Case report

Cross-frictional therapy and stretching for the treatment of palmar adhesions due to Dupuytren’s contracture: A prospective case study

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ABSTRACT

Objective: To examine the potential for treatment of palmar adhesions associated with Dupuytren’s contracture using instrument-assisted cross-frictional massage (CFM) and stretching.

Methods: This was a prospective case study. The primary intervention consisted of a 2-min multi-planar CFM over the affected area of the palm, followed by a 2-min maximal finger-extension stretch.

Results: Following eight weeks of treatment there were increases in both passive and active extension range of motion of the digits, reduction in the visibility of palmar adhesions, and subjective improvements in hand function.

Conclusions: This treatment protocol may offer a substitute for the current invasive surgical and injection procedures that are available.

1. Introduction and purpose

Dupuytren’s Contracture (DC) is an idiopathic, chronic and progressive fibrocontractile disorder of the hand that primarily involves the flexor tendons and palmar aponeurosis (Shaw et al., 2007; Rayan, 2007). Contracture of the palmar aponeurosis frequently forces the 4th and 5th fingers into flexion and ultimately limits finger extension (McFarlane, 1997; Azad et al., 2001). Early presentation of DC includes pitting in the skin of the palm, the presence of garrod nodes, painful nodules and/or progressive development of a contractile band on the palm (Rayan, 2007). Although DC often occurs bilaterally, one hand is usually more severe than the other. The disorder is thought to be more common, more severe and have an earlier age of onset in men (Godmundsson et al., 2000). In addition, there is likely a hereditary link to the disease, as it has been suggested to be more prevalent in individuals of Northern European descent (McFarlane, 1997; Townley et al., 2006).

The precise cause of DC is unknown, however, certain risk factors have been associated with the disorder and include: smoking, high alcohol consumption (Godmundsson et al., 2001), manual labor (Lucas et al., 2008), hand or wrist trauma (Logan et al., 2005), and a history of repetitive hand vibrations (Thomas and Clarke, 1992). The source of the contracture has been postulated to stem from dense collagenous nodules that develop in the palm (Tomasek et al., 1999). DC has been described as having a three-stage process of progression (i.e., proliferation, involution, and residual) that is analogous to the three stages of dermal wound healing (Tomasek et al., 1999; Hindman et al., 2003). These stages are characterized by a repetitive sequence of flare, contracture, and resolution and each cycle can result in a further contracted state (Chiu and McFarlane, 1978; Tomasek et al., 1999).

With regard to treatment, surgical management is most commonly used for DC, but is not recommended until the proximal interphalangeal and/or metacarpophalangeal joint flexion contracture exceeds 30° (Brandt, 2010). Another common form of treatment is injection therapy, which is considered to be a non-operative alternative. Unfortunately, no single medical procedure has proven completely effective and the recurrence rates for most methods are either high or unknown. Moreover, there are potential complications associated with both approaches (Skoff, 2004; Brandt, 2010; O’Gorman et al., 2010).

In recent years, cross-frictional massage (CFM) has emerged as a potential form of treatment for the removal of adhesions such as that seen with trigger finger, chronic ankle fibrosis and tight patellar retinaculum (Howitt et al., 2006). The most current theories proposed to explain the mechanisms that underlie this intervention are that it: 1) enhances proliferation of extracellular matrix fibroblasts, improves ion transport and decreases cell matrix adhesions (Howitt et al., 2006), and 2) stimulates healing by initiating a focal inflammatory response (Perle and Lawson, 2004). Indeed, research has demonstrated that a palpable difference in connective tissue can be achieved in as little as 2 min, by acting specifically on altered fascia (Ercole et al., 2010). To date, this

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approach has not been tested with regard to its potential for use as a treatment for symptoms of DC. As such, the objective of this study was to evaluate the potential for instrument-assisted CFM combined with stretching to reduce the fibrous palmar adhesions associated with DC.

2. Case description

2.1. History

Mr. X is a healthy 42-year-old manual/exercise therapist and student who presented with a 5-year history of progressive wrinkling and contraction in the skin on the palmar surface of both hands. He reported that his palmar deformities had been progressively limiting the extension of the 4th and 5th hands. He reported that his palmar deformities had been progressively limiting the extension of the 4th and 5th fingers of both hands and this was most noticeable with activities such as leaning back on his hands while in a recumbent position and with Olympic style weight lifting. Activities of daily living were otherwise not affected and no associated symptoms were noted. His personal medical history was unremarkable and there was no known family history of DC. Lifestyle considerations included a 35-year history of weekly baseball and daily weight training, a healthy diet and no alcohol consumption.

2.2. Physical

On examination, there was a pair of palpable, pea-sized nodules and a visible contractile band with associated skin wrinkling overlying the flexor tendons of the 4th and 5th digits on the palm of the left hand. The palm of the right hand showed minimal wrinkling or contracture, but a single pea-sized subcutaneous nodule was palpable over the flexor tendons of the fourth and fifth digits. Pressure applied to the palmar nodules elicited pain in both hands. Extension of the 4th and 5th digits was moderately limited on the left and mildly limited on the right (Table 1).

2.3. Ultrasound imaging

Diagnostic ultrasound images were captured using a 35 mm, 10 MHz linear ultrasound probe (Ultrasonix; BC). The presence of hypoechoic and fibrous nodules in direct continuity with the palmar aponeurosis above the 4th flexor tendon were apparent (Fig. 1), supporting a diagnosis of DC (Créteur et al., 2010).

2.4. Treatment design

The primary intervention was performed on Mr. X’s left hand and consisted of a 2-min multi-planar CFM using the NARSON-6 instrument (Narson Body Mechanic N6) over the affected palmar skin, followed by a 2-min maximal extension stretch of the wrist, hand and 4th and 5th digits (Fig. 2). The authors chose to apply approximately 20 s of instrumental strokes along the medial, lateral, oblique, superior and inferior aspects of the tendon. Graston® technique emollient was applied to the palmar skin prior to the application of CFM. The Narson instrument was then used in a multidirectional stroking fashion, applied to the skin at the treatment site with a 30–60° angle. A comparative intervention was performed on his right hand, which involved only the 2-min stretch. The pressure applied for the stretching component of both interventions was enough to maintain a feeling of tension in the palmar region (as described by Mr. X) during the entire 2-min protocol. The treatment protocol was carried out three times per week for eight weeks, with at least one day in between each treatment day. Mr. X was asked to maintain all normal activities during the course of the treatment.

2.5. Outcome measures

Outcomes were measured prior to commencing the interventions, after eight weeks of continuous treatment, and at 16 weeks (i.e., an 8-week no treatment follow-up). Active and passive extension of the 4th and 5th digits were monitored by resting Mr. X’s hand on a flat surface and measuring his ability to actively or passively extend each digit individually (Fig. 3). Conditions for extension measurements were controlled by ensuring that Mr. X was seated at the same table and chair, with his forearm comfortably resting on the table for all measurements. Pre-/post-photographs (Sony Cybershot, DSCHX1) were taken to monitor any visible changes. Finally, Mr. X was asked to report any subjective changes.

Table 1

<table>
<thead>
<tr>
<th></th>
<th>Pre- (mm)</th>
<th>Post Tx (mm)</th>
<th>Change post-tx; (mm (%))</th>
<th>Follow-up (mm)</th>
<th>Change remaining at follow-up; (mm (%))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cross-frictional massage plus stretching (left hand)</td>
<td></td>
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</tr>
<tr>
<td>Active extension</td>
<td>4th Digit</td>
<td>26</td>
<td>29</td>
<td>3 (11.5)</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>5th Digit</td>
<td>28</td>
<td>44</td>
<td>16 (57.1)</td>
<td>41</td>
</tr>
<tr>
<td>Passive extension</td>
<td>4th Digit</td>
<td>54</td>
<td>96</td>
<td>42 (77.8)</td>
<td>86</td>
</tr>
<tr>
<td></td>
<td>5th Digit</td>
<td>60</td>
<td>78</td>
<td>18 (30.0)</td>
<td>72</td>
</tr>
<tr>
<td>Stretching alone (right hand)</td>
<td></td>
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<tr>
<td>Active extension</td>
<td>4th Digit</td>
<td>54</td>
<td>53</td>
<td>-1 (1.9)</td>
<td>51</td>
</tr>
<tr>
<td></td>
<td>5th Digit</td>
<td>36</td>
<td>36</td>
<td>0</td>
<td>34</td>
</tr>
<tr>
<td>Passive extension</td>
<td>4th Digit</td>
<td>80</td>
<td>87</td>
<td>7 (8.8)</td>
<td>81</td>
</tr>
<tr>
<td></td>
<td>5th Digit</td>
<td>56</td>
<td>72</td>
<td>16 (28.6)</td>
<td>63</td>
</tr>
</tbody>
</table>

Fig. 1. Longitudinal 10 MHz ultrasound image of a hypoechoic fibrous nodule ( ), without color Doppler signal, in direct continuity with the palmar aponeurosis ( ) above the fourth flexor tendon ( ).

Fig. 2. Narson 6 instrument and demonstration of applied instrument technique on the intervention hand.
3. Results

3.1. Subjective

Following eight weeks of treatment, Mr. X reported feeling less restricted with his left (primary intervention) hand when performing activities that required finger extension (e.g., when doing push ups or Olympic style hang cleans). There were no subjective changes reported with regard to his right (comparative) hand.

3.2. Active and passive extension of the 4th and 5th digits

The limits of active and passive extension of the 4th and 5th digits, before and after treatment, are displayed in Table 1. Following eight weeks of treatment, the primary intervention hand, which received instrumented CFM combined with stretching, showed an increase in active extension of the 4th and 5th digits by 11.5% and 57.1% respectively. There was also an increase in passive extension of the 4th and 5th digits by 77.8% and 30.0% respectively. While there was some regression of maximal extension by the 8-week follow-up, the majority of the improvement achieved from the treatment protocol was maintained. The comparison hand showed a much smaller change in maximal active and passive extension after the 8-week treatment protocol and at follow-up.

3.3. Morphological changes

Ultrasound imaging was unable to detect any changes to the subcutaneous features of the contractures after eight weeks of treatment. However, photographs of the primary intervention hand (Fig. 4) revealed a reduction in the size of the nodules and a decrease in both the wrinkling in the skin and the visibility of contractile bands. There was no apparent regression of the superficial improvements to the primary intervention hand at the 8-week follow-up. The superficial features of the palm of the comparison hand (stretching alone) did not appear to change over the course of the 8-week protocol.

4. Discussion

Current options for the treatment of DC are limited to surgical management or injection therapies, both of which are invasive, associated with significant side-effects and have high rates of adhesion recurrence. In recent years, CFM has emerged as a potential form of treatment for the removal of adhesions such as that seen with trigger finger, chronic ankle fibrosis and tight patellar retinaculum (Howitt et al., 2006). The objective of this study was to evaluate the potential for instrument-assisted CFM combined with stretching to reduce the fibrous adhesions associated with DC. With eight weeks of treatment, the subject in this case experienced improvements in both passive and active extension ranges of motion his hands. Moreover, there were significant improvements in the visual appearance of his palm. All improvements were seen to a greater degree in the hand treated with the CFM combined with stretching, as compared to the other hand that received stretching alone. However, when the study commenced, the hand that received the CFM was at a more advanced stage of symptom development than the comparison hand, with regard to morphological and physical changes. As such, the potential for improvement of the comparison hand was likely less from the outset.

As this was a study examining a novel treatment approach to DC, our treatment protocol had to be based on some assumptions. The cross-frictional massage intervention was used with the intent of initiating an inflammatory response, which is known to last at least 48 h. We thus spaced our treatments a minimum of 48 h apart to allow the inflammatory cascade to resolve prior to the next treatment application, while still treating relatively aggressively to maximize the potential treatment effect. We used an 8 week intervention period as an attempt to recreate a realistic manual therapy treatment plan, while balancing the number of visits with our goal of maximal treatment effect.

As with any case report, this study has a number of limitations. Most significantly, because there was only one subject, the generalizations that can be made with regard to the expected efficacy of this treatment are limited. Also, the protocol did not allow the elucidation of the individual treatment effects of CFM, stretching, or emollient. Moreover, biopsies were not performed therefore it is unknown as to whether or not an increase in range of motion was
due to myofibroblast changes or absolute increases in muscle length. Also, the extension ranges of motion outcomes were measured using an un-validated approach, which could bias the results. Lastly, this treatment was performed on a subject who was in the early stages of this condition and therefore, few conclusions can be made with regard to patients who have already progressed to a stage at which surgical options become viable. Regardless, this study demonstrates that instrumented CFM combined with stretching has the potential to ameliorate both subjective and objective outcomes in a patient diagnosed with DC. As such, this treatment protocol may offer a substitute for the current high-risk and invasive procedures that are offered. Further studies with more subjects are indeed indicated.

5. Conclusions

The goal was to increase the range of motion of the affected digits and reduce the visual appearance of the fibrous adhesions associated with DC using CFM combined with stretching. In the short term, this non-invasive soft-tissue treatment protocol shows a great deal of promise and may eliminate the need or at the very least, prolong the time before surgery is required. It is the opinion of the authors that this treatment protocol can be used by any healthcare professional trained in instrumented therapy and positive results can be elicited in less than eight weeks. Further research is needed to validate the outcomes seen in this study and to determine the lasting effects of this treatment.

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References