|  |  |
| --- | --- |
| **PLEASE NOTE** | * ***This form must be typed. Handwritten forms will not be accepted.*** * ***Double clicking on the check boxes enables you to change them from not-checked to checked.*** |

|  |
| --- |
| student to complete |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Student ID** | 0641847 | | **Name** | Monique Baigent | |
| **Faculty** | **Health & Environmental Sciences** | | **School/Dept** |  | |
| **Discipline** | **Physiotherapy** | | **Proposed Start Date** | **01/12/2020** | |
| **Programme** | **Masters of Philosophy** | | | **Full-time** | **Part-time√** |
| **Ethnicity** | European NZ | | **Residency** | **Citizen/PR** | **International** |
| **Is an AUTEC/Ethics application required?** | | | | **Yes√** | **No** |
| **Will this research involve working with children?**  If yes, see note below. | | | | **Yes** | **No** **√** |
| **Has a supervision agreement been completed?**  Supervision agreements are compulsory | | | | **Yes** | **No** |
| **Thesis √** | | **Dissertation** | | **Points Value** |  |
| **Traditional Format 1** | | **Manuscript Format 2** | | **Practice-led Format 3** | |
| **Working Title** | Can clinical tests accurately diagnose chronic acromioclavicular joint (CACJ) pain? | | | | |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| indicate where you will be based during your studies:  (This does not include trips for data collection) | | | | | | | | |
| **I will be based on an AUT Campus for the full duration of my studies:** | | | | | | | **Yes √** | **No** |
| **If you will be off-campus (either temporarily or permanently) where will you be based:** | | | **City:** |  | | **Country:** |  | |
| **Dates will be off campus:** | **From:** |  | | **To:** |  | | | |
| Note: Contact your Faculty Postgraduate Coordinator with information relating to an additional supervisor located at the external location, and an off-campus plan (schedule of meetings, access to equipment, fees requirements, Intellectual property requirements, support and expectations/goals). | | | | | | | | |

|  |  |  |
| --- | --- | --- |
| Confidential material | | |
| **Will you be requesting that your research be embargoed?**  If yes, please include documents to support this request from your supervisor | **Yes** | **No √** |

|  |  |  |  |
| --- | --- | --- | --- |
| Scholarships | | | |
| **Do you hold, or are you likely to hold, any scholarships/awards/sponsorship by an external organisation?** | | **Yes** | **No**  **√** |
| **Are fees included in the scholarship?** | | **Yes** | **No √** |
| **Give the name(s) of scholarships/awards/sponsors** |  | | |

|  |  |  |
| --- | --- | --- |
| Language | | |
| The University supports theses written in English or Te Reo Māori. Sign language is an official language of New Zealand, however theses must be written. Will your research be presented in: | | |
|  | English | **√** |
|  | Te Reo Māori |  |

|  |
| --- |
| Research Proposal |

***Provide 2-3 pages containing a description of your proposed research. Use the following headings.***

**Working Title**

Can clinical tests accurately diagnose chronic acromioclavicular joint pain?

**Research Question(s)**

What is the reliability and diagnostic accuracy of individual and combinations of commonly used clinical tests for the diagnosis of chronic acromioclavicular joint pain?

**Abstract/Summary:** (100 words or fewer)

Chronic acromioclavicular joint (CACJ) pathologies are often misdiagnosed due to the limited diagnostic accuracy of individual tests and a poor correlation with radiographic imaging (Cadogan et al., 2011; Javed et al., 2017). This can result in negative impacts on a patient’s quality of life and increased healthcare costs (Deyo, 2002).This research includes an inter-rater reliability study with 20 participants and a prospective diagnostic accuracy study with 136 participants. The studies will be conducted in a tertiary care environment in collaboration with patients reporting shoulder pain who have been referred for specialist evaluation and treatment. Each patient will undergo a standardised clinical examination and a fluoroscopy guided anaesthetic injection (FGAI) into the acromioclavicular joint.

**Literature/Past Research Review**

Musculoskeletal disorders are the leading cause of disability in New Zealand (Bossley & Miles, 2009). They affect one in four adults, and make up at least 25% of the annual health costs totaling more than $5.57 billion a year (Bossley & Miles, 2009). Shoulder pain has been reported to be the third most common musculoskeletal disorder (Greving et al., 2011). The three most prevalent causes of shoulder pain are rotator cuff, glenohumeral joint and acromioclavicular joint (ACJ) pathologies (Cadogan et al., 2011). Chronic ACJ (CACJ) pain is defined as pain persisting at this joint longer than the expected healing time of three to six months (Treede et al., 2015).

A number of chronic conditions can affect the ACJ including osteoarthritis, distal clavicle osteolysis, ligament damage and post traumatic arthritis (Shaffer, 1999). Accurate diagnosis of chronic ACJ pain enables the clinician to triage a patient and tailor their treatment plan appropriately (Cadogan et al., 2013).

The accepted reference standard for the diagnosis of ACJ pain is significant pain relief following a guided anesthetic injection into the joint (Cadogan et al., 2013; Malfair, 2008). Currently, a clinical diagnosis is made on the basis of information obtained from the subjective and objective examination of the patient and from medical imaging (Shaffer, 1999). However, the reported diagnostic accuracy of these clinical investigations is poor and diagnostic imaging has a high incidence of false positive findings for the ACJ (Cadogan et al., 2011). No correlation exists between imaging results from MRA, x-ray or ultrasound and patients who have a positive anaesthetic response (PAR) to an ACJ injection (Cadogan et al., 2011; Javed et al., 2017). Hence, there is a risk that abnormal findings identified via medical imaging will be over emphasised, despite the proven poor correlation between such findings and pain of ACJ origin (Cadogan et al., 2013).

With respect to the value of information from the clinical examination, there is a significant scarcity of high quality diagnostic accuracy studies for CACJ pain. In addition, the available research findings indicate that diagnostic tests for the ACJ have limited validity as stand-alone tools (Cadogan et al., 2013). Krill et al. (2018) published a systematic review of studies that examined the accuracy of ACJ tests. These authors excluded any studies below Level II evidence, resulting in only two studies being included. Krill et al. (2018) concluded that there is a paucity of high level studies in this field and that based on current evidence, no combination of special tests has a meaningful impact on the post-test probability of ACJ pathology being present.

A systematic review of current literature identified only five relevant ACJ diagnostic accuracy studies (Cadogan et al., 2013; Chronopoulos et al., 2004; O’Brien et al., 1998; van Riet & Bell, 2011; Walton et al., 2004). Across these studies, positive and negative likelihood ratios were poor for most tests. Only two studies (Cadogan et al., 2013; O’Brien et al., 1998) reported tests with likelihood ratios that indicate a useful shift in probability of ACJ pathology being appropriately identified. The study by Cadogan et al. (2013) is unique in that it considered the diagnostic accuracy of combinations of test findings rather than just those of individual tests. These authors reported that a combination of five diagnostic examination variables, including both subjective and objective findings, could accurately discriminate between a positive and negative anaesthetic response for ACJ pain.

The quality of the five studies varied significantly. The Cadogan et al. (2013) study, in contrast to the other four, had a high standard of reporting and control of bias. This study however had only 22 patients with a PAR following an ACJ injection. A larger study would be required to validate these findings. Weaknesses observed in the remaining studies included a lack of evidence of blinding of assessors (Chronopoulos et al., 2004; van Riet & Bell, 2011), inclusion of only patients with confirmed ACJ pain (Chronopoulos et al., 2004; Van Riet & Bell, 2011) and an inappropriate reference standard (O’Brien et al., 1998). Varying definitions of a PAR across these studies also makes comparison and interpretation of findings difficult. The PAR criteria used by these studies were an 80% or higher PAR (Cadogan et al., 2013), a full or nearly full resolution of pain (Chronopoulos et al., 2004), all post injection ACJ tests being negative (van Riet & Bell., 2011) and a 50% or more PAR (Walton et al., 2004). Additionally, the Chronopoulos study was retrospective, and not all tests were done on all patients. These design flaws are likely to introduce bias into the studies, leading to over-estimation of the ability for a test to correctly diagnose, or rule out a CACJ condition.

The misinterpretation of poor diagnostic tests can lead to overutilization of imaging, ineffective corticosteroid injections, failed rehabilitation, more visits to medical practitioners, increased medications prescribed, more time off work and/or even surgical procedures (Deyo 2002). An inaccurate diagnosis therefore has the potential to result in increased costs to the healthcare system, delays in treatment and potentially increased risk for the patient (Deyo, 2002). Patients without a timely diagnosis and resultant persistent pain can experience multiple negative consequences including poor mood, economic difficulty, poor sleep, changes in cognitive processes, poor quality of life and a reduced overall health status (Fine, 2011).

This research will provide a clear understanding of the diagnostic utility of tests for chronic ACJ pain. It will consider the value of combinations of test findings as well as individual tests. This will enable an early, accurate diagnosis and subsequent initiation of appropriate treatment, benefitting future patients with shoulder pain as well as physiotherapists, doctors and orthopaedic surgeons who manage patients with such pathologies. Improved confidence in the diagnostic accuracy of tests can therefore reduce the health burden of persistent ACJ pain and the healthcare costs associated with misdiagnosis.

Sub-acromial pain and acromioclavicular pain have overlapping characteristics and clinical signs and can occur concurrently (Cools et al., 2008). In order to ensure potential participants with ACJ pain are not unknowingly excluded from this study, participants with pain that may originate from the sub-acromial space or ACJ will be recruited.

The study will be designed to follow the procedural guidelines outlined in the STARD standards for reporting of diagnostic accuracy studies to ensure bias is minimized (Bossuyt et al., 2003). All tests will be performed by either a consultant orthopaedic surgeon or a musculoskeletal physiotherapist with more than ten years of experience, increasing the generalisability of the results.

For a clinical test to be valid it requires an adequate diagnostic accuracy and inter-examiner reliability (Fritz & Wainner, 2001). A poor inter-examiner reliability has a directly negative influence on a test’s validity and may be the reason a patient receives conflicting diagnoses (Lange et al., 2017). The reliability of many diagnostic tests for the ACJ has not been investigated (Lange et al., 2017). To be able to discuss ACJ diagnostic tests both aspects of validity need to be considered. Hence, this research will also examine the reliability of the tests included in the diagnostic accuracy study.

***Methods***

Patients for both studies will be recruited from the Counties Manukau District Health Board (CMDHB) outpatient orthopaedic shoulder clinic (OSC). This is a tertiary clinic involved in the assessment of shoulder conditions to triage patients for surgical or conservative management. Patients who attend this clinic have been referred from other specialists or general practitioners who may have been unable to confirm a diagnosis and the majority have been treated unsuccessfully. The purpose of this research is to inform and facilitate the clinical diagnosis of ACJ pain in patients with chronic, difficult to manage ACJ pathologies.

The orthopaedic surgeons and physiotherapists performing the physical examinations in this study will undergo training prior to the commencement of data collection to ensure standardisation of the performance and interpretation of the tests and familiarity with the study methods.

***Inclusion Criteria***

Potential participants in the studies will need to meet the following inclusion criteria:

* Age 18 and above
* Legally able to give consent and fluent in English
* Persistent shoulder pain of ≥ 3 months in patients referred to the outpatient shoulder clinic at CMDHB
* Shoulder pain identified as the dominant symptom by both the participant AND clinician
* Pain of an intensity of two or more as determined by the Numeric Pain Rating Scale (NPRS) during testing
* X-ray or relevant imaging (e.g. MRI or CT) that depicts bone quality/morphology of the shoulder complex taken within 6 months prior to the date of data collection
* A provisional diagnosis of either CACJ or subacromial pain based on the standardised baseline assessment.

Exclusion Criteria

As part of standard practice for any patient referred to the OSC, potential participants would be screened for the following criteria:

* a current or previous history of cancer of the head, neck, chest, thorax and upper limb.
* known rheumatological conditions with musculoskeletal manifestation e.g. polymyalgia rheumatica, spondyloarthropathy or rheumatoid arthritis
* current or previous osteomyelitis, avascular necrosis, fractures or dislocations around the shoulder complex
* previous ipsilateral shoulder or neck surgery
* any contra-indications to having an anaesthetic injection
* a previous ACJ or sub-acromial injection (to remove bias)

This initial screening will take place during a phone call made by the researcher (see detail under the ‘Recruitment’ subheading below).

When the potential participant attends their initial appointment at OSC, further screening will be conducted to identify the following exclusion criteria:

* severe widespread pain with a a cut-off score of 40 or higher on the central sensitization index (Neblett et al., 2013).
* pain likely to be associated with a frozen shoulder, calcific tendinopathy, glenohumeral osteoarthritis (OA) and glenohumeral instability based on their imaging and standardized examination for stiffness or history of dislocation/subluxation.
* ipsilateral upper limb neuropathic pain (e.g. cervical radiculopathy, brachial plexopathy or other peripheral neuropathy)
* significant muscle weakness secondary to rotator cuff insufficiency or denervation determined by manual muscle testing (3/5 or less) or evident muscle wasting
* Clinical differential diagnoses requiring further investigation (laboratory, other imaging or referral to other medical specialty). i.e. suspicion of metastases, a clinical history that suggests an undiagnosed inflammatory arthritis or suspicion of an infection.

The additional information needed to identify these exclusions will be obtained during the standardised baseline assessment.

***Recruitment***

Potential participants will be identified from those referred to the outpatient shoulder clinic at the time of triage by the researcher. Figure 1 provides a visual overview of the recruitment process

Those identified, will be contacted by a trained clinic administrator to book an appointment time for their clinic consultation as per standard practice. Following this, they will be informed that they may fit the criteria for a research project and asked if they are interested in learning more. For those that are interested permission for the lead researcher to make a follow-up phone call, 5-10 days later, will be sought. Potential participants will be sent the ‘Study Information Sheet’, a consent form and the researchers’ contact details. This material will include a statement to clarify that a decision not to participate in the study will not in any way change the normal assessment and management of their condition provided by the outpatient shoulder clinic. They will be encouraged to phone or email should they wish to ask any questions.

The potential participant will also be sent the standard clinic letter that includes details of their clinic appointment along with baseline questionnaires (the Central Sensitisation Index (CSI) and Oxford shoulder score) to complete.

At the time of the follow-up phone call, the patient will be given a chance to learn more about the research and then to either decline or agree to be involved in the study. Those that agree, will then be asked standardised questions about their current medications, medical history relevant to the shoulder, injection history, duration of the shoulder complaint, previous surgery and any previous fractures or dislocations so that those that meet any of the relevant exclusion criteria can be identified. Potential Participants will be asked to not take analgesics for six hours prior to the study’s examination or intervention. If they do take their medication however, they will still be included if their familiar pain can be reproduced to more than two out of ten on the NPRS.

When the potential participant attends their scheduled clinic appointment, they will undergo a standardized baseline examination (see Appendix 2) as per usual practice for patients attending the outpatient shoulder clinic. Only the minimal stress needed to reproduce symptoms will be used with the 23 physical tests to minimize irritability. These tests are commonly used in clinical practice for assessing painful shoulders. They have been selected based on current literature, the clinical practice of the four experienced clinicians conducting the assessments and a survey of 80 New Zealand physiotherapists.

The findings of this examination will enable the researcher to determine if the potential participant meets the study inclusion criteria. Those that do will be invited into the study, and given a further opportunity to have any questions answered before completing a written consent form. Data from this baseline examination for patients who consent to participate will be retained for later analysis.

Figure 1 Recruitment Flow Chart

***Reliability Study***

The first 20 consecutive eligible participants will be recruited into the reliability study. The sample size for reliability calculations is based on precision of the estimates of reliability rather than statistical significance (Apeldoorn et al. 2019).These participants will undergo the physical component of the standardised baseline examination (see Appendix 2) twice. Initially the full baseline examination will be performed to confirm their eligibility. Following this the participant will be given a minimum of a 30-minute interval before the second clinician repeats the physical examination. The clinicians conducting the reliability study will be the lead researcher and an orthopaedic surgeon (Brendan Coleman).

Clinician order will be decided by the toss of a coin and the order of tests will be randomized using a computer program to avoid an order effect. The participant will be asked to report the reproduction of their pain and to grade the intensity of that pain using the NPRS for each test performed during this examination. Prior to each physical examination, the participant will be asked to rate their pain intensity using the NPRS while performing a patient specific functional test. This test will be identified during the participant interview as their most provocative movement, they will be asked to perform it and rate their NPRS. In addition to comparing the test findings between clinicians, average pain scores across all tests will be calculated for each examination, allowing subsequent statistical analysis to identify if there is any significant flare of the participants pain as a consequence of back to back assessment. Should there be a significant difference in pain scores due to irritability a separate reliability analysis will be run excluding participants with pain scores elevated by more than two points between the first and second assessment (Apeldoorn et al. 2019). All patients will be given standard care management following their assessment.

***Diagnostic Accuracy Study***

At the completion of the reliability study, a separate group of potential participants will be recruited for the diagnostic accuracy study. They will be identified and recruited following the same procedure as detailed above for the reliability study, except for the addition of information obtained from a sub-acromial anaesthetic injection as detailed below. These potential participants will have been provided with information about the study, an opportunity to ask questions and time to consider being a participant in the study as previously detailed.

These potential participants will undergo the physical component of the standardised baseline examination performed by either the lead researcher or one of the two orthopaedic surgeons involved in the study, as determined by the roll of a dice. In order to recruit 136 participants over two years, three clinicians will be required to assess and inject participants.

Information from this examination will allow the researcher to determine if the potential participant meets all eligibility criteria and therefore be able to participate in the study. At this stage, they will be given a further opportunity to ask questions about the next phase of this study and asked to sign the consent form if they wish to continue. Consented patients will then undergo a diagnostic sub-acromial anaesthetic injection (SAI). This injection will be performed by the assessing clinician; either an orthopaedic surgeon or the researcher who is physiotherapist trained to administer such injections under ‘standing-orders’.

Patients with an 80% or greater reduction in pain intensity (see the statistical analysis section below for detail) will be considered to have sub-acromial pain, the most common cause of shoulder pain (Cadogan et al., 2011). The data from this group of patients will be analysed to determine the diagnostic accuracy of the tests included in the examination for identifying sub-acromial pain. However, this research is focused on chronic ACJ pain and the examination does not include classical tests for sub-acromial pain. Hence, it is not expected that the included tests will demonstrate any clinical utility for diagnosing sub-acromial pain. Patients who have a positive response to the sub-acromial injection will have completed their role in the study. They will be followed up for treatment as per usual practice at the outpatient shoulder clinic.

The decision to perform this injection without image guidance is a pragmatic one. This is standard practice at the outpatient clinic and it is not appropriate to change this component of their diagnostic workup. Research by Kane and Koski (2016) demonstrates the accuracy rate for a blind SAI is 70-91%. This compares favourably to blind ACJ injections which have only 24% accuracy (Javed et al.,2017). Should the blind SAI be inaccurate participants are very unlikely to demonstrate a positive anaesthetic response and therefore still go on to have a guided ACJ injection.

Participants that have less than an 80% reduction in pain intensity following the subacromial injection will be considered not to have subacromial pain and hence appropriate for a diagnostic anaesthetic injection into the ACJ. Those who agree to undergo this procedure will continue in the study and be given an appointment (within 1-2 weeks) for a fluoroscopy guided anaesthetic injection (FGAI) into their ACJ at the hospital radiology department.

Figure 2 Diagnostic Accuracy Flow Chart

At this second appointment, the physical component of standardised baseline examination will be repeated, by one of the two physiotherapists, to establish baseline pain intensity prior to the FGAI. The FGAI will be performed by a radiologist or radiology registrar who will be blinded to the findings of the physical examination. Ten minutes after this injection, the physical examination will be repeated by the same therapist so that any change in pain scores can be determined and recorded. Those participants with 80% or more PAR following the ACJ injection will be diagnosed with ACJ pain.

***Statistical Analysis***

Demographic and other baseline characteristics, as well as prevalence of sub-acromial and ACJ pain diagnoses, will be reported as proportions for factor data and mean, standard deviation, extrema and quartiles for continuous data, stratified by Level 1 total response ethnicity, which will include Maori-specific descriptive statistics (Health Information Standards Organisation, 2017). Stratified results for total response non-Maori, non-Pasifika, as well as Polynesian (Maori or Pasifika) and non-Polynesian, will also be presented for comparison purposes.  Given that there is no available research which examines prevalence of shoulder pathologies in Maori and Pasifika populations, this research presents an opportunity to explore potential inequity as a secondary aim. The study is not powered on this aim, which is opportunistic and in accord with guidelines from the Counties Manukau Health Ko Awatea Research and Evaluation Office

Reliability will be measured with Cohen’s *κ* pooled over the 23 tests (De Vries et al., 2008). A 95% confidence interval for the Cohen’s pooled *κ* will be obtained using the bootstrap (Efron & Tibshirani, 1993).

A mean pain intensity score will be calculated by averaging the reported pain intensity (using the NPRS) of the three most provocative of the 23 tests (Appendix 2), performed in the baseline physical examination for each participant. This mean pain score will be calculated again after the repeat examination that follows the FGAI. A positive anaesthetic response (PAR) will be considered to be an 80% or greater reduction in this mean score. A PAR will be considered evidence that the ACJ is the source of the patient’s pain.

Two by two tables will be utilised to calculate various measures of diagnostic accuracy, including specificity, sensitivity, positive and negative likelihood ratios and positive and negative predictive values.

The accuracy of combinations of test findings will explored via logistic regression analysis. Models of up to 8 predictors of the diagnosis (including some interactions to be determined) will be fitted and evaluated based on the criteria of area under the ROC curve (AUC) and misclassification using 10-fold cross-validation after parameter selection and shrinkage through the use of the elastic net (Friedman et al., 2010). The goal will be to obtain a well-performing 5-predictor model, but larger numbers of predictors will also be assessed for completeness. Analyses will be carried out using the current version of R (Core Team, 2020). The cross-validation and shrinkage will be carried out using the *glmnet* package (Friedman et al., 2010).

***Sample Size***

The sample size computation for the reliability sub-study is based on the precision of the reliability estimate, expressed as width of the confidence interval (CI). We use the averaged rather than the pooled *κ* for this computation, as the former will yield a conservative estimate of the CI width, without the need to resort to simulations. Cohen’s *κ* averaged over 25 tests is expected to have standard deviation 4 to 5 times smaller than the individual *κ*’s. Assuming an average probability of agreement by chance of 50% and average probability of inter-rater agreement between 70% and 80%, the true averaged *κ* will lie between 0.4 and 0.6. With a sample size of 20, expected confidence interval width for the averaged *κ* will lie between 0.15 and 0.2 (NCSS, 2020).

With respect to the diagnostic accuracy study clinical prevalence data from our recruitment sites indicates that we can expect approximately 37% of eligible participants to have a diagnosis of ACJ pain. In order to construct an overall predictive model from at most 5 predictors (considered to be manageable by a clinician), we will need a minimum of 50 participants with a positive diagnosis (Harrell, 2015), using the lower end of Harrell’s rule and requiring 10 events per predictor. This number of positive diagnoses will be achieved with an expected sample size of 136. With this sample size, specificity and sensitivity for single predictors can be estimated with confidence intervals having expected half-widths of 11 and 15 percentage points respectively (assuming true values of 85% for the specificity and sensitivity). The aim is to recruit 136 potential participants with likely ACJ or sub-acromial pain. Once 50 consecutive participants with a PAR to an ACJ injection have been recruited the study will be concluded.

**Ethics**

Ethics approval will be sought from the Health and Disability Ethics Committees. This study does not significantly alter the normal care a patient attending this clinic would receive. Typically, any patient who displays clinical symptoms that suggest CACJ pain is offered a therapeutic injection of cortico-steroid combined with an anaesthetic into their ACJ. Those that enter the diagnostic accuracy study will first undergo an anaesthetic injection for diagnostic purposes prior to any cortisone injection. The advantage for these participants is that if the anaesthetic does not relieve their pain, they can choose not to have the steroid injection. There are risks associated with administering a steroid injection into a joint (Dean et al., 2014). This process would help to minimise this risk and ensure their treatment/management is more targeted and appropriate.

All potential participants will be provided with detail about the study both verbally and in written format with time to ask questions and consider whether or not they wish to participate before they sign the consent form. Material provided will include a statement to clarify that their decision not to participate in the study will not in any way change the assessment and management of their condition.They will be informed they have a right to decline or withdraw from the study at any point. Patient clinical information will be anonymously included in the study and kept in a secure locked location on site in Middlemore Hospital. No confidential patient information will be emailed outside the organisation protected servers unless the receiver also has a well-established protected server network. A signed confidentiality deed will be required for any collaborators not working for CMDHB.

**Resources and Budget**

The goal is to collect data for 50 participants with a positive anaesthetic response to an ACJ injection. It is estimated there may be as many as 70 patients sent to the radiology department before this is met.

|  |  |  |
| --- | --- | --- |
| **BUDGET ITEMS**1 | **Amount Requested ($)** | **Amount Received ($)** |
| **Personnel**  multi-coloured pens $15 x5  5 clip boards | $75  $15 |  |
| **Patient gratuity**  70 koha (gift) $20 petrol vouchers | $1400 |  |
| **Working expenses**  $50 per patient to cover anaesthetic and material costs at the radiology department  Approximately 70 patients  $350 to translate the final research summary from English to Maori | $3500  $350 |  |
| **Total:** | $ 5340 |  |

Funding will be sought from the New Zealand Manipulative Physiotherapists Association.

**Location**

At CMDHB Middlemore Radiology Department and Manukau Super Clinic-Orthopaedic Department Module 1

**Timetable for Completion**

Recruitment of 20 patients for the reliability study and 136 patients for the diagnostic accuracy study over the course of two years and write up of data.

|  |  |  |
| --- | --- | --- |
| **Description** | **Start date** | **End date** |
| Submission for research funding | 01/09/2020 | 15/11/2020 |
| Submission to AUT Ethics Committee | 28/09/2020 | 1/11/2020 |
| Participant recruitment | 1/12/2020 | 1/08/2022 |
| Data collection | 1/12/2020 | 1/08/2022 |
| Data Analysis | 1/12/2021 | 1/08/2022 |
| Write up | 1/10/2020 | 1/12/2022 |

**References**

Apeldoorn, A. T., Den Arend, M. C., Schuitemaker, R., Egmond, D., Hekman, K., Van Der Ploeg, T., Kamper, S. J., Van Tulder, M. W., & Ostelo, R. W. (2019). Interrater agreement and reliability of clinical tests for assessment of patients with shoulder pain in primary care. *Physiotherapy theory and practice*, 1–20. Advance online publication. https://doi.org/10.1080/09593985.2019.1587801

Bossley, C. J., & Miles, K.B. (2009, May). *Musculo-skeletal conditions in New Zealand: The   
 crippling burden.* The Bone & Joint Decade 2000-2010.   
 <https://nzoa.org.nz/system/files/The%20Crippling%20Burden.pdf>

Bossuyt, P. M., Reitsma, J. B., Bruns, D. E., Gatsonis, C. A., Glasziou, P. P., Irwig, L. M., Moher, D., Rennie, D., de Vet, H. C., & Lijmer, J. G. (2003). The STARD statement for reporting studies of diagnostic accuracy: Explanation and elaboration. *Annals of Internal Medicine, 138*(1), W1-12. https://doi.org/10.7326/0003-4819-138-1-200301070-00012-w1

Cadogan, C., Laslett, M., Hing, W. A., McNair, P. J., & Coates, M. H. (2011). A prospective study of shoulder pain in primary care: Prevalence of imaged pathology and response to guided diagnostic blocks. *BMC Musculoskeletal Disorders, 12*(119). <https://doi.org/> 10.1186/1471-2474-12-119

Cadogan, A., McNair, P., Laslett, M., & Hing, W. (2013). Shoulder pain in primary care:   
 diagnostic accuracy of clinical examination tests for non-traumatic acromioclavicular   
 joint pain. *BMC musculoskeletal disorders*, *14*, 156. https://doi.org/10.1186/1471-  
 2474-14-156

Cools, A. M., Cambier, D., & Witvrouw, E. E. (2008). Screening the athlete's shoulder   
 for impingement symptoms: a clinical reasoning algorithm for early detection   
 of shoulder pathology. *British journal of sports medicine*, *42*(8), 628–635.   
 https://doi.org/10.1136/bjsm.2008.048074

Core Team (2020). *R: A language and environment for statistical computing*. R Foundation   
 for Statistical Computing. <https://www.R-project.org/>

Chronopoulos, E., Kim, T. K., Park, H. B., Ashenbrenner, D., & McFarland, E. G. (2004). Diagnostic value of physical tests for isolated chronic acromioclavicular   
 lesions. American Journal of Sports Medicine, 32(3), 655-  
 661. https://doi.org/10.1177/0363546503261723

Dean, B. J., Lostis, E., Oakley, T., Rombach, I., Morrey, M. E., & Carr, A. J. (2014). The risks   
 and benefits of glucocorticoid treatment for tendinopathy: A systematic review of the   
 effects of local glucocorticoid on tendon. *Seminars in arthritis and rheumatism*, *43*(4),   
 570–576. https://doi.org/10.1016/j.semarthrit.2013.08.006

De Vries, H., Elliott, M. N., Kanouse, D. E., & Teleki, S. S. (2008). Using pooled kappa to   
 summarize interrater agreement across many Items. *Field Methods* 20(3), 272–282.   
 <https://doi.org/10.1177/1525822X08317166>

Efron, B., & Tibshirani, R. J. (1993). *An Introduction to the Bootstrap*. Boca Raton:   
 Chapman and Hall/CRC Press.

Friedman, J., Hastie, T., & Tibshirani, R. (2010). Regularization Paths for Generalized Linear   
 Models via Coordinate Descent. *Journal of Statistical Software*, *33*(1).   
 <https://doi.org/10.18637/jss.v033.i01>

Greving, K., Dorrestijn, O., Winters, J. C., Groenhof, F., van der Meer, K., Stevens, M., &   
 Diercks, R. L. (2012). Incidence, prevalence, and consultation rates of shoulder   
 complaints in general practice. *Scandinavian journal of rheumatology*, *41*(2), 150–  
 155. https://doi.org/10.3109/03009742.2011.605390

Harrell , F. E. (2015). Chapter 4: Multivariable modeling strategies, in *regression modeling   
 strategies: with applications to linear models, logistic and ordinal regression, and   
 survival analysis*. Springer International Publishing.

Health Information Standards Organisation - Paerewa Pārongo Hauora. (2017,   
 September). *HISO 10001:2017 ethnicity data protocols.* New Zealand Ministry of   
 Health. https://www.health.govt.nz/system/files/documents/publications/hiso-10001-  
 2017-ethnicity-data-protocols-v2.pdf

Javed, S., Sadozai, Z., Javed, A., Din, A., & Schmitgen, G. (2017). Should all   
 acromioclavicular joint injections be performed under image guidance? *Journal of   
 orthopaedic surgery (Hong Kong)*, *25*(3), 1-4. <https://doi.org/10.1177/2309499017731633>

Kane, D., & Koski, J. (2016). Musculoskeletal interventional procedures: With or without   
 imaging guidance? *Best practice & research. Clinical rheumatology*, *30*(4), 736–750.   
 https://doi.org/10.1016/j.berh.2016.09.012

Krill, M. K., Rosas, S., Kwon, K., Dakkak, A., Nwachukwu, B. U., & McCormick, F. (2018). A   
 concise evidence-based physical examination for diagnosis of acromioclavicular joint   
 pathology: a systematic review. *The Physician and sportsmedicine*, *46*(1), 98–104.   
 <https://doi.org/10.1080/00913847.2018.1413920>

Lange, T., Matthijs, O., Jain, N. B., Schmitt, J., Lützner, J., & Kopkow, C. (2017). Reliability of specific physical examination tests for the diagnosis of shoulder pathologies: a systematic review and meta-analysis. *British journal of sports medicine*, *51*(6), 511–518. https://doi.org/10.1136/bjsports-2016-096558

Malfair, D. (2008). Therapeutic and diagnostic joint injections. *Radiologic Clinics of North   
 America, 46* (2008), 439–453. <https://doi.org/10.1016/j.rcl.2008.02.007>

McGee, S. (2002). Simplifying likelihood ratios. Journal of General Internal Medicine. 17 (8),   
 647–650. <https://doi.org/10.1046/j.1525-1497.2002.10750.x>

Ministry of Health. (2013). *Health loss in New Zealand: A report from the New Zealand   
 burden of diseases, injuries and risk factors study, 2006–2016*. Wellington: Ministry   
 of Health. [https://www.moh.govt.nz/notebook/nbbooks.nsf/0/F85C39E4495B9684C   
 C257BD3006F6299/$file/health-loss-in-new-zealand-final.pdf](https://www.moh.govt.nz/notebook/nbbooks.nsf/0/F85C39E4495B9684C%20%20%09C257BD3006F6299/$file/health-loss-in-new-zealand-final.pdf)

Neblett, R., Cohen, H., Choi, Y., Hartzell, M., Williams, M., Mayer, T. H., & Gatchel, R. J.   
 (2013). The central sensitization inventory (CSI): Establishing clinically-significant   
 values for identifying central sensitivity syndromes in an outpatient chronic pain   
 sample. *The Journal of Pain*, *14*(5), 438–445.   
 <https://doi.org/10.1016/j.jpain.2012.11.012>

NCSS.(2020). *Power Analysis and Sample Size Software.* NCSS Statistical Software.   
 ncss.com/software/pass.

O'Brien, S. J., Pagnani, M. J., Fealy, S., McGlynn, S. R., & Wilson, J. B. (1998). The active   
 compression test: a new and effective test for diagnosing labral tears and   
 acromioclavicular joint abnormality. *The American journal of sports medicine*, *26*(5),   
 610–613. <https://doi.org/10.1177/03635465980260050201>

Shaffer, B. S. (1999). Painful conditions of the acromioclavicular joint. *The Journal of the   
 American Academy of Orthopaedic Surgeons*, *7*(3), 176–188.   
 <https://doi.org/10.5435/00124635-199905000-00004>

Treede, R. D., Rief, W., Barke, A., Aziz, Q., Bennett, M. I., Benoliel, R., Cohen, M., Evers,   
 S., Finnerup, N. B., First, M. B., Giamberardino, M. A., Kaasa, S., Kosek, E.,   
 Lavandʼhomme, P., Nicholas, M., Perrot, S., Scholz, J., Schug, S., Smith, B. H.,   
 Svensson, P., … Wang, S. J. (2015). A classification of chronic pain for ICD-  
 11. *Pain*, *156*(6), 1003–1007. https://doi.org/10.1097/j.pain.0000000000000160

Walton, J., Mahajan, S., Paxinos, A., Marshall, J., Bryant, C., Shnier, R., Quinn, R., &   
 Murrell, G. A. (2004). Diagnostic values of tests for acromioclavicular joint pain. *The   
 Journal of bone and joint surgery. American volume*, *86*(4), 807–812.   
 https://doi.org/10.2106/00004623-200404000-00021

|  |  |  |  |
| --- | --- | --- | --- |
| DECLARATION BY Student | | | |
| I declare that the information provided by me in this application is true and complete. I recognise that it is my responsibility to provide all necessary documentation to support my application and I authorise Auckland University of Technology, where necessary, to obtain further relevant documentation and to verify my qualifications as detailed in this application. I acknowledge that AUT reserves the right to vary or reverse any decision regarding admission to candidature on the basis of this application. I have read and understand the conditions of candidature outlined in the current Postgraduate Handbook and am prepared to accept them in full. | | | |
| **Student’s signature**: | Image | **Date**: | **12/09/2020** |

|  |
| --- |
| Supervisor(s)/ADvisor(s) to complete |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| SUPERVISOR / ADVISOR DECLARATION | | | | | |
| As supervisors, we are committed to ensure that adequate and appropriate supervision will be provided according to University policy and any/all issues relating to conflict of interest with respect to the student and/or the project will be declared and managed appropriately. | | | | | |
| **Primary Supervisor** | **Steven White** | **Supervised Master’s to Completion** | | **Yes** | **No** |
| **Signature** |  | **Date** | **14th September 2020** | | |
| **Secondary Supervisor** | **Julia Hill** | **Supervised Master’s to Completion** | | **Yes** | **No** |
| **Signature** |  | **Date** | **11th September 2020** | | |
| **Additional Supervisor** |  | **Supervised Master’s to Completion** | | **Yes** | **No** |
| **Signature** |  | **Date** |  | | |
| **Role of Additional Supervisor/ Advisor** |  | | | | |
| **External Supervisor/ Advisor** | **Alain C. Vandal** | **Supervised Master’s to Completion** | | **Yes** | **No** |
| **Contact email address:** | **alain.vandal@auckland.ac.nz** | **An approval email has been received from line manager?** | | | **Yes** |
| **Signature** | **A picture containing drawing  Description automatically generated** | **Date** | **2020-09-11** | | |

|  |  |  |  |
| --- | --- | --- | --- |
| mentor supervisor | | | |
| Where a supervisor has not supervised to completion a mentor should normally be appointed. The following supervisor will act as mentor for all who requires this within the supervisory team. | | | |
| **Name** |  | | |
| **Signature** |  | **Date** |  |

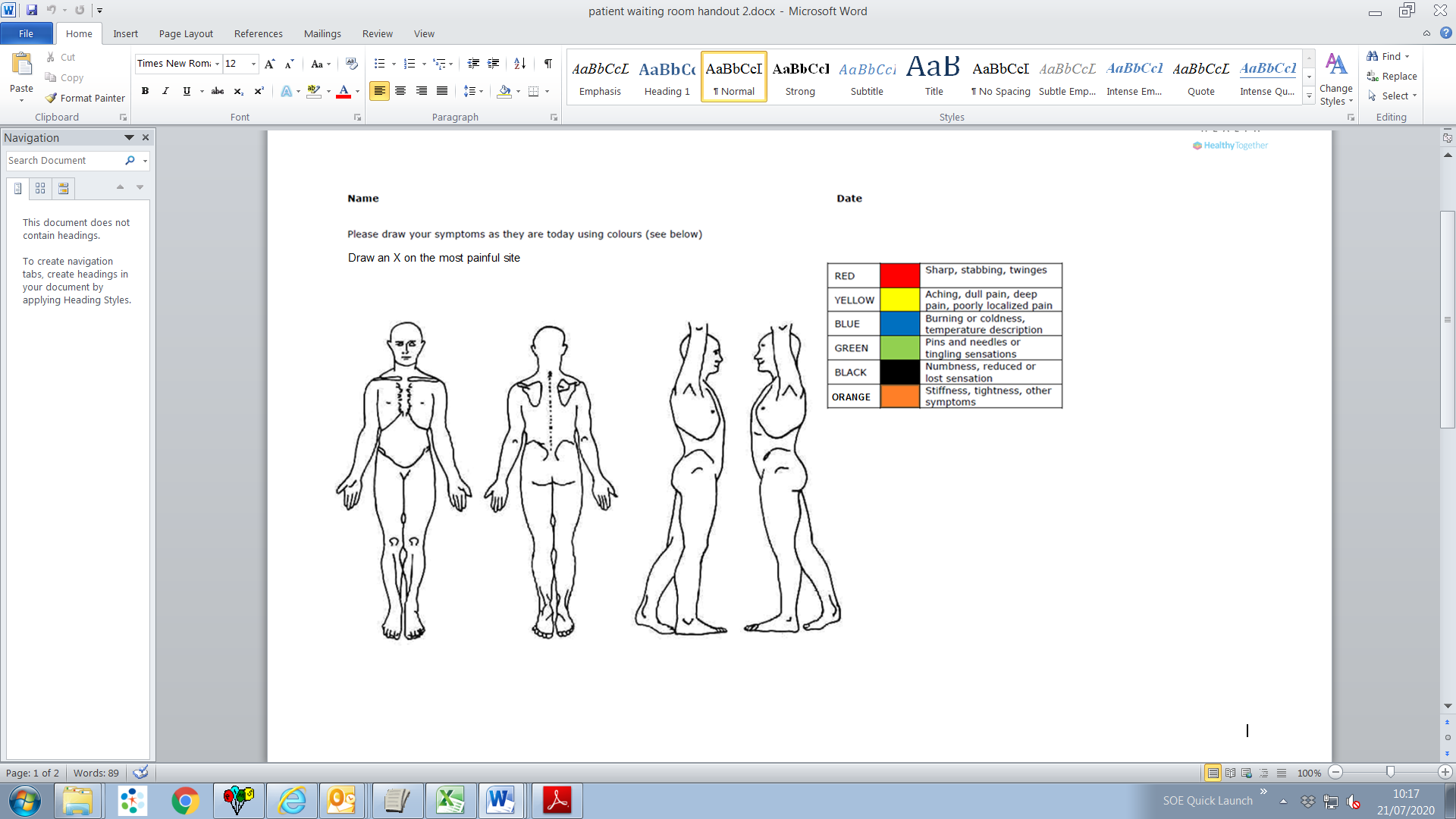
|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| resource sign off | | | | |
| **HOD/HOS/Dep Chair/**  **Authorised staff member** |  | **Confirm Resources**  **Available for this project** | **Yes** | **No** |
| **Signature** |  | **Date** |  | |
| **Name of HOD/HOS of Secondary Supervisor** when supervisor is located in a different department/ school/faculty |  | **Confirm Supervision**  **Available for this project** | **Yes** | **No** |
| **Signature** |  | **Date** |  | |
|  |  |  |  | |

|  |
| --- |
| Faculty/Department/School to complete |

|  |  |  |  |
| --- | --- | --- | --- |
| faculty postgraduate committee endorsement | | | |
| **Associate Dean (name)** |  | **Faculty PGC Approval Date** |  |
| **Signature** |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| university postgraduate board approval (Mphil Only) | | | |
| **Approval** | I approve admission to the above AUT doctoral programme with any conditions as listed above | | |
| **Name** |  | **Title** |  |
| **Signature** |  | **UPB Approval Date** |  |
|  |  |  |  |

**Appendix One**



**Please Fill in the Below Information**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| How long have you had your shoulder pain?  (Circle your answer) | 0-3 months | 3-6 months | 6-12 months | More than 12 months |

|  |  |
| --- | --- |
| Shoulder pain score at worst  (0 is no pain and 10 is the worst pain imaginable) |  |
| Do you have constant pain? (Yes or No) |  |
| a) If yes what is the lowest level of pain you   experience (out of 10) |  |
| Are you right or left handed? |  |
| Is your shoulder pain on the left or the right? |  |

Tick your Answer

|  |  |  |  |
| --- | --- | --- | --- |
|  | Yes | No | N/A |
| Was your shoulder pain caused by an accident/injury? |  |  |  |
| Are you currently employed? |  |  |  |
| Have you had to stop working due to your shoulder pain? |  |  |  |
| Have you had shoulder or neck surgery before? |  |  |  |
| Do you smoke? |  |  |  |

**Appendix Two**

***Index tests***

|  |  |  |  |
| --- | --- | --- | --- |
|  | Positive | Negative |  |
| **Subjective assessment** |  |  |  |
| Traumatic injury |  |  |  |
| Strain injury |  |  |  |
| Repetitive overuse injury |  |  |  |
| Insidious onset |  |  |  |
| Can’t lie on the affected side |  |  |  |
| Can’t lie on the non affected side (due to contralateral shoulder pain) |  |  |  |
| Pins and needles/numbness |  |  | Area affected: |
| Difficulty with overhead tasks |  |  |  |
| Difficulty Hand behind back |  |  |  |
| Difficulty shoulder extension |  |  |  |
| Difficulty with across chest movement |  |  |  |
| Crepitus/clicking |  |  |  |
| Associated neck pain |  |  |  |
| Symptom duration |  |  |  |
| Numeric Pain rating scale  (NPRS) at worst |  |  |  |
| Numeric Pain rating scale  (NPRS) at rest |  |  |  |
| Right hand dominant |  |  |  |
| Dominant arm affected |  |  |  |
| Smoker? |  |  |  |
| Oral Steroid? | List: |  |  |
| Pain medications |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Objective Assessment** | Positive | Negative | Pain response (NPRS out of 10) |
| Evident muscle wasting |  |  |  |
| Unilateral ACJ deformity |  |  |  |
| Bilateral ACJ deformity |  |  |  |
| 1 Tenderness over ACJ |  |  |  |
| 2 Cross arm adduction stress test |  |  |  |
| 3 AC resisted extension (resisted horizontal abduction), |  |  |  |
| 4 Active compression test (O’Briens) |  |  |  |
| 5 Paxinos Sign |  |  |  |
| 6 Bell Van Reit test |  |  |  |
| 7 Pain with Scapula protraction |  |  |  |
| 8 Pain with Scapula depression |  |  |  |
| 9 Pain with Scapula elevation |  |  |  |
| 10 Pain with Scapula retraction |  |  |  |
| X-ray or CT evidence of OA, osteolysis at the ACJ or a subacromial spur |  |  |  |
| MRI findings of ACJ bony oedema, joint cysts, capsular hypertrophy and/or osteophytes. Any rotator cuff tears or GHJ OA. |  |  |  |

|  |  |  |
| --- | --- | --- |
| Active range of shoulder motion | Range | Pain response (NPRS out of 10) |
| 11 Flexion |  |  |
| 12 Abduction |  |  |
| 13 External rotation |  |  |
| 14 Internal rotation (hand behind back level) |  |  |

|  |  |  |
| --- | --- | --- |
| Passive range of shoulder motion | Range | Pain response (NPRS out of 10) |
| 15 Flexion |  |  |
| 16 Abduction |  |  |
| 17 GHJ abduction |  |  |
| 18 External rotation (90° abduction) |  |  |
| 19 Internal rotation (90° abduction) |  |  |

|  |  |  |
| --- | --- | --- |
| Resisted shoulder testing | Strength out of 5 (Oxford Scale) | Pain response (NPRS out of 10) |
| 20 Flexion |  |  |
| 21 Abduction |  |  |
| 22 External rotation |  |  |
| 23 Internal rotation (belly press) |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Cervical spine range of motion | Normal range of motion | | Pain limited range of motion | |
| Flexion, extension and rotation |  | |  | |
| Spurling’s test | **+ve:** |  | **-ve:** |  |

***Demographics***

|  |  |
| --- | --- |
| Age |  |
| BMI |  |
| Ethnicity |  |
| Gender |  |
| Currently Employed |  |
| Unable to work due to shoulder pain |  |
| SPADI score |  |
| Oxford shoulder score |  |
| CSI score |  |