

# Trapezius fibre muscle analysis: A pilot inter/intra-examiner reliability study.

Shaun Cashman and Charles Blum

**Abstract:** This paper is an evidence-based report of DeJarnette's '*trapezius fibre technique*.' DeJarnette describes that the palpation of the trapezius muscle begins at the lateral border of T1 and moves out laterally in 7 equally spaced steps to finish at the acromioclavicular junction. The relationship between a palpated nodule and its causative vertebrae is documented in chart-form. The indicated thoracic or lumbar vertebrae shows irritation or off-centering on digital palpation. That vertebra is designated as the one causing the greatest stimulation of the trapezius muscle. Inter- and intra-examiner reliability was determined in this study with a cohort N=36 Australian chiropractors trained (advanced certification in Sacro Occipital Technique) and experienced (m=12y, R=r=12-34y) in the application of the trapezius fibre technique. In 72% (26/36) of cases there was at least one nodule/no nodule located by at least two examiners. The reliability of the examiners in so far as they could detect the same nodule on all three occasions was impressive and far greater than the inter-examiner reliability. Indeed there were 10 out of the 18 occasions where the one nodule was identified on all three occasions. We conclude that the examiners were relatively able to reliably detect nodules in the trapezius muscle.

**Indexing Terms:** subluxation; Sacro Occipital Technique; trapezius fiber/fibre; DeJarnette; spondylogenic reflex syndrome; conventional chiropractic.

**Note:** You may use this case as an element within your Continuing Professional Learning - see here

## Introduction

The '*trapezius fibre technique*' was first observed and developed by a chiropractor named Major Bertrand DeJarnette in 1962 and described in detail in his 1963 Sacro Occipital Technique convention notes. (1) DeJarnette continued to develop and refine the trapezius fibre technique over many years with his final version published in 1984. (2, 3, 4, 5)

According to a national survey 49.6% of chiropractors in the United States responded that they use Sacro Occipital Technique (SOT) with their patients. (6) It is this high level of usage that has warranted study into an aspect of SOT, the trapezius fibre, its existence and the theories behind it.

According to DeJarnette (5, 7) the trapezius fibre technique has two main functions. Firstly, it is used as an emergency type of care for a person suffering from musculoskeletal pain. Its second use is that of a preventative treatment to locate and correct a spinal problem before it becomes too serious. The areas of swelling in the trapezius muscle are localized to seven equally spaced points between the tip of the transverse process of the first thoracic vertebra and the acromioclavicular joint. These areas of swelling are known as trapezius fibre nodules. [Figure 1]

... the SOT '*trapezius fibre technique*' is found to have good inter- and intra-examiner reliability.'

Quick Tap or Scan:

The use of the word 'nodule' throughout this paper is used to describe a roughly spherically shaped abnormal structure. It should be noted that even though these nodules are referred to as an 'abnormal' structure, that is, being something that is not normally present as part of the anatomy, their abnormality has not been established and is only theorised. It is also used when referring to the description given by DeJarnette for the changes within the trapezius muscle. DeJarnette describes that the palpation of the trapezius muscle begins at the lateral border of T1 and moves out laterally in 7 equally spaced steps to finish at the acromioclavicular junction. According to DeJarnette once the specific area of swelling in the trapezius muscle has been identified the corresponding problematic vertebra can then be determined.

### **Practical guide to the 'trapezius fibre' technique**

The trapezius fibre/fiber is a very interesting phenomena. It is more a pre and post assessment tool and less about the type of adjustment rendered. I discuss this in the video (see *Journal section on Continuing Professional Learning*).

But the gist is that you isolate the most sensitive fiber with pressure by the thumb into the 7 regions located between just lateral to T1 all the way to the acromioclavicular 'V' or joint depression. You use the patient's report of pain as the primary indicator as well as the region of greatest 'mounding' or fiber swelling, which can be on the right or left. The greatest tension or sensitivity is the location of the most active fiber. However the patient's report of sensitivity tends to predominate over what the doctor notices with palpation. Though the majority of times these occur synchronistically.

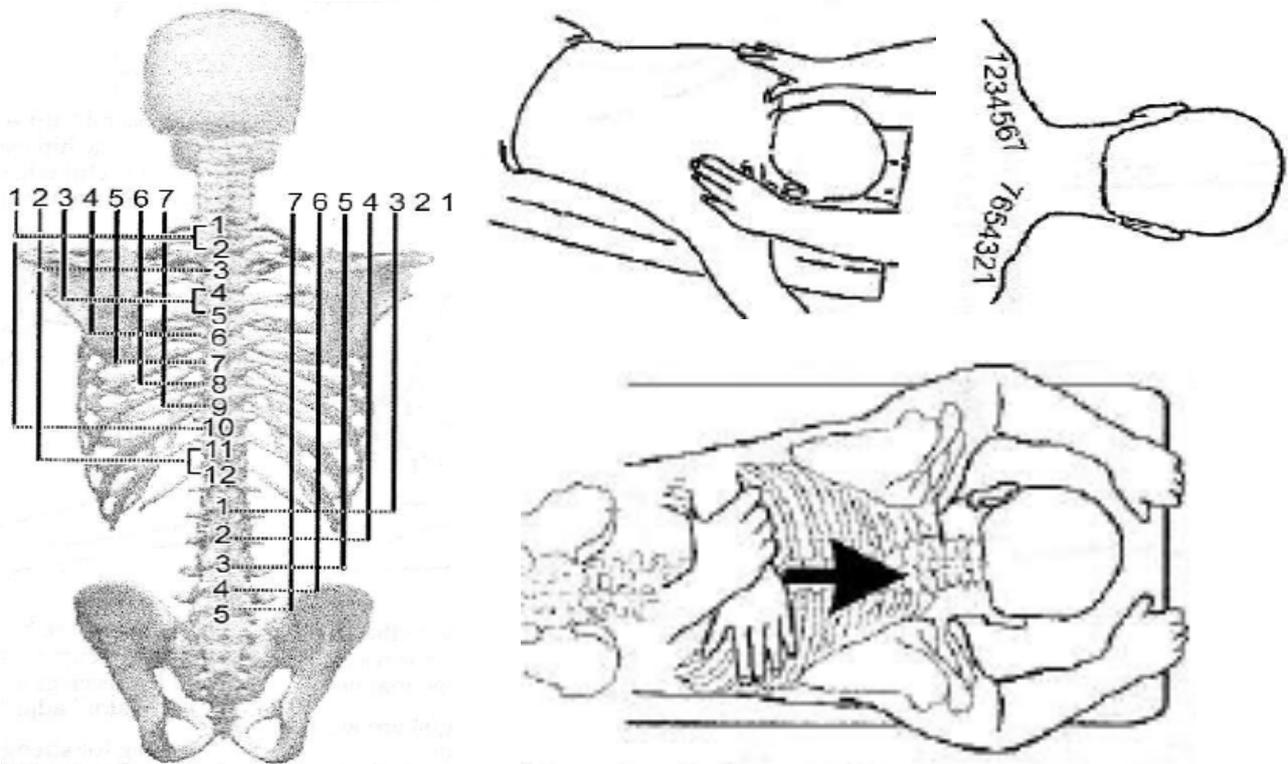
Once you locate the most active trapezius fiber the next step is locating the most sensitive vertebra by pressing superior-medial to each lamina/pedicle in the reflex arc. Usually the reflex arc follows the fiber-vertebral relationship described by DeJarnette however sometimes less frequently you may need to move up or down a vertebral segment from this fiber-vertebral relationship, to find the most sensitive vertebra.

Once you have the trapezius fiber and predominant vertebra in the reflex arc the next step is to apply inferior to superior force into the spinous process lifting it in various vectors (up to the left shoulder, between the left shoulder and T1, up towards T1, between T1 and the right shoulder, or towards the right shoulder). Simultaneously you contact the trapezius fiber and notice if one vector reduces the trapezius fiber's sensitivity or swelling.

Once you find the optimal vector of force you then have the trapezius fiber, vertebra, and vector of correction. You can thrust on it, use an Activator,<sup>TM</sup> toggle recoil, or just hold and maintain pressure as the patient breathes in or out. Usually if there is a thrust it can be whatever contact the doctor prefers and commonly completed on exhalation.

Then go back and note if the trapezius fiber swelling and/or sensitivity has decreased. The goal is for at least a 50% decrease and this reduction in trapezius fiber sensitivity or swelling will generally occur each visit until the fiber is no longer active. Sometimes it will then move to another fiber and sometimes the trapezius fibers will not have an active reflex after a few visits since the region and its reflex arc was neutralized.

**Figure 1:** Location and numbering of trapezius fibre indicators along with an example of palpation and adjusting according to M.B. DeJarnette.



To determine which of the chart-selected thoracic or lumbar vertebrae has the major irritation or off-centering, the practitioner uses digital palpation. The practitioner palpates along the lamina of each spinal segment. The vertebra which is found to be the most tender is designated as the one causing the greatest stimulation of the trapezius muscle. The chiropractic adjustment recommended by DeJarnette is an inferior to superior thrust, performed by hand, with the contact point under the spinous process. The trapezius area of local swelling is then re-examined and a reduction to both pain and swelling should be observed. DeJarnette believed that the relationship between trapezius fibre nodules and vertebra off-centering was specifically present in the thoracic and lumbar spines. (7) [Figure 1]

The objective of this study was to investigate the reliability of a chiropractic technique called the 'trapezius fibre technique' as developed by Major B. DeJarnette. While this technique has apparently been utilized extensively by chiropractors for over 40 years there has been no review of the mechanisms behind it or the reliability of its application.

### Methods

Institutional review board approval was granted by *Macquarie University* Ethics Review Committee, reference number: HE01APR2005-M03926. All of the examiners in this study were endorsed by the Sacro Occipital Technique Organisation of Australasia (SOTOA). This was to ensure that the examiners possessed a high level of training and experience in the application of the trapezius fibre technique in Australia. The examiners had at least 12-years (12-34 years)

experience and advanced certification in Sacro Occipital Technique (SOT), which requires the passing of 2 written and 2 practical examinations.

The participants for the trial were sourced from the participants at the 2006 Annual Convention for SOTOA, held in Melbourne. The participants comprised of chiropractors with a wide range of ages, and some students. Volunteers were asked for and exclusion criteria were applied. Those who met our requirements [n=36] were permitted to participate after completing the appropriate consent form.

The following exclusion criteria were applied

- ▶ Obvious obesity
- ▶ Skin lesions over trapezius muscle
- ▶ Taking medication that alters muscle function
- ▶ Under the age of 18 years

The examiners were seated at the head of a table and blindfolded so that they would have no visual way of identifying their participants. Each examiner had a specific coloured text mark made down the centre of both of their thumbs. Male participants were asked to remove their upper clothing and instructed to lay prone on the table with their face down a breathing hole and their hands up beside their head. Female participants were asked to do the same with the option of wearing a gown that opened at the rear. All participants were instructed to remain quiet for the duration of the trial. The positioning of the participants was in accordance with DeJarnette's most current manual. (7)

The examiners were then asked to palpate the participant's trapezius muscle and if they believed they found a trapezius fibre nodule they would indicate this by turning their thumb to a vertical position. A dedicated recording person upon seeing this would then continue the line from the centre of the examiner's thumb onto the skin of the participant's trapezius muscle.

### **Interexaminer reliability**

When all three examiners had completed their examinations the participants were asked to stand up and move to another table. This was done in a non-verbal way so that the examiners would be unaware as to the participant's movements. This was performed a total of three times so that each participant was examined by all three examiners. Each examiner palpated each of the thirty-six participants three times.

Once the participant had been examined by all 3 examiners they were instructed to lay prone on another table so that photographs could be taken of their markings. A ruler was placed on the skin so that measurements could be extracted at a later time. If there was a solitary marking on the opposite trapezius muscle then this was not photographed, but was recorded in writing. If there were no markings at all then this was recorded both in writing and a photograph.

### **Intraexaminer reliability**

Every seventh subject participated in the intra-examiner reliability component of the study. The procedure was the same as that of the inter-examiner study with the exception that when the participant stood up after being examined they walked to another table then returned to their original table and proceeded to be re-examined by the same examiner. Participants 1-6 of the 36 participants would be seen by each of the 3 examiners (inter-examiner reliability), whereas participant 7 would be seen by only one examiner each. As the examiners were physically blindfolded they were unaware that they were re-examining the same participant. This was the intraexaminer testing.

The data was extracted by (i) determining which marking was the most lateral on the trapezius muscle, and (ii) using the ruler that was photographed, measuring the distance between this lateral marking and all others.

It was necessary to determine the average distance is between the seven trapezius fibre areas on a male and female. To do this the distance between the lateral tip of the transverse process of cervical 7 and the acromio-clavicular junction was measured in 30 male and 30 females, and divided into seven equal areas. From this it was determined that a conservative average distance between nodules was 15mm for males and 12mm for females.

## Results

### *Inter-rater agreement*

There was only a single case where all three examiners found no nodules, and three cases where two examiners found no nodules. Of the 36 participants in the inter-rater study, 20 had precisely one agreement (i.e., two examiners found the same point or both found no points). There were 6 occasions in which there were two or three agreements. It was found that in 26/36 = 72% of cases there was at least one nodule/no nodule located by at least two examiners. (Table 1)

The use of Kappa in inter-examiner reliability studies is documented. (8) Kappa is expressed as:

$$\frac{Po - Pe}{1 - P}$$

where Po = observed proportion and Pe is the expected proportion. The value achieved gives an indication of the agreement observed beyond chance. However the determination of Pe is seen as intractable in this case. The expected probabilities will be dependant upon whether a participant had a nodule or not. At that time there is no way to determine this, therefore specificity and sensitivity analyses could not be conducted. In this case the sensitivity of the test would have look at the proportion of people who have trapezius fibre nodules who also show up as a positive finding, while the specificity would look at the proportion of people who do not have trapezius fibre nodules who show up as a negative upon testing.

The proportion of participants on whom there was some agreement is 26/36 = 72%, 95% confidence interval (58%, 87%).

The proportion of participants on whom there was complete agreement is 4/36 = 11%, 95% CI (1%, 21%).

It seems that nodules can be very subtle things to detect and that there is a good chance that a nodule will be picked up by just one person or sometimes two but rarely by all three. It was not recorded in the 3 cases where all agreed on the one nodule whether or not that nodule was a relatively large nodule and hence more readily detectable.

### *Intra-examiner agreement*

The findings from this aspect of the study is where each examiner palpated six participants three times and each participant being assigned to just one examiner. In 16/18 (89%) of cases the one point was located at least two times by the same examiner. In 10/18 (56%) the one point was located three out of three times by the examiner.

It was noted that in the two cases where no agreement was found the two points in question were only just outside the agreed limits by 3mm in one case and 5mm in the other. If the agreed limits were relaxed to include these two occasions then a level of agreement of 100% could be

made. One of the examiners was able to locate the same point on all three occasions in 5/6 cases. In 18 separate examinations (six participants, three examinations) the examiner was able to locate the same point 15 times. Again, if a 3mm leeway on the final participant were given his proportion of positive findings would have increased to 17/18 examinations. If this examiner had no skill and was in fact just randomly picking points on the participant's trapezius muscles then the chance of them replicating their findings would be 1 in 2 million.

The reliability of the examiners in so far as they could detect the same nodule on all three occasions was impressive and far greater than the inter-examiner reliability. Indeed there were 10 out of the 18 occasions where the one nodule was identified on all three occasions. This occurred three times with examiner 1 and five times with examiner 3.

Table 1: Summary of inter-examiner findings	
Number of Occasions	Summary of Examiner Findings
10	No agreement at all between the three examiners
1	All three agree that there is no nodule
3	All three agree on one nodule
1	1 and 2 agree there is no nodule
2	1 and 3 agree there is no nodule
5	1 and 2 agree on one nodule (2 left, 3 right)
7	1 and 3 agree on one nodule (all on left)
9	2 and 3 agree on one nodule (5 left, 4 right)

When the examiners were not finding the one nodule on the one participant three times, they were finding the one nodule (or total absence of a nodule) twice on all but 2 occasions. So they located a nodule (or a total absence of a nodule) on at least two of the three occasions on 16/18 of the examinations.

This would indicate that at least in the case of all three examiners but particularly in the case of examiners 1 and 3, there was considerable consistency in the sort of structure they were looking for. The intra-examiner data would indicate that the examiners are sensitive to slightly different structures.

## Discussion

The trapezius fibre technique has a long history of practitioner use, primarily within the chiropractic profession. This reliability study offers promising results, however determining if the trapezius fibre analysis and treatment behaves as purported is something for future studies.

There are various theories that lend a biological plausibility to DeJarnette's trapezius fibre technique such as the 'Spondylogenic Reflex Syndrome' (SRS), discussed in various manual medicine methodologies. (9, 10, 11)

Sutter, a German rheumatologist, described SRS as the 'reproducible, causative relationship between the reciprocal functionally abnormal position (segmental dysfunction) of parts of the axial skeleton and the local, anatomically determined non-inflammatory rheumatic soft tissue changes.' (12) He further stated that the functionally abnormal position is not necessarily something that can be seen on a radiograph. (12) Sutter also described that the functional vertebral misalignment is almost always bilateral which also correlates with DeJarnette's theories. (1)

Other theories could relate to visual and vestibular righting functioning in an ascending pattern from the spine with compensatory stabilizing contractions along the trapezius muscle. (12) It is also possible that some visual righting has a descending affect on righting as well as trapezius muscle retained excitability. (14, 15) These relationships may help explain why Barbero and others found that innervation zones and myofascial trigger points are located in well-defined areas in upper trapezius muscle. Mirroring DeJarnette's theory they also found that nodules or myofascial trigger points along the upper trapezius are proximally located to the innervation zones but not overlapped. (16)

Logan Chiropractic College's library has various student senior research projects that investigated trapezius fibres such as, relationship between trapezius fibres and pain thresholds at vertebral spinous processes, (17) trapezius trigger points and vertebral subluxations, (18) trapezius fibres and SOT pelvic block treatment, (19) trapezius fibre hypertonicity and vertebral tenderness, (20) and investigating a relationship between intersegmental spinal motion and reflex trapezius muscle modulation. (21)

This study was essentially a pilot study as a means to develop a more rigorous methodology to repeat this endeavor. Future studies might record additional variables within the subjects such as age, weight, height, body mass index, fitness status etc. as an aid to explaining the variability in results. This could allow for a profiling of different sectors of the community as to their probability of having trapezius fibre nodules. More studies are needed to help determine whether repeated palpation of the trapezius fibres changes their level of tension possibly confounding inter/intra-examiner reliability findings in some instances.

## Conclusion

From the inter-examiner reliability study it was demonstrated that the examiners were relatively able to reliably detect nodules in the trapezius muscle. The intra-examiner reliability study demonstrated fairly well that the examiners were able to detect the same nodules repeatedly. Good intra-reliability scores coupled with the observed relationship between examiner experience and ability to detect nodules, supports a conclusion that practitioners of the technique may be able to locate trapezius fibres nodules with clinical experience helping to develop a skillset to discern the more subtle ones.

This first attempt at an inter/intra-examiner reliability study on trapezius fibre analysis was promising, further validity studies will also need to be performed.

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## Declaration

This paper was submitted (ID #117) to the 2016 ACC-RAC scientific symposium. Ethics approval is documented.

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