Prospective	71	Return of symptoms	68%		8 years (7–8 years)

¥Median (range)

§5% for 3–5 injections