The ability of a sustained within-session finding of pain reduction during traction to dictate improved outcomes from a manual therapy approach on patients with osteoarthritis of the hip

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Objectives: The objectives of this study were to: (1) determine the association of a within-session finding after traction of the hip with self-report of well-being, pain, and self-report of function at 9 weeks; and (2) to determine if the interactions between the within-session finding and the outcome measure are different between groups of patients with hip OA who receive and who do not receive manual therapy.

Methods: Data were retrospectively analysed in 70 subjects who were part of a randomized control trial. Correlation analyses of within-session findings from the initial visit after traction of a concordantly painful hip were compared to self-report measures for function, pain, and well-being at 9 weeks. A comparison of slope coefficients between manual therapy and non-manual therapy groups was performed to determine the interactive aspects of the within-session finding.

Results: Although the correlations for the manual therapy group were higher than for the supervised neglect group, none of the correlational analyses for both groups was strong or significant. Significant differences in the slope coefficients for well-being and pain were found, suggesting that the interactions between the within-session findings and the targeted outcomes were different in the manual therapy group versus supervised neglect group.

Discussion: These findings suggest that within-session findings during the initial evaluation are not strongly related to a positive outcome after manual therapy, although the interaction of the finding of a within-session change and the use of manual therapy is more compelling than the finding in a sample of patients who did not receive manual therapy.

Keywords: Function, Hip osteoarthritis, Manual therapy, Within-session changes

Hip osteoarthritis (OA), the most common form of osteoarthritis,^{1,2} is costly,³ is frequently treated with expensive approaches such as surgery, and has an increasing prevalence in the aging population.⁴ Hip OA is characterized by progressive loss of articular cartilage, development of osteophytes,⁵ soft tissue damage to the joint capsule, and high intra-articular pressures at the joint.⁶ Conservative approaches such as manual therapy, endeavor to increase the mobility of the joint capsule, alter the intra-articular pressures within the joint,⁷ and reduce pain and stiffness, related to these impairments.

Use of manual therapy (thrust and non-thrust manipulation techniques) for treatment of hip OA has demonstrated preliminary benefits, mostly at the impairment level of outcome. In selected case reports, traction and other various mobilization methods lead to improvement in internal rotation range of motion,⁸ although most studies demonstrate reduction in subjective pain more so than range of motion:⁹ in some cases, as quickly as one visit.¹⁰ In particular, the use of a thrust or non-thrust traction technique at the hip is a commonly used assessment and treatment procedure.¹¹ Hoeksma *et al.*⁷ reported statistically significant improvements of hip function and pain in a group that received manual therapy (which included thrust and non-thrust traction), versus a group that was limited to exercise alone. After 5 weeks, patients in the manual

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therapy group (who received concomitant therapeutic exercise) had significantly better outcomes for pain, stiffness, hip function, and range of motion. Improvements of pain, hip function, and range of motion values were still present after 29 weeks.

The decision to use a specified manual therapy approach, such as thrust or non-thrust treatments, is often ascertained during the initial clinical examination.^{12,13} Physical therapists are often guided by assessment of single or multiple findings of impairment-based, within-session effects, both patient perceived (e.g. report of reduction of pain or stiffness) and clinician observed (e.g. changes in range of motion, and improvements in strength) that occur during examination or intervention, particularly in manual therapy methods. By definition, within-session changes are those that occur after the application of a specific intervention, when a noticeable and immediate change in pain, range, or self-report of improvement by the patient is present. This assessment rationale has been advocated for a number of regions of the body, including the shoulder, spine, and hip.¹⁴ Within-session changes have been shown to be useful in predicting improvements in between-session changes for acute lumbar spine pain and improvements in impairments associated with mechanical cervical spine pain. At present, evidence suggests that within-session changes appear to be associated with improvements in impairments (such as range of motion) and pain, more so than improvements with function.^{15,16}

To our knowledge, the influence of within-session findings through application of manual therapy on outcomes associated with function, self-report of global well-being, and pain, with patients who have hip OA is unknown. Consequently, the aims of this study were to: (1) determine the association of a within-session finding of a sustained reduction of pain during traction of the hip with self-report of well-being, pain, and self-report of function at 9 weeks; and (2) determine if the interactions between the within-session finding and the outcome measure are indeed different between groups of patients with hip OA who receive and who do not receive manual therapy as a targeted intervention. Findings from this study may improve our understanding of the role within-session findings during assessment play on self-report of function, global well-being, and pain in patients with hip OA.

Methods

Design

Data were extracted from a randomized controlled trial designed to investigate the long-term effectiveness of different physical therapy treatment programs against that of a usual care group in patients with osteoarthritis of the hip and knee.¹⁷ Details of recruitment and selection of patients have been

described elsewhere.¹⁷ This study used data only on those patients with OA of the hip randomized into a physical therapy treatment group ($n=47$) and the usual care group that receive no treatment ($n=23$). All patients agreed to be enrolled in the study and provided their signed informed consent. The study was granted ethical approval by the Lower South Regional Ethics Committee of the New Zealand Ministry of Health.

Participants

The study consisted of patients with a clinical diagnosis of hip OA. The sample represented consecutive patients fulfilling the eligibility criteria from March 2008 to March 2009. Participants were included in the study if they met clinical criteria for diagnosis of OA of the hip according to the American College of Rheumatology (ACR) criteria and at their baseline assessment, were able to walk 10 m without an assistive device.^{17,18} Exclusion criteria were: previous knee or hip joint replacement surgery of the affected joint; any other surgical procedure of the lower limbs in the previous 6 months; scheduled surgical operation within 3 months; rheumatoid arthritis; initiation of opioid analgesia or corticosteroid, or analgesic injection intervention for hip or knee pain within the previous 30 days; uncontrolled hypertension or moderate to high risk for cardiac complications during exercise; physical impairments unrelated to the hip or knee preventing safe participation in exercise, manual therapy, walking or stationary cycling, including vision problems that affect mobility, body weight greater than 155 kg, neurogenic disorder, primary or significantly limiting back pain, advanced osteoporosis, or inability to walk 10 m without an assistive device; inability to comprehend and complete study assessments or comply with study instructions; and stated inability to attend or complete the proposed course of intervention and follow-up schedule.

Fifty-four potential subjects were excluded from the study based on these criteria. The majority of these individuals were excluded because they did not meet the ACR criteria previously mentioned.

Allocation of assignment

In the randomized controlled trial, patients were randomly assigned to one of three groups: (1) a manual therapy intervention group; (2) a manual therapy and exercise treatment group; and (3) a control group that received supervised neglect from a physician. A fourth group from the original randomized controlled trial was not included in the data analyses since the patients in that group only received therapeutic exercise and no manual therapy. For this study, data from groups 1 and 2 (manual therapy and manual therapy plus exercise) were combined into one group.

Examination procedures

All subjects, regardless of treatment group allocation, participated in a standardized examination. The assessing clinician was blinded to group allocation. After the patients signed an informed consent document, patients completed a baseline questionnaire, answered various historical questions, and underwent the physical examination by the assessing clinician.

The baseline questionnaire included demographic information and a numeric pain rating using an 11-point scale.^{19,20} The Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) assessed disability related to OA. Each patient received a standardized history and physical examination by the same blinded clinician. The examination occupied 45–60 minutes and was carried out following the completion of baseline questionnaires. History taking included localization of pain, duration of symptoms, previous falls, history of smoking, self-reported activity level, popping or clicking in the hip, prior hip or knee injuries requiring medical attention, symptom-aggravating and symptom relieving factors, previous physical therapy treatment for hip osteoarthritis, and use of an assistive device.

Physical examination procedures included range of motion measurements, strength testing, flexibility testing, and a battery of special tests that are associated with hip OA. Physical performance measures including the timed up and go (TUG), 40 m self-paced walk (40 m SPWT), 30 second chair stand (30 CST), sock test, and 20 cm step test were also performed.

Within-session change

A within-session response was captured in this study by combining concordant range of motion values with the response of a hip distraction assessment during the initial assessment. Concordant responses during passive movements of hip flexion, abduction, adduction, extension, internal, and external rotation were identified. For a response to be concordant, the patient had to indicate that the pain (or stiffness) experienced during the passive movement was one of the primary reasons they sought treatment. In addition, the determination of a within-session change in pain was captured during a hip distraction test. Each patient was queried for a baseline level of concordant pain (point A) (11-point scale, 0–10) before the application of manual traction. Pain was again evaluated during the applied traction (point B) and again once traction was terminated (point C), within a minute of termination of treatment. A positive within-session response was associated with a reduction of self-report of pain after the application (point A minus point C) and was coded dichotomously. For a positive within-session response in this study, the participants had to exhibit both a concordant finding during the range of motion

examination and a reduction of pain after the hip distraction test.

Manual therapy treatment

Patients allocated to the manual therapy treatment group received techniques designed to improve the quality and range of motion of the hip joint and surrounding soft tissue structures.¹⁷ Each technique was prescribed individually for each patient based on the findings of the clinical examination and was performed by one of four trained clinicians who did not participate in the assessment of outcomes. In all cases, thrust or non-thrust traction was used as an intervention and in all cases, patients were assigned an individualized home exercise program that was designed to improve hip joint range of motion exercises.

Twenty-one of the 46 patients also received both exercise therapy and manual therapy interventions, as described above. The exercise therapy protocol consisted of multi-modal, supervised exercises of warm-up/aerobic, muscle strengthening, muscle stretching, and neuromuscular control exercises, prescribed individually for each participant on the basis of the physical examination findings. Home exercises were also provided that were targeted to improve the strength and endurance of the muscles. Both those in the manual therapy only and exercise and manual therapy received 1-hour interventions within the 9-week span of care.¹⁷ Compliance and consistency with the program was tracked and recorded as a part of the original protocol.¹⁷

Supervised neglect (non-manual therapy treatment)

The supervised neglect group received no physical therapy and received treatment that was limited to usual, normal, routine care offered by each patient's own general practitioner and/or other healthcare provider(s).

Main outcome measures

The primary outcome measures for the study included the global rating of change scale (GROC), the 9-week change score of the WOMAC functional scale and the 9-week change score of the WOMAC pain scale. Outcome measures were captured at baseline and 9 weeks (WOMAC function and pain subscales) and at 9 weeks only (GROC).

The GROC is a single-item, recall-based questionnaire of well-being since an initial treatment encounter. Patients were asked to make global ratings on changes in regards to their level of hip well-being since the baseline examination on a 15-point self-report scale (from –7 to 7) (Fig. 1). The GROC has demonstrated useful anchor properties when used in the short term but does suffer from recall bias when used in long-term analyses.^{21–23} Likewise, a GROC score greater than 5 has been identified as an important improvement that reflects discontinuance of treatment.²⁴

Please imagine how you would have described your OVERALL HEALTH STATUS one year ago when you entered this trial. HOW DO YOU FEEL TODAY as compared to then as far as your hip osteoarthritis is concerned? (circle only one)

- +7 A very great deal better
- +6 A great deal better
- +5 Quite a bit better
- +4 Moderately better
- +3 Somewhat better
- +2 A little bit better
- +1 A tiny bit better (almost the same)
- 0 About the same
- 1 A tiny bit worse (almost the same)
- 2 A little bit worse
- 3 Somewhat worse
- 4 Moderately worse
- 5 Quite a bit worse
- 6 A great deal worse
- 7 A very great deal worse

Figure 1 Patient global rating of change scale.

The WOMAC physical function (WOMAC-PF) consists of 17 items, each rated on an 11-point scale (0–10). Total scores can range from 0–170 with higher

scores representing lower levels of functional status. Patients completed the function scale unassisted.²⁵ Summing the responses and dividing by the number of items generated the mean score of hip physical function.²⁵ The change score was calculated by subtracting the score at week 9 from the score at baseline.

The WOMAC pain (WOMAC-PN) subscale consists of five items, each rated on a 11-point scale (0–10), with higher scores representing more pain. Total scores can range from 0 to 50. Summing the responses and dividing by the number of items generated the mean score of hip pain.²⁵ The change score was also calculated by subtracting the score at week 9 from the score at baseline.

Demographic and descriptive variables

Demographic and descriptive variables captured in this study included age, gender, duration of symptoms, marital status, educational status, employment status, comorbidities, and baseline WOMAC physical function subscale and pain subscale findings. The Deyo index was used to capture comorbidities for each patient. The Deyo index summarizes patients' comorbidities using ICD-9-CM diagnosis codes and takes into account the severity of the specific diagnoses by weighting.²⁶

Table 1 Demographics of manual therapy group and usual care group (no manual therapy)

Variable	Yes MT treatment group Mean/SD frequency	No MT treatment group Mean/SD frequency	P value
Age	66.4 (9.9)	64.8 (9.2)	0.53
Gender	29=men 18=women	14=men 9=women	0.95
Duration of symptoms	5=less than 1 year 12=1–2 years 13=more than 2–5 years 8=more than 5–10 years 9=more than 10 years	1=less than 1 year 7=1–2 years 5=more than 2–5 years 5=more than 5–10 years 5=more than 10 years	0.86
Education	12=less than 3 years of high school 14=3 years or more of high school 9=some tertiary training 9=graduated from university or polytechnic 3=any postgraduate study	9=less than 3 years of high school 2=3 years or more of high school 3=some tertiary training 4=graduated from university or polytechnic 5=any postgraduate study	0.11
Marital status	5=married/civilly united 12=living with significant other 13=divorced 8=widowed 9=single	1=married/civilly united 7=living with significant other 5=divorced 5=widowed 5=single	0.35
Employment status	16=work regular duty, full-time 7=work regular duty, part-time 1=work light duty or modified position, part-time 0=temporarily unable to work due to health reasons 0=permanently unable to work due to health reasons 18=retired (not due to health reasons) 1=unemployed 4=homemaker	9=work regular duty, full-time 3=work regular duty, part-time 2=work light duty or modified position, part-time 0=temporarily unable to work due to health reasons 1=permanently unable to work due to health reasons 7=retired (not due to health reasons) 1=unemployed 2=homemaker	0.33
Comorbidities	1.2 (0.86)	1.2 (0.94)	0.98
WOMAC physical function at baseline	77.5 (34.3)	70.3 (43.7)	0.34
WOMAC pain at baseline	23.3 (10.4)	20.1 (10.8)	0.46

WOMAC=Western Ontario and McMaster Universities Osteoarthritis Index

Table 2 Correlation of sustained within-session changes and outcome measures at 12 weeks

Outcome measure	Within-session changes for those in the MT group	
	Correlation	P value
GROC	$r = -0.06$	$P = 0.69$
WOMAC pain	$r = 0.21$	$P = 0.15$
WOMAC function	$r = 0.25$	$P = 0.09$
Outcome measure	Within-session changes for those in the control group (non-manual therapy)	
	Correlation	P value
GROC	$r = -0.11$	$P = 0.60$
WOMAC pain	$r = -0.07$	$P = 0.76$
WOMAC function	$r = -0.06$	$P = 0.80$

Note: GROC=global rating of change; WOMAC=Western Ontario McMaster Arthritis Questionnaire.

Statistical analysis

All statistical analyses were performed using SPSS 12.0.1 (SPSS Inc., Chicago, IL, USA). Descriptive statistics included bivariate analyses of age, comorbidities, and other criteria between those who received and did not receive a manual therapy treatment approach.

Correlation analyses consisted of a biserial correlation of the within-session findings and the GROC at 9 weeks, and the change scores of the WOMAC pain subscale (from baseline to 9 weeks), and WOMAC physical function subscale (from baseline to 9 weeks). At present, no criteria exist to determine an appropriate relationship, thus we selected $r \leq 0.40$ as an appropriate level and a P value of ≤ 0.05 as significant. Correlational analyses were run for both groups (manual therapy and usual care/supervised neglect).

To determine whether differences between those who received a manual therapy approach and those who did not receive a manual therapy approach (control group) were significant, we performed a comparison of slope coefficients across groups. A comparison of slope coefficients has been used previously^{27,28} as a mechanism to determine if the interaction between a targeted variable (in our study, the within-session findings) and the outcomes are different among two distinct groups. By comparing slope coefficients for all three outcome measures (GROC, WOMAC pain subscale, and WOMAC physical function subscale), we endeavored to determine the influence of within-session findings was more impactful and significant when manual therapy was applied than when manual therapy was not applied (in the usual care group). A comparison of slopes is analogous to a test of homogeneity of regression coefficients between the two groups (manual therapy and non-manual therapy). This finding also dictates whether or not our analyses of association using a biserial correlation were purely coincidental in nature or were indeed a consequence of group allocation. For the comparison of slope

coefficients, a P value of ≤ 0.05 was selected as statistically significant.

Results

Data from 70 subjects were included in the final analyses. There were no baseline differences among the two groups in any of the demographic categories or baseline function and pain scores (Table 1).

Although the correlations for the manual therapy group were higher than the supervised neglect group, none of the correlational analyses for both groups were significant, nor did any of the findings yield an associative value of ≥ 0.40 (Table 2). This suggests no definitive relationship between a baseline finding of within-session findings after application of traction and a global well-being score at 9 weeks or changes scores for pain and function involving 9 weeks of outcomes.

Lastly, Table 3 outlines the comparison of slope coefficients (tests for homogeneity) which assessed whether differences in regression slopes between groups who received manual therapy and those that did not. Significant differences in the regression coefficients for GROC and the WOMAC pain were found, suggesting that the interactions between the within-session findings and the targeted outcomes of WOMAC pain change score and the GROC were different in the manual therapy group versus supervised neglect group.

Discussion

As previously mentioned, clinical decision making underlying the training of many manual therapists is often based upon patient response (within- and

Table 3 Analyses of slopes for variable created from sustained within-session changes and dedicated outcome measures at 12 weeks: a comparison of a manual therapy treatment group with a non-manual therapy treatment group

Outcome measure	P value
GROC	0.02
WOMAC pain	0.01
WOMAC function	0.06

between-session findings) to specific technique and modifying their treatment approach based upon these findings.¹⁶ While the concept of tailoring a specific treatment approach to the individual patient appears intuitive, and has led to short- and long-term improvements in impairments in past studies,^{29,30} our findings were unable to confirm a notable association of within-session change found at baseline toward change scores at 9 weeks for pain and function and a global well-being assessment in patients who receive a manual therapy-oriented treatment intervention. However, when the interactions of the baseline findings and outcome measures between the manual therapy and supervised neglect group that received no manual therapy were compared, significant differences did exist in global rating of change and pain, but not function. This suggests that although the association between a within-session change finding during the initial evaluation and a change score at 9 weeks does not exist, there does seem to be a significantly different interaction in the manual therapy group compared with that in the supervised neglect group. There are several possible explanations for these findings.

First, the poor association may reflect the complexity of the targeted outcome measures (e.g. global rating of change and function). Pain reduction using a traction technique, a component of the within-session change used in this study, involves an assessment at the impairment level, and impairment level changes may not equate to functional or global well-being changes. Given the extent to which OA is characterized by rapid fluctuations in pain, it is easy to understand why an immediate reduction in pain in response to a traction technique may not be associated with longer-term improvement in functional status. Further, past studies have shown that impairment level changes are more sensitive to change than functional measures, which may explain why we were unable to find any association between within-session changes of pain and functional change.³¹ Pua *et al.*³² has shown hip flexion range of motion and quadriceps strength as important correlates of physical function reinforcing the idea that perhaps within-session changes in range of motion is a stronger indicator of a manual therapy approach in patients with hip OA.^{32,33} Combining hip flexion range of motion, strength, and pain further increased the association with function.³³ To the extent that function is a multidimensional construct, it is not surprising to learn that a single positive response in terms of pain is unable to predict functional outcome. Osteoarthritis is also a multidimensional disease process and involves a wide spectrum of consequences, which may fall outside the reach of manual therapy.

Second, previous authors that have investigated within-session changes capturing a number of findings (e.g. range of motion, stiffness, etc.) and measured

these changes against intermediate changes in impairment and function.^{29,30} We only addressed hip traction within-session changes, and selected to do so after reviewing the positive outcomes of that interventional approach outlined by Hoeksma and colleagues.⁷ Although thrust and non-thrust traction was also part of the dedicated intervention and used by the clinicians to assist in driving and directly care, there is a good chance that pain relief during traction, despite being combined with a concordant restriction or pain during range of motion of the hip, does not fully address the full level of impairments that each patient represented.

Third, there is a risk that within-session findings at the hip are not clinically useful. In other words, the lack of association between a within-session finding and an outcome measure at 9 weeks may be reflective of the lack of usefulness of the within-session finding. There are two thought processes that deserve mention with respect to this assumption. First, there was a significant difference in the interaction between the manual therapy group and the supervised neglect group for global rating of change and pain, which suggests that the interaction between the within-session change and the outcome measure was indeed different between the two groups. The lack of statistical significance in the baseline findings of pain reduction with traction and findings at 9 weeks may be reflective of the small sample size, more so than the poor association. Additionally, we feel that assuming that within-session findings are not clinically useful is a premature concept. While the impairment level finding may not be reflective of functional changes, a finding that has been stated by others,^{15,29} the impairment level finding may support changes in impairment level outcomes (not targeted in our study), which still provide overall benefit to patients.

Limitations

Although all subjects received either thrust or non-thrust manipulation to the hip as an intervention, the specific findings during the within-session assessment by the blinded assessor did not influence the application of that intervention. This may have underestimated the effectiveness of within-session changes in pain intensity to predict functional outcome or the effectiveness of a specific manual therapy treatment approach. The treating clinician also assessed within-session changes with selected procedures, but the data of that assessment were not captured. Furthermore, we can only confirm that within-session changes of pain intensity associated with hip distraction are unable to predict long-term outcomes as we did not assess the combination of within-session changes in pain in conjunction with other impairments such as range of motion. We did not reassess range of motion of the hip after hip distraction and this finding may have led to stronger associations with long-term outcomes.

Conclusion

Within-session changes in pain following hip distraction are not associated with 9-week change scores in pain, function, or global report of change in patients with OA of the hip. However, the interactions between a within-session finding and the outcomes of pain and global rating of change are different when groups that receive manual therapy and that do not receive manual therapy are compared. Future studies may want to consider combining baseline responses to treatment techniques and determine whether a combination of findings is better able to predict functional outcome. While previous studies have demonstrated that manual therapy is an effective treatment of long-term outcomes of pain, stiffness, hip function, and range of motion, within-session findings do not appear to indicate the use of manual therapy over another treatment approach in patients with hip OA. Other baseline variables may be of more value in predicting who responds well to physiotherapy treatment in patients with hip OA.

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