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Contents

Monthly Volume 15 Number 4 April 18, 2024

EDITORIAL

ORIGINAL ARTICLE

Retrospective Cohort Study

Retrospective Study

Observational Study

Prospective Study

Basic Study

World Journal of Orthopedics

Monthly Volume 15 Number 4 April 18, 2024

Contents

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Peer Reviewer of *World Journal of Orthopedics*, Vaibhav Jain, MS, Assistant Professor, Surgeon, Department of Orthopaedics, Gandhi Medical College, Bhopal 462001, India. vaibhavigmc@gmail.com

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ORIGINAL ARTICLE

Prospective Study

Long-term assessment of collagenase treatment for Dupuytren's contracture: A 10-year follow-up study

Marco Passiatore, Vitale Cilli, Adriano Cannella, Ludovico Caruso, Giulia Maria Sassara, Giuseppe Taccardo, Rocco De Vitis

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Marco Passiatore, Department of Bone and Joint Surgery, ASST-Spedali Civili, Brescia 25123, Italy

Vitale Cilli, Department of Chirurgie de la Main, Centre Hospitalier Interregional Edith Cavell, Bruxelles 1160, Belgium

Adriano Cannella, Ludovico Caruso, Giulia Maria Sassara, Giuseppe Taccardo, Rocco De Vitis, Department of Orthopedics, Fondazione Policlinico Universitario Agostino Gemelli IRCSS, Rome 00168, Italy

Corresponding author: Rocco De Vitis, MD, Additional Professor, Surgeon, Department of Orthopedics, Fondazione Policlinico Universitario Agostino Gemelli IRCCS, Unità Operativa Complessa di Chirurgia della mano, Università Cattolica del Sacro Cuore, Largo Agostino Gemelli, 8, Roma 00168, Italy. roccodevitis@yahoo.com

Abstract

BACKGROUND

Enzymatic fasciotomy with collagenase clostridium histolyticum (CCH) has revolutionized the treatment for Dupuytren's contracture (DC). Despite its benefits, the long-term outcomes remain unclear. This study presented a comprehensive 10-year follow-up assessment of the enduring effects of CCH on patients with DC.

AIM

To compare the short-term (12 wk) and long-term (10 years) outcomes on CCH treatment in patients with DC.

METHODS

A cohort of 45 patients was treated with CCH at the metacarpophalangeal (MCP) joint and the proximal interphalangeal (PIP) joint and underwent systematic re-evaluation. The study adhered to multicenter trial protocols, and assessments were conducted at 12 wk, 7 years, and 10 years post-surgery.

RESULTS

Thirty-seven patients completed the 10-year follow-up. At 10 years, patients treated at the PIP joint exhibited a 100% recurrence. However, patients treated at the MCP joint only showed a 50% recurrence. Patient satisfaction varied, with a

lower satisfaction reported in PIP joint cases. Recurrence exceeding 20 degrees on the total passive extension deficit was observed, indicating a challenge for sustained efficacy. Significant differences were noted between outcomes at the 7-year and 10-year intervals.

CONCLUSION

CCH demonstrated sustained efficacy when applied to the MCP joint. However, caution is warranted for CCH treatment at the PIP joint due to a high level of recurrence and low patient satisfaction. Re-intervention is needed within a decade of treatment.

Key Words: Collagenase; Xiapex; Dupuytren disease; Dupuytren recurrence; Long term follow-up

Core Tip: Collagenase has shown efficacy in the treatment of Dupuytren's contracture (DC). While its short-term effectiveness is well-documented in the existing literature, there is an absence of studies addressing the long-term outcomes of collagenase treatment of DC. The objectives of this study were to compare the short-term and long-term (10 years) outcomes and to assess the satisfaction with the treatment in 45 subjects enrolled in a phase 3 study in 2012.

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INTRODUCTION

Patients with Dupuytren's contracture (DC), also known as palmar fibromatosis, experienced a significant breakthrough for treatment in the early 21st century. This advancement was marked by the introduction of the enzymatic fasciotomy technique, which is a novel approach involving the infiltration of the fibrous cord with collagenase derived from collagenase clostridium histolyticum (CCH)[1-5]. In contrast to traditional surgical procedures, enzymatic fasciotomy is a less invasive alternative[5-11]. However, the long-term outcomes of this innovative technique are unknown due to its recent introduction and the scarcity of studies with extended follow-up periods[6-9,12-18].

There is a growing trend of re-assessing patients who underwent enzyme fasciotomy[5]. Notably, it has been observed that some individuals treated with this technique have not experienced sustained long-term benefits. In 2012, our institution enrolled 45 patients into a phase 3 study to receive CCH for the treatment of DC with palpable cord manifestations. A comprehensive 7-year follow-up revealed a recurrence of the disease, particularly among patients who were treated at the proximal interphalangeal (PIP) joint. Additionally, there was evidence of recurrence in patients who were treated at the metacarpophalangeal (MCP) joint[6]. The aim of this study was to compare the outcomes observed at 12 wk post-treatment with those documented over a 10-year follow-up period.

MATERIALS AND METHODS

This study was part of a multicenter trial aligned with the Ministry of Health Decree of May 8, 2003 and was carried out at the Unit of Orthopaedics and Surgery of the Hand at the Fondazione Policlinico Universitario A. Gemelli IRCCS in Rome (Ethics Committee Protocol P/488-857-872-1041-1113/CE/2012)[3]. Initiated in January 2012, the study involved 45 patients receiving CCH injection for the treatment of DC with palpable cord manifestations. The primary focus was to evaluate the long-term (10 years) clinical outcomes following CCH treatment in individuals diagnosed with DC.

Inclusion and exclusion criteria

The inclusion and exclusion criteria of the prospective study are listed in Table 1. Within the framework of the present investigation, all individuals who had been previously subjected to a comprehensive review during the 7-year follow-up were systematically contacted. Those re-examined at 10 years after treatment underwent assessments encompassing both goniometric and clinical parameters.

Treatment

The surgery procedure was conducted by experienced hand surgeons injecting the appropriate drug quantity into the affected cords. A sterile dressing was applied, and patients were told to refrain from finger extension. The following day, a forced extension disrupted the pathologic cord, and a thermoplastic splint was applied for 7 d continuously followed by 12 h each day for an additional 7 d. Evaluations were conducted before treatment and 7 d after the procedure by the

Table 1 Inclusion and exclusion criteria of the prospective study

Inclusion criteria	Exclusion criteria
DC with a PED of at least 20° at MCPJ and any degree at PIPJ	Breastfeeding or pregnant (or planning to be) during the treatment phase
No oral anticoagulant therapy; patient in therapy with anti-platelet drugs (discontinued for at least 7 d before treatment)	Undergoing any treatment of the affected hand up to 90 d prior to commencement of the trial
Positive table-top test (a patient fails to lay the palm of the hand and the fingers flat on a table surface)	Known systemic hypersensitivity to collagenase or any of the other components of the product
TPED ≥ 45° (that is greater than or equal to the second stage according to the Tubiana-Michon classification)	Presence of other psychiatric or organic conditions that could jeopardize the patient's compliance
Palpable cord	
Informed consent from the patient	
Consent for examination according to the plan	

DC: Dupuytren's contracture; PED: Passive extension deficit; MCPJ: Metacarpophalangeal joint; PIPJ: Proximal interphalangeal joint; TPED: Total passive extension deficit.

surgeon and a physiotherapist. The 10-year follow-up was conducted by the same treating surgeon.

Data collection and follow-up

Passive extension deficit (PED) and total PED (TPED) measurements were recorded before treatment and 12 wk, 7 years, and 10 years after treatment. Additionally, the recurrence rate of the disease at 7 years after treatment was assessed. Recurrence was characterized as a postoperative angular deformity exceeding 20° in at least one of the treated joints accompanied by the presence of a detectable cord[10,11]. Recurrence could be accompanied by a loss of hand function necessitating further intervention. The overall satisfaction of participants was appraised using a 10-point scale known as the general satisfaction index administered during the 10-year follow-up visit.

In light of recent advancements in patient-reported outcome measures, our patients underwent evaluation utilizing the Michigan Hand Questionnaire (MHQ) and the Unité Rhumatologique des Affections de la Main Scale (URAM Scale)[19,20].

End points

The primary endpoint of the study was assessment of the long-term efficacy and the occurrence of significant disease recurrence at the 10-year follow-up. The secondary outcomes included evaluating sustained functionality at the 7-year follow-up and assessing general satisfaction with the received treatment.

Statistical analysis

The presented data encompassed mean values and standard deviations, with precision limited to a single decimal digit. Parametric data were subjected to comparative analysis using the Student's *t* test, while non-parametric data underwent analysis *via* the Mann-Whitney test or Wilcoxon test. Significance levels were set at $P < 0.05$. The statistical analyses were conducted using GraphPad Software Prism 8 for Mac (La Jolla, CA, United States).

RESULTS

For the initial study, 45 patients (38 males and 7 females) were enrolled. At the 7-year follow-up, 3 patients required surgical treatment before completing the established follow-up due to an unsatisfactory clinical result. Two patients died and did not complete the 7-year follow-up assessment. At the 10-year follow-up, an additional 2 patients did not complete the assessment. Therefore, 37 patients were included in the current study. Patients were categorized by treatment in the MCP joint or in the PIP joint.

Patients treated at the MCP joint

There were 31 patients treated at the MCP joint (10-year PED: 11.5 ± 11.4; range: 0-30). Nine patients (29.0%) had a recurrence on the treated joint (Figure 1 and Table 2). Seventeen patients (54.8%) had a worse TPED due to recurrence of disease by PIP joint involvement (10-year TPED: 25.8 ± 10.9; range: 0-50). Overall patient satisfaction was 6.7 ± 1.7. The mean MHQ score was 80 ± 21. The mean URAM score was 59 ± 19. A statistically significant difference was observed when comparing the outcomes at the 7-year follow-up and at the 10-year follow-up for PED ($P = 0.00222$) and TPED ($P < 0.00001$).

Table 2 Results for patients injected at the metacarpophalangeal joint

Patient	MCPJ PED in degrees				MCPJ TPED in degrees				10-yr recurrence
	Before	12 wk	7 yr	10 yr	Before	12 wk	7 yr	10 yr	
1	60	0	0	5	70	10	10	25	Yes
2	75	0	5	5	75	10	10	25	Yes
3	50	0	5	5	50	5	10	15	No
4	45	0	0	0	60	10	10	20	No
5	45	0	5	5	55	10	10	15	No
6	90	0	5	30	100	10	10	40	Yes
7	50	0	5	5	50	5	10	15	No
8	50	0	5	5	50	5	10	15	No
9	45	0	5	10	95	10	10	20	No
10	70	0	5	35	75	10	10	40	Yes
11	70	0	0	0	70	10	10	10	No
12	45	5	5	5	50	5	10	15	No
13	45	5	5	10	45	10	10	20	No
14	50	5	5	5	50	10	15	40	Yes
15	50	0	5	5	50	5	5	15	No
16	45	5	10	10	45	10	10	20	No
17	45	0	5	5	45	5	10	25	Yes
18	70	5	0	0	80	10	10	30	Yes
19	50	0	5	25	50	10	15	40	Yes
20	45	0	5	25	45	10	10	40	Yes
21	80	0	5	5	95	10	10	30	Yes
22	45	5	5	25	45	10	20	50	Yes
23	50	0	0	0	45	10	10	30	Yes
24	45	5	5	5	45	15	10	15	No
25	45	0	5	5	45	5	10	35	Yes
26	45	0	5	25	45	10	10	40	Yes
27	65	5	10	30	65	10	25	30	Yes
28	45	5	15	30	45	10	10	30	Yes
29	50	0	0	0	50	5	10	10	No
30	45	5	5	5	55	10	10	15	No
31	45	0	15	30	55	10	10	30	Yes
mean ± SD	60	0	0	5	70	10	10	25	N/A
	75	0	5	5	75	10	10	25	N/A

MCPJ: Metacarpophalangeal joint; PED: Passive extension deficit; TPED: Total passive extension deficit; N/A: Not applicable; SD: Standard deviation.

Patients treated at the PIP joint

There were 6 patients treated at the PIP joint (10-year PED: 41.7 ± 5.2; range: 35-50). All patients experienced recurrence at the treated joint (Figure 2 and Table 3). All patients had a worse TPED due to recurrence of the disease by PIP joint involvement (10-year TPED: 56.7 ± 8.2; range: 50-70). Overall patient satisfaction was 5.0 ± 0.6. The mean MHQ score was 70 ± 15. The mean URAM score was 63 ± 16. The sample size (n = 6) did not meet the criteria for the Wilcoxon test to approximate normality. Therefore, accurate computation of a P value was not feasible.

Table 3 Results for patients injected at the proximal interphalangeal joint

Patient	PIPJ PED in degrees				PIPJ TPED in degrees				10-yr recurrence
	Before	12 wk	7 yr	10 yr	Before	12 wk	7 yr	10 yr	
32	50	10	30	40	50	10	15	50	Yes
33	65	10	20	40	70	10	15	50	Yes
34	70	20	25	50	70	20	25	60	Yes
35	65	10	20	40	65	10	20	50	Yes
36	60	15	20	45	70	10	15	70	Yes
37	90	15	20	35	95	15	15	60	Yes
mean ± SD	66.7	13.3	22.5	41.7	70.0	12.5	17.5	56.7	N/A
	13.3	4.1	4.2	5.2	14.5	4.2	4.2	8.2	N/A

PIPJ: Proximal interphalangeal joint; PED: Passive extension deficit; TPED: Total passive extension deficit; N/A: Not applicable; SD: Standard deviation.

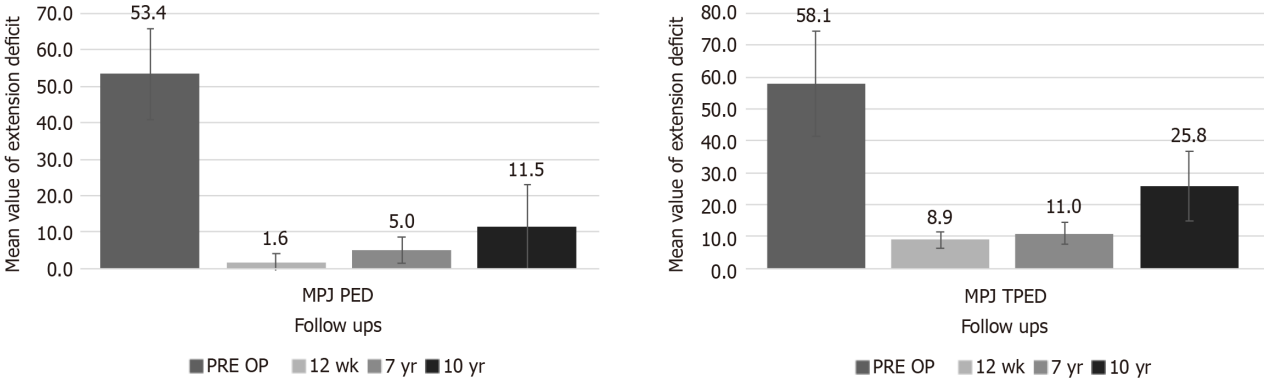

Figure 1 Results for patients injected at metacarpal-phalangeal joints level reported in Table 2. All numerical data are reported in degrees. Standard deviations are reported as interval. MPJ: Metacarpal-phalangeal joints; PED: Passive extension deficit; TPED: Total passive extension deficit; PRE OP: Pre operative.

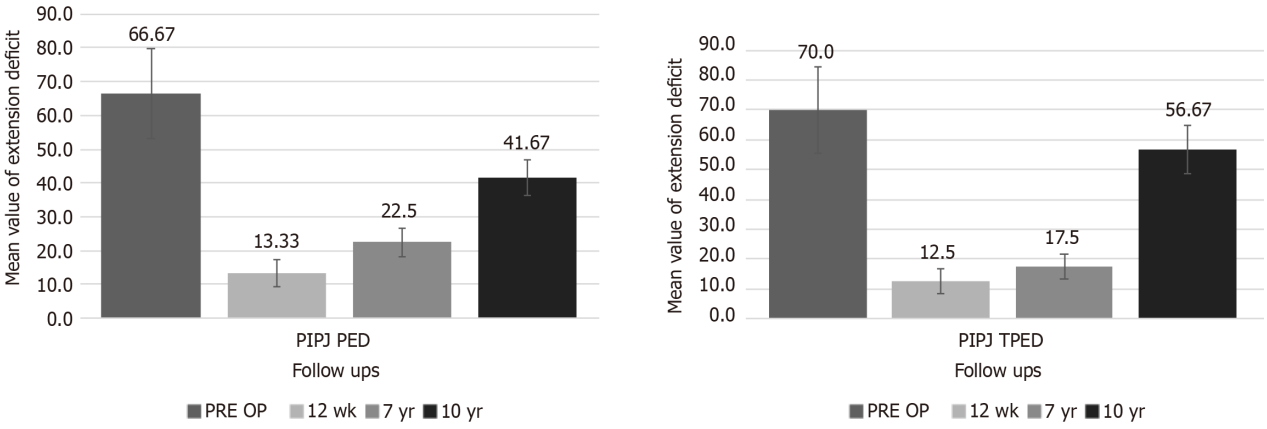

Figure 2 Results for patients injected at proximal inter-phalangeal joints level reported in Table 3. All numerical data are reported in degrees. Standard deviations are reported as interval. PIPJ: Proximal inter-phalangeal joints; PED: Passive extension deficit; TPED: Total passive extension deficit; PRE OP: Pre operative.

DISCUSSION

This investigation represents one of the longest follow-up studies demonstrating the efficacy of enzymatic fasciotomy. It should be noted that during this follow-up study, collagenase was removed from the European market, but not due to safety or efficacy issues. The data from this 10-year follow-up, along with data from the 7-year follow-up[6], has revealed novel findings for the use of collagenase in the treatment of DC. Our results mostly align with trends observed in other studies with shorter follow-up periods[6,12-18].

Previous studies with extended follow-ups have already reported instances of disease recurrence. Zhang *et al*[12] documented a recurrence rate of 80% and the necessity for re-intervention in 53% of cases after a minimum of 5 years of follow-up. Similarly, Göransson *et al*[14] reported a 5-year recurrence rate of 50% that was accompanied by high patient satisfaction. Our previous study, evaluating the population 7 years after treatment[6], revealed that 86.7% of PIP joint-treated patients and 65.6% of MCP joint-treated patients experienced recurrence of the contracture. Notably, 86.7% of patients concluded treatment after a single collagenase injection despite subsequent recurrences[6].

Our analysis adhered to the international consensus definition of recurrence[11], which revealed that 54.8% of patients exhibited a deterioration of more than 20 degrees of TPED in the MCP joints. According to this criterion, 100% of patients treated at the PIP joint experienced a recurrence. Additionally, if we included patients with 20 degrees of TPED (the lower limit of recurrence definition), the recurrence rate would reach 67.7%. Notably, no patient exhibited a TPED of zero at the 10-year follow-up. In addition, our evaluation did not account for the potential activation of the disease in untreated fingers.

The recurrence is likely due to DC pathophysiology and the nature of CCH treatment. While CCH enables cord lysis, it does not eliminate a substantial portion of pathological aponeurosis, which allows the persistence of pathological collagen. There is limited evidence suggesting that CCH induces inflammatory stimulation, potentially activating the generation of further pathological collagen.

Despite these challenges, patients generally express satisfaction with the treatment, particularly when applied to the MCP joint. Conversely, patients treated at the PIP joint exhibited lower satisfaction levels, necessitating further treatment in most cases.

Given our findings, we would recommend collagenase treatment for palpable cords at the MCP joint if it were currently available. We also recommend cautioning patients about the potential for recurrence. Conversely, we do not recommend CCH application at the PIP joint due to low patient satisfaction, the high recurrence rate, and the need for re-intervention within 10 years.

Our study had some limitations, including result disparities between the MCP joint and PIP joint, and a 17.6% loss to follow-up from the initial sample of 45 patients. The deterioration observed in this case series underscores the importance of re-evaluating cases beyond the typical 5-year follow-up.

CONCLUSION

The use of CCH in treating DC is recommended when applied to palpable cords at the MCP joint. The benefits of the treatment are the non-invasiveness and the rapid postoperative recovery. However, patients should be informed of the risk of recurrence.

ARTICLE HIGHLIGHTS

Research background

Dupuytren's contracture (DC), also known as palmar fibromatosis, has been shown to be successfully treated with enzymatic fasciotomy. This novel approach involves the injection of collagenase derived from collagenase clostridium histolyticum (CCH) into a fibrous cord causing DC.

Research motivation

In contrast to traditional surgical procedures, enzymatic fasciotomy is a less invasive alternative. However, the long-term outcomes of this innovative technique remain largely unexplored. Recently, there has been a growing trend of re-assessing patients who underwent enzymatic fasciotomy. Notably, it has been observed that not all individuals treated with this technique have experience long-term efficacy.

Research objectives

This study compared the short-term (12 wk) and long-term (10 years) outcomes of CCH treatment of DC.

Research methods

This was a prospective study that was part of a multicenter trial conducted in a university hospital beginning in 2012. Our institution conducted 45 injections of CCH for the treatment of DC with palpable cord manifestations. A comprehensive 7-year follow-up revealed a recurrence of the disease, particularly among patients injected at the proximal interphalangeal (PIP) joint. Additionally, there was evidence of disease recurrence in patients injected at the metacarpo-

phalangeal (MCP) joint.

Research results

When CCH was injected at the PIP joint, 100% of patients experienced recurrence at 10 years. When CCH was injected at the MCP joint, over 50% of patients experienced recurrence after 10 years. There was a statistically significant difference in passive extension deficit (PED) and total PED when comparing the outcomes at the 7-year follow-up and the 10-year follow-up.

Research conclusions

The use of CCH for the treatment of DC is recommended when applied to palpable cords at the MCP joint. However, patients should be informed of the risk of recurrence. We do not recommend CCH for the treatment of DC at the PIP joint due to low patient satisfaction, the high rate of recurrence, and the need for re-intervention within 10 years.

Research perspectives

The deterioration observed in our case series underscores the importance of re-evaluating cases beyond the typical 5-year follow-up. Further long-term studies are required to completely evaluate the long-term efficacy of CCH for the treatment of DC.

FOOTNOTES

Author contributions: Passiatore M wrote the manuscript; Cilli V, Cannella A, Caruso L, and Sassara GM participated in acquisition, analysis, and interpretation of the data; Taccardo G was the guarantor, designed the study, and performed the surgical treatments; De Vitis R designed the study and performed the surgical treatments; Taccardo G and De Vitis R critically revised the article for important intellectual content; All authors read and approved the final manuscript.

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ORCID number: Marco Passiatore 0000-0002-4361-6505; Adriano Cannella 0000-0001-8163-562X; Rocco De Vitis 0000-0002-9714-1285.

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