The Effectiveness of an Upper Extremity Neuromuscular Training Program on the Shoulder Function of Military Members With a Rotator Cuff Tendinopathy: A Pilot Randomized Controlled Trial

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ABSTRACT

Introduction: Shoulder pain, a leading reason to consult a physician or physiotherapist, continues to be a challenge to rehabilitate, particularly with a military population. A rotator cuff (RC) tendinopathy, the most important source of shoulder pain, is one of the leading reasons for sick leave or a discharge from active military service. Research encourages the use of exercise prescription for the management of a RC tendinopathy, however the ideal method of delivery (group setting versus one-on-one) remains uncertain. The purpose of this single-blind (evaluator) pilot randomized clinical trial was to compare two 6-week rehabilitation programs, a newly developed group-supervised neuromuscular training program and usual one-on-one physiotherapy care, on the pain and symptoms of Canadian soldiers affected by a RC tendinopathy. Materials and Methods: Thirty-one soldiers with the Canadian Armed Forces were randomly assigned to (1) a group-supervised neuromuscular training program (UPEx-NTP) or; (2) one-on-one usual physiotherapy care (UPC). The primary outcome was the Disability of Arm, Hand and Shoulder (DASH) questionnaire. Secondary outcomes included the Western Ontario Rotator Cuff (WORC) Index, pain levels at rest, and maximum isometric voluntary contractions (MIVC) of the abductors and external (lateral) rotators of the affected shoulder. Both were assessed at baseline (T0), 6 (T6) and 12 (T12) weeks. Analysis included two-way repeated measures of variance for intention-to-treat (ITT) and per-protocol analyses. Results: Eighty military members with a RC tendinopathy were contacted, resulting in 31 participants who were randomized for their active intervention, in the UPEx-NTP or UPC, respectively. No significant group (p ≥ 0.16) or group × time interactions (p ≥ 0.11) were found for either ITT or per-protocol analyses. A statistically significant time effect (p < 0.001) was established for the DASH and WORC, showing that both groups improved over time. Conclusions: Our preliminary data demonstrates that both rehabilitation approaches, grounded in active exercises, were not statistically different from each other, and derived similar benefits over time for a military population. This suggests that a group intervention for a RC tendinopathy has potential to be just as effective as a one-on-one approach for a military population, an interesting avenue for an active working population. Larger sample sizes and further investigation are warranted regarding the cost and clinical resource benefits of a supervised group approach.

BACKGROUND

Shoulder pain is a leading complaint among musculoskeletal (MSK) injuries within a Western population, which also includes a military population, for which shoulder disorders are third in prevalence.2-3 Shoulder disorders have a professional and personal impact on soldiers and on the operational readiness of military capability, as they lead to restricted duties, sick leave and the inability to deploy.2,4,5 Shoulder disorders within a military population are more related to sports/physical training, rather than combat.6 It can therefore be surmised that a shoulder MSK condition is a costly problem for military organizations.

Among shoulder disorders, a rotator cuff (RC) tendinopathy remains the leading source of shoulder pain.7-10 The term RC tendinopathy indicates a clinical diagnosis, without knowing the specific underlying mechanisms of injury,11 or etiology.12 RC tendinopathies have been associated with dysfunctional shoulder biomechanics,13,14 which can result in a physical pinching or encroachment of soft tissues (such as the tendons or bursae) under the acromion during shoulder movements.15 The most common cause of an impingement to the RC tendons include an abnormal superior and/or anterior migration of the humeral head within the glenoid fossa,16,17 and poor biomechanical control of the scapula.18-21 A neuromuscular dysfunction of the shoulder complex is said to alter the normal shoulder arthrokinematics,22 and predispose the development of an injury.23-24

Currently, the literature encourages the application of active exercise prescription for the management of a RC tendinopathy,25,26 which includes strengthening,27 of the stabilization muscles as well as neuromuscular training28-31 of the shoulder complex. This incorporates motor control and (re) learning, proprioceptive, and functional training for the
upper extremities. What is currently unknown, is whether the delivery method of the exercises influences the effectiveness of the treatment, notably one-on-one with a physiotherapist (PT) or within a supervised-group setting. A supervised group-exercise approach has been suggested to reduce waitlist time and increase access to rehabilitative care, which is pertinent for a military population where access to rehabilitation care has a direct impact on a soldier’s operational readiness and ability to deploy.

Group exercise approaches have been documented for the knee, thoracolumbar spine, cervical spine, and wrist. The evidence for the shoulder is less clear. Shoulder programs are often either home-based, or one-on-one supervised programs with a few programs involving a structured and supervised group approach in a clinic. Using group-exercise programs with a military population is especially relevant as it can be used with several patients simultaneously; anywhere, anywhere, in a gym, at the unit or squadron level and even aboard a ship.

The aim of this pilot randomized clinical trial (RCT) was to evaluate the effectiveness of a group Upper Extremity Neuromuscular Training Program (UpEx-NTP) in the treatment of soldiers with a RC tendinopathy, using a single-blind RCT design, in comparison with usual physiotherapy care (UPC). We hypothesized that both the UpEx-NTP and UPC groups would demonstrate both statistical and clinical changes, above the minimally clinically important difference (MCID), with shoulder function and pain over time, notably 6 weeks (T0) and 12 weeks (T12) after the baseline evaluation (T0).

**METHODOLOGY**

**Participants**

Participants were recruited by physicians or PTs from the military hospital at the Valcartier Garrison in Courselette, Quebec, Canada. All participants were military personnel aged between 18 and 60, with a clinical diagnosis of a RC tendinopathy. Inclusion criteria included having a Disability of the Arm, Shoulder, and Hand - Canadian French (DASH-CF) score greater than 15%, based on its MCID, and at least one positive finding in each of the following categories: (1) reported shoulder pain; (2) painful arc of movement during flexion or abduction; (3) positive Neer’s or Kennedy–Hawkins Test; (4) pain on resisted external (lateral) rotation, abduction or Empty Can Test. The combination of criteria (2), (3), and (4) has a good diagnostic accuracy with sensitivity and specificity values ≥0.74 and +LR of 3–5. Individuals were excluded if they had any prior history of shoulder surgery, dislocations, fractures, capsulitis, a full thickness RC tear identified my imagery, demonstrated any signs or symptoms of a systematic or neurological pathology, had a confirmation of another diagnosis by imagery or declared an inability to attend the treatment sessions. This project was approved by the Sectorial rehabilitation and social integration research ethics committee of the Centre intégré universitaire de santé et de services sociaux de la Capitale-Nationale (CIUSSS-CN) and the Surgeon General’s Health Research Board of the Canadian Armed Forces Health Services Group.

**Study Design**

This single-blind (evaluator), parallel-group RCT included three evaluation sessions, baseline (T0) and week-6 (T6), and an e-mail follow-up with the questionnaires at week 12 (T12). At T0, following written consent, baseline demographics and maximum voluntary isometric contraction (MVIC) values were collected, and self-reporting questionnaires, including the DASH-CF questionnaire, the Western Ontario Rotator Cuff – French Canadian (WORC-CF) Index and a 11-point Numerical Pain Rating Scale (NPRS), were administered. Thereafter, participants were randomized to one of the two intervention groups and scheduled to attend 2-3 treatments per week over a 6-week period. Symptoms and disability/physical limitation outcomes (DASH-CF, WORC-CF) were reevaluated at T0 and T12, whereas the MVIC and pain levels at rest were reassessed only at T0.

**Randomization and Blinding**

A researcher not directly involved in the data collection generated a randomization list using a random number generator (block randomization) with stratification according to sex (male/female). Each evaluator attended a familiarization session (3–5 hours) to become proficient with the examination process. The same participant was evaluated by the same evaluator pre and post intervention, and one evaluator was responsible for the follow-up e-mail contact (T12). Group allocations were concealed in sequentially numbered sealed opaque envelopes, which were opened by the scheduling administrative assistant of the clinic. Precautions were taken to ensure that the groups were physically separated from each other, as each intervention took place at different locations in the physiotherapy clinic. Blinding was assessed using a question about group allocation following the final assessments at week 12.

**Interventions**

The UPC guidelines were developed through a round-table discussion involving 3 researchers and 11 PTs from the Valcartier physiotherapy clinic in June 2015. The UpEx-NTP was developed by the authors through clinical experience and a thorough literature review over a 2-year period. All treatments were systematically documented and participants received written explanations of their assigned treatments. One PT was responsible for the supervision of the UpEx-NTP, whereas three PTs were responsible for providing one-on-one UPC.

**Group-supervised Upper Extremity Neuromuscular Training Program (UpEx-NTP)**

Each participant assigned to the UpEx-NTP group partook in a 6-week multi-station, group-supervised neuromuscular
The progression of each station also reflects best-practices and usual physiotherapy care for the rehabilitation of a shoulder RC tendinopathy. The treating PTs of the UPC group did not have any knowledge of the content of the UpEx-NTP during this pilot RCT.

OUTCOME MEASURES

Symptoms and Disability

The DASH questionnaire, our primary outcome, assessed upper limb symptoms and disability. The DASH is valid ($r > 0.70$), highly reliable (ICC = 0.96 [95% CI, 0.93–0.98]) and demonstrates a high reliability for the French Canadian version (ICC = 0.93). The DASH-CF has a MCID of 10.8 DASH points (sensitivity 79%, specificity 75%). Our secondary outcome, the WORC Index, is a disease-specific quality of life questionnaire, evaluating the change in symptoms specific to a RC tendinopathy. It is highly valid and reliable (ICC = 0.96), supports a MCID of 245 points of the total score, or 11.7% (11.7 points on the scaled index with maximum value of 100) and has a minimal detectable change (MDC) of 19.1 points (moderate change).

Pain levels were assessed using the 11-point Numerical Pain Rating Scale (NPRS), where 0 represents “no pain” and 10 represents “worst pain imaginable.” Participants were asked “On a scale from 0 to 10, 0 being no pain at all, and 10 being the worst pain imaginable, how would you rate your shoulder pain at this moment?” The French version of the NPRS is considered to be moderately reliable (ICC range 0.74–0.76) and a reduction of two points is deemed as being clinically important.

Muscle Impairment

Muscle impairment was assessed at $T_0$ and $T_6$ by evaluating the Maximal Voluntary Isometric Contraction (MVIC) of shoulder external (lateral) rotators and abductors muscles, bilaterally, using the MEDup electronic hand-held dynamometer (HHD; MEDup, Atlas Medic Inc., Quebec City, Quebec, Canada). The HHD has good concurrent validity to a stationary isokinetic dynamometer ($r = 0.81$) and has excellent inter/intra examiner reliability for shoulder external

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The evaluation was standardized and followed respectively (Table I and the WORC Index (estimated 1) and were subsequently contacted by telephone for screening PT as demonstrating clinical signs of a RC tendinopathy, Eighty military members were identified as having RC tendinopathy. RESULTS All data were tested to check the distributional assumptions for the inferential statistical analyses. An intention-to-treat (ITT) and per-protocol analysis were performed for the DASH-CF and WORC-CF, pain levels at rest and the measurements of muscle strength for the affected shoulder. The effects of the interventions on the DASH-CF and the WORC-CF were analyzed using a 2 × 3 (UpEx-NTP and UPC groups × T0, T6, and T12) repeated measure analysis of variance (ANOVAs). Similarly, a 2 × 2 × 2 (group × time × shoulder) repeated measure ANOVAs was used for MVIC and a 2 × 2 (group × time) ANOVA was used for the NPRS pain rating to compare values from T0 and T6 for both groups. All analyses were performed using SPSS version 24.0 (SPSS, Chicago, IL, USA) for Mac software, with all α values set to 0.05 with a Bonferroni correction applied for multiple levels of comparison.

RESULTS
Eighty military members were identified by a physician or PT as demonstrating clinical signs of a RC tendinopathy, and were subsequently contacted by telephone for screening (Fig. 1). Eighteen individuals were excluded over the phone and 31 were excluded during the in-person objective evaluation (total excluded: 49), for reasons, which included their inability to commit to a 6-week program due to military tasks, or the reproduction of neurological symptoms. Therefore, 31 military members were eligible and randomly allocated to a treatment group (UpEx-NTP: 16, UPC: 15).

Before the completion of the 6-week intervention, 1 participant dropped out of the UpEx-NTP group and 3 from the UPC group (Drop-outs: 4, UpEx-NTP: 15, UPC: 12). Reasons included three participants could no longer attend the treatment sessions due to work obligations of military tasks and one voluntarily abandonment due to a self-reported resolution of symptoms. Each participant was contacted up to three times by e-mail at T12. If there was no response, the data was considered missing and the results from T0 were used for the ITT analysis. At T12, 14 participants responded from the UpEx-NTP group (missing data n = 2, response rate: 87.5%), whereas 9 responded from the UPC group (missing data n = 8, response rate: 52.9%). The ITT analysis included all 31 participants (UpEx-NTP: 16, UPC: 15), whereas the per-protocol analysis included 23 participants (UpEx-NTP: 14, UPC: 9) who completed the treatment allocated from baseline to the end of the study at 12 weeks. Both groups were similar in all baseline demographics, as no statistically significant between-group differences were found (p = 0.1–0.9) (Table I).

Symptoms and Level of Disability
The DASH-CF: neither the ITT nor per-protocol analyses showed any statistically significant group (p ≥ 0.4) or group × time interaction (p ≥ 0.13). Both did, however, demonstrate a significant time effect, with an improvement in the mean scores (time effect; p < 0.0001) at T6 and T12, compared to T0. The WORC-CF Index: the total WORC scores ITT and per-protocol analyses revealed no statistically significant group (p ≥ 0.1) or group × time interaction (p ≥ 0.1). Both analyses did demonstrate a significant time effect (time effect; p < 0.0001) at T6 and T12 compared to T0. Both groups demonstrated clinical improvements that surpass the minimal clinically important difference (MCID) for the DASH (10.8 points) and the WORC Index (an estimated −300 points, or 14.3%), respectively (Table II).

As shown by Figure 2, there were no observed group or group × time interaction (p ≥ 0.18) for shoulder pain at rest

Data Analysis
Descriptive statistics were used for all outcome measures at each measurement time. Baseline demographics were used for comparability of groups (Independent t-test/Chi-square tests).
for the ITT or per protocol analysis. A statistically significant time effect ($p < 0.001$) was observed between $T_0$ and $T_6$ for both groups. Both groups demonstrated a clinically significant decrease in pain of at $T_6$ of 2.4 and 1.4 points for the UPC and UpEx-NTP, respectively.

### Muscle Strength Impairments

Overall, there were no noted group $\times$ time $\times$ shoulder interaction found ($p \geq 0.1$) for either intervention. There was a mean increase of the MVIC for the affected shoulder for abduction and external (lateral) rotation strength for both groups, with noted statistically significant time effects in both groups (Table III).

### DISCUSSION

To our knowledge, this is the first pilot RCT comparing a supervised-group exercise program to UPC for the management of a RC tendinopathy among soldiers. Both groups demonstrated that clinical improvements at $T_6$, with mean change scores surpassing the MCID for both the DASH and WORC Index. Both groups also had a statistically significant decrease in reported pain over time, which was only clinically significant for the UPC group only. Simply put, they had the potential for a larger reported change over time, which would have been favored by the responsiveness qualities of the NPRS.

A further explanation in favor of the UPC group is the unique use of a HEP in addition to the one-on-one treatments, in order to account for equal treatment time between the two groups (9–10 hours over 6 weeks). Military members are used to engaging in independent exercise and have a personal and professional investment in their physical well-being. Future studies investigating the effects of a group-supervised approach for the management of an RC tendinopathy should include a HEP component, in order to evaluate its effectiveness among this population.

### Comparison of Interventions

Despite the fact that exercise prescription is the preferred method of conservative treatment for a RC tendinopathy, the prescription or delivery method, as well as important components of the exercises are not yet well understood. In this study, we chose to address the component of delivery and supervision, a group setting versus one-on-one. Both interventions taught strength, neuromuscular (re)learning and motor control exercises to their participants. Both groups demonstrated symptomatic and functional gains over time, with no noted group $\times$ time interaction. Both groups also surpassed the MCID for the DASH questionnaire and the WORC index; while only the UPC group demonstrated a clinically important difference for reported pain levels. This could be partially explained by the additional option of using multimodal care, such as active or passive range of motion exercises, general advice on posture or activity modification, and/or the benefits of hands on therapy by the PTs. Multimodal care may assist with pain management, which could further encourage the patient to partake in active exercises. It could also be suggested that the addition of manual therapy may optimize the effects of the exercises as reported by a recent systematic review and meta-analysis for the management of neck pain among adults. At this time, however, it is unclear if manual therapy can improve function over time for individuals with an RC tendinopathy. The fact that the UPC group also reported a higher baseline pain of $2.2 \pm 2.5$ points, compared to the $1.8 \pm 1.9$ points of the UpEx-NTP group, could also account for the clinically significant results seen with the UPC group only. Simply put, they had the potential for a larger reported change over time, which would have been favored by the responsiveness qualities of the NPRS.

### Military Population and a Group-Supervised Program

Fitness and physical health play a pivotal role in the functionality of military members. Understanding that there is an undisputable link between a soldier’s physical performance and military strength and operational readiness, it is crucial to evaluate the efficiency and effectiveness of military health care services for the rehabilitation of shoulder injuries. One-on-one care may not be the best approach for a specialized

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**TABLE I. Baseline Demographics**

<table>
<thead>
<tr>
<th></th>
<th>UpEx-NTP Group ($n = 16$)</th>
<th>UPC Group ($n = 15$)</th>
<th>Independent t-Test or Chi-Square Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age ($\bar{X} \pm SD$)</td>
<td>$33.4 \pm 9.5$</td>
<td>$36.9 \pm 7.1$</td>
<td>$p = 0.2$</td>
</tr>
<tr>
<td>Sex male/female</td>
<td>16/0</td>
<td>14/1</td>
<td>$p = 0.2$</td>
</tr>
<tr>
<td>Height (cm) ($\bar{X} \pm SD$)</td>
<td>$174 \pm 6.0$</td>
<td>$172.3 \pm 5.5$</td>
<td>$p = 0.3$</td>
</tr>
<tr>
<td>Weight (kg) ($\bar{X} \pm SD$)</td>
<td>$95 \pm 21.0$</td>
<td>$86.2 \pm 14.4$</td>
<td>$p = 0.1$</td>
</tr>
<tr>
<td>Smoker yes/no</td>
<td>1/15</td>
<td>4/11</td>
<td>$p = 0.2$</td>
</tr>
<tr>
<td>Dominance R/L</td>
<td>15/1</td>
<td>13/2</td>
<td>$p = 0.4$</td>
</tr>
<tr>
<td>Affected shoulder R/L/both</td>
<td>8/7/1</td>
<td>7/7/1</td>
<td>$p = 0.9$</td>
</tr>
<tr>
<td>Length of symptoms (months) ($\bar{X} \pm SD$)</td>
<td>$23.2 \pm 41.5$</td>
<td>$38.9 \pm 50.5$</td>
<td>$p = 0.5$</td>
</tr>
<tr>
<td>Years of military service ($\bar{X} \pm SD$)</td>
<td>$12.8 \pm 7.2$</td>
<td>$12.1 \pm 8.7$</td>
<td>$p = 0.8$</td>
</tr>
<tr>
<td>Service element Army/Navy/Air</td>
<td>15/10</td>
<td>15/0/0</td>
<td>$p = 0.4$</td>
</tr>
</tbody>
</table>

Means and standard deviations of baseline characteristics of the participants, according to intention-to-treat analysis ($n = 31$).
population that is accustomed to working in a group-setting and engaging in communal physical training.

Presently, there is a lack of understanding regarding the effects of a supervised-group approach for the rehabilitation among military members. A recent study by Perron et al questioned the suitability of military members with sub-acute and chronic low back pain (LBP) to participate in an active supervised-group approach. Their clinical message suggests that because of the non-uniformed presentation of chronic LBP, the identification of clear prognostic indicators would help clinicians determine which patients are best suited to a group approach for rehabilitation, a message that may apply to the population of our study. The identification of clear prognostic indicators for a patient affected by a RC tendinopathy could help clinicians determine the appropriate method of delivery for active exercises, one-on-one or a group setting. It would also be worth investigating when a group approach is most appropriate along the rehabilitation spectrum, coinciding with the level of healing and repair of the RC tendons and surrounding tissues.

**Benefits of a Group Approach**

It may also be beneficial to examine the possible benefits of a group approach in terms of an analysis of clinical resources, for example the ratio of clinical time versus number of participants seen for treatment, and the use of consumable supplies for the same number of patients seen within the clinic. Specifically regarding a military context, it would be worth investigating the time factor as it pertains to the operational readiness of a unit. A group approach favors a higher concentration of soldiers being treated simultaneously, instead of individualized appointments throughout the working day.

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**TABLE II.** Mean Scores and Standard Deviations of DASH Questionnaire and WORC Index

<table>
<thead>
<tr>
<th>Outcome measures</th>
<th>UPC PPA (n = 9)</th>
<th>UPC ITT (n = 15)</th>
<th>UpEx-NTP PPA (n = 14)</th>
<th>UpEx-NTP ITT (n = 16)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DASH (general)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T0 (baseline)</td>
<td>30.1 (±11.9)</td>
<td>30.1 (±11.9)</td>
<td>24.2 (±12.3)</td>
<td>24.2 (±12.3)</td>
</tr>
<tr>
<td>T6 Δ</td>
<td>17.6 (±14.5)</td>
<td>17.6 (±14.5)</td>
<td>11.6 (±10.2)</td>
<td>11.6 (±10.2)</td>
</tr>
<tr>
<td>T12 Δ</td>
<td>25.7 (±14.5)</td>
<td>25.7 (±14.5)</td>
<td>16.1 (±14.5)</td>
<td>16.1 (±14.5)</td>
</tr>
<tr>
<td>Time effect</td>
<td>0.56</td>
<td>0.56</td>
<td>0.36</td>
<td>0.36</td>
</tr>
<tr>
<td>WORC (total)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T0 (baseline as a %)</td>
<td>55.2 (±15.5)</td>
<td>55.2 (±15.5)</td>
<td>64.2 (±20.4)</td>
<td>64.2 (±20.4)</td>
</tr>
<tr>
<td>T6 Δ</td>
<td>31.5 (±17.7)</td>
<td>31.5 (±17.7)</td>
<td>22.6 (±14.1)</td>
<td>22.6 (±14.1)</td>
</tr>
<tr>
<td>T12 Δ</td>
<td>43.0 (±15.4)</td>
<td>43.0 (±15.4)</td>
<td>28.2 (±14.7)</td>
<td>28.2 (±14.7)</td>
</tr>
<tr>
<td>Time effect</td>
<td>0.7</td>
<td>0.7</td>
<td>0.4</td>
<td>0.4</td>
</tr>
</tbody>
</table>

Mean scores and standard deviations of DASH-CF and WORC-CF questionnaires in relation to baseline values for the UPC and UpEx-NTP groups (PPA: n = 23, ITT: n = 31). Data presented as mean change (± standard deviation). Δ denotes a change from the baseline score (indicated at T0 in bold) DASH: Disabilities of the Arm, Shoulder and Hand questionnaire (lower score indicates higher disabilities, therefore a negative change from baseline indicates an improvement); WORC: Western Ontario Rotator Cuff Index (higher score indicates higher functional capacity, therefore a positive change from baseline indicates an improvement).

**FIGURE 2.** Pain levels at rest for both groups at T0 and T6, represented as (x ± SD), per protocol analysis (PPA: n = 27) and intention-to-treat (ITT: n = 31) of the injured shoulder. Using the NPRS scale where 0 represents “no pain at all” and 10 represents “worst pain imaginable.”
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TABLE III. Mean Scores and Standard Deviations of MVIC

<table>
<thead>
<tr>
<th>Outcome measures</th>
<th>Time</th>
<th>Per-Protocol Analysis (PPA) (n = 27)</th>
<th>Intention-to-Treat (ITT) Analysis (n = 31)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>MVIC of ABD</td>
<td>Mean Score</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T0</td>
<td>56.0 ± 17.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T6</td>
<td>60.2 ± 16.0</td>
</tr>
<tr>
<td>Time effect $\eta^2$</td>
<td></td>
<td>0.02$^{+}$</td>
<td>0.05$^{+}$</td>
</tr>
</tbody>
</table>

Mean scores and standard deviations of MVIC, Expressed as muscle strength in Newton meters (Nm) of the injured shoulder for the UPC and UpEx-NTP Groups at T0 and T6 (per-protocol analysis, n = 27 and intention-to-treat, n = 31).

ABD, abduction, ER, external rotation.

$^{+}$indicates a significant time effect ($p < 0.05$).

Moreover, the argument has already been made that a supervised-group approach may be more cost and resource effective for a rehabilitation clinic, which could be an avenue worth exploring for military health care facilities. It could be an approach that maximizes rehabilitative resources offered in a group setting, which is a familiar training environment for soldiers. In addition, a group approach could be morally favorable for military members, by facilitating active engagement in their own rehabilitation while encouraging group cohesiveness, ultimately increasing their motivation and compliance to treatment.

Strengths and Limitations of This Study

The strength of the present study is the development and implementation of a supervised neuromuscular training program for the management of a RC tendinopathy among soldiers. The structure and clear parameters of the program could inspire other clinicians and researchers to investigate the effectiveness of the program with a larger sample size.

This study also includes some limitations. This RCT was conducted with a population that presents a high homogeneity in terms of age range, sex, and type of work, which decreases the external validity of this study. Our group-supervised program should have included advice, education specific to the pathology and home exercises, in order to further minimize the differences between the UPC and UpEx-NTP conditions. Furthermore, the PTs treating the UPC group had the prerogative of using multimodal care in addition to active neuromuscular exercises, which could have also contributed to their clinically significant results for pain management. For ethical reasons, in addition to the obligation of providing physiotherapy treatments to active military members, we did not have a true control group, such as a sham or placebo treatment. It is therefore difficult to definitively evaluate the effect of time, on the noted improvements of both of our active interventions. A placebo treatment, such as a HEP group only during a 6-week period, followed by the appropriate care, could be an option for future studies.

Main Findings and Take Home Message

- There is potential for a group exercise program to be just as effective as one-on-one physiotherapy care for the management of a RC tendinopathy amongst soldiers;
- The identification of clear prognostic indicators involving a RC tendinopathy may help clinicians determine which patients are more suitable for a supervised-group approach;
- A supervised-group program is worth investigating, as it may have potential to increase access to physiotherapy care while decreasing wait-time and cost for treatment;
- A supervised group approach to rehabilitation may be appropriate for a military population due to the value placed on team-work and group activities;
- We encourage clinicians to use our UpEx-NTP (Supplementary Appendix I) for future research and clinical implementation;
- Further research with a larger sample size, the equal utilization of a HEP, and a third group involving a placebo treatment is encouraged to verify our findings.

CONCLUSION

Both the group-supervised program and usual one-on-one physiotherapy care approaches resulted in statistically and clinically significant improvements over time for a military population affected by a RC tendinopathy. Our preliminary
results suggest that further investigation is needed to determine the effectiveness of a structured and supervised-group program for this population in different military settings, including in garrison as well as in theater or exercises and/or operations. Our research hopes to encourage the exploration of the potential economical and compliance arguments for the use of supervised-group rehabilitation programs for the management of common shoulder conditions among military populations.

SUPPLEMENTARY MATERIAL

Supplementary material is available at Military Medicine online.

ACKNOWLEDGMENTS

The authors would like to recognize the outstanding contributions by the Canadian Armed Forces, particularly the physiotherapy clinic at the Valcartier Garrison. The authors would like to highlight the unique contributions of the following PTs: Pierre-Marc Vézina, Sophie Bernard, Valérie Charbonneau, Myriam Cyr, and Marie-Elise Frémont. We would further like to highlight the support received from the Canadian Armed Forces Surgeon General’s Health Research Board, who facilitated our scientific curiosity by granting us permission to work with our Canadian soldiers. The CIRRIS/IRDPQ, Laval University and the physiotherapy department at the Valcartier Garrison, Quebec.

FUNDING

Research reported in this publication was supported by the 4.2.1 program from the Réseau provincial en adaptation-réadaptation et Ordre Professionnel des Physiothérapeute de Québec (REPAR-OPPQ) under the award number 2016–2017. Additional support was provided by the Centre for Interdisciplinary Research in Rehabilitation and Social Integration (CIRRIS) and Laval University in the form of a student bursary. JSR was supported by salary awards from the Canadian Institutes of Health Research (CIHR). IRDPQ/OPPQ Quebec. Program 4.2.1.

ETHICAL APPROVAL

Quebec Rehabilitation Institute Research Ethics committee.

TRIAL REGISTRATION NUMBER

ClinicalTrials.gov (NCT02926443).

REFERENCES


