Association chiropratique canadienne

Canadian Chiropractic Association

JCCA
Journal of the Canadian Chiropractic Association

(Formerly the Canadian Chiropractic Association Journal)

Published by the Canadian Chiropractic Association and issued quarterly

EDITORIAL AND EXECUTIVE OFFICES,
186 SPADINA AVENUE, SUITE 6, TORONTO, CANADA M5T 3B2

General Information: The Journal of the Canadian Chiropractic Association is the official publication by the Canadian Chiropractic Association. The JCCA is published by the Canadian Chiropractic Association as a medium of communication between the Association and its members and is a forum for fair comment and discussion of all matters of general interest to the chiropractic profession and the Association. Readers are invited to comment and express their opinions on relevant subjects. Views and opinions in editorials and articles are not to be taken as official expression of the Association's policy unless so stated. Publication of contributed articles does not necessarily imply endorsement in any way of the opinions expressed therein and the Journal and its publisher does not accept any responsibility for them. Business correspondence should be addressed to: the Editor of JCCA, 186 Spadina Avenue, Suite 6, Toronto, Canada M5T 3B2.

INDEXING SERVICES

JCCA is indexed by PubMed Central, Scopus, CINAHL (Cumulative Index to Nursing and Allied Health Literature), MANTIS (formerly CHIROLARS), AMED, PASCAL, Index to Chiropractic Literature, and selectively by SPORTDiscus.

Contents

JCCA Vol 64 No 2 ISSN 0008-3194 (Print) and ISSN 1715-6181 (Electronic)

Original Articles

Imaging Case Review

Editorial Board

ISSN 0008-3194 (p)/ISSN 1715-6181 (e)/2020/97–108/$2.00/©JCCA 2020

Understanding how chiropractors build trust with patients: a mixed-methods study

Gaelan Connell, BHK, DC[1]
Lesley Bainbridge, BSR(PT), MEd, PhD[2,3]

Introduction: *Trust is a key component of any therapeutic relationship and correlates with treatment satisfaction. Patients with high levels of trust in their healthcare providers report more beneficial heath behaviours, fewer symptoms, and a higher quality of life. The purpose of this study was to explore how chiropractors in British Columbia (BC) understand the process of building trust with patients.*

Design: *This was a sequential exploratory mixed-methods design. Semi-structured one-on-one interviews informed an online survey that was sent to all BC Chiropractic Association members.*

Participants: *Interviews were completed by six chiropractors from the Vancouver Practice Based Research Network; an online survey was completed by 97 chiropractors.*

Results: *Themes of honesty, communication, perceived competence, and caring emerged during interviews.*

Introduction : *La confiance est un élément fondamental dans toute relation thérapeutique; elle est en corrélation avec la satisfaction à l'égard du traitement. Les patients faisant grandement confiance en leurs professionnels de la santé affirment avoir une attitude plus bénéfique à l'égard de leur santé, moins de symptômes et une meilleure qualité de vie. Cette étude visait à examiner comment des chiropraticiens de la Colombie-Britannique (C.-B.) comprennent comment établir un lien de confiance avec leurs patients.*

Méthodologie : *Cette recherche a été menée selon des méthodes exploratoires mixtes. Des entrevues individuelles semi-dirigées ont précédé l'envoi d'un sondage en ligne à tous les membres de la BC Chiropractic Association.*

Participants : *Les entrevues ont été menées par six chiropraticiens du Vancouver Practice Based Research Network; 97 chiropraticiens ont répondu à un sondage en ligne.*

Résultats : *L'honnêteté, la communication, la compétence perçue et la bienveillance ont été les aspects qui sont ressortis des entrevues. Les résultats du sondage ont confirmé l'importance de l'honnêteté,*

[1] Rehabilitation Sciences, Faculty of Medicine, The University of British Columbia
[2] Department of Physical Therapy, Faculty of Medicine, The University of British Columbia
[3] School of Leadership Studies, Royal Roads University

Corresponding author: Gaelan Connell, 2655 Commercial Drive, Vancouver, BC, Canada, V5N 4C3
E-mail: g.connell@alumni.ubc.ca
Tel: 604-862-5578

The authors have no disclaimers, competing interests, or sources of support or funding to report in the preparation of this manuscript.

Survey findings confirmed the importance of honesty, communication, and perceived competence in building trust.

Conclusion: *Chiropractors can employ a variety of interpersonal strategies to foster trust with patients.*

(JCCA. 2020;64(2):97-108)

KEY WORDS: chiropractic, interpersonal skills, interviews, mixed-methods, survey, trust

de la communication et de la compétence perçue dans l'instauration de la confiance.

Conclusion : *Les chiropraticiens peuvent utiliser diverses stratégies interpersonnelles pour favoriser la confiance avec leurs patients.*

(JCCA. 2020;64(2):97-108)

MOTS CLÉS : chiropratique, entregent, entretiens, méthodes mixtes, sondage, confiance

Introduction

Collaboration, affective bond, agreement, and trust are constructs of any therapeutic alliance between a patient and a care provider, in this case a chiropractor.[1] Stilwell and Harman[2] suggested that a "therapeutic alliance provides the central foundation for patients to receive the benefits from other contextual factors and their placebo effects, further improving health related outcomes". The concept of trust is multifaceted and requires vulnerability based on the goodwill, benevolence, and competence of another individual.[3] Prior to the formation of trust between patient and chiropractor, particular events or phenomena are generally required. Bell and Duffy[4] described antecedents of trust as perception of practitioner competence and past experiences of positive outcomes. Understanding how chiropractors foster trust with patients may offer insights into contextual antecedents of trust. According to Hall *et al*.[5], five key components of physician trust include: fidelity, competence, honesty, confidentiality, and global trust. These may also hold true for chiropractors; however, patient characteristics and situational factors are also antecedents of trust. Patient perception of practitioner benevolence and belief that their chiropractor is working in the patient's best interest may influence trust.[4] In addition, positive communication, openness, and listening may influence the formation of trust.[4]

The concept of trust is extremely complex but is fundamental in a therapeutic relationship.[4] Trust affects patient behavior and attitudes, including willingness to seek care, return for subsequent episodes of care, divulge sensitive information, and adhere to a plan of management.[6] Trust in physicians has been shown to correlate positively with adherence to treatment recommendations, willingness to recommend a physician to others, perceived effectiveness of care, improvement in self-reported health, staying under the care of the same physician, and avoiding seeking second opinions.[5] Patients with high levels of trust in their healthcare providers report more beneficial heath behaviours, fewer symptoms, a higher quality of life, and greater satisfaction with treatment.[7] Patient trust in their chiropractor can be defined as a collaborative relationship that includes knowledge sharing, professional and emotional connection, partnership agreement, respect, and honesty.[8] Understanding how chiropractors build trust with their patients will provide insights into fostering trust.

Trust has been positively correlated with satisfaction; therefore, a trusting therapeutic alliance may foster patient satisfaction and may improve the patient experience with their healthcare practitioner.[3] Trust is an important component of the therapeutic alliance and can be separated into technical skills and relational skills.[9] Patients and caregivers have emphasized that relational skills more important than technical skills as they enable patients to feel safe.[9] Feeling safe is often a pre-requisite for treatment as there can be a "…sense of loss of control caused by positional inequality".[9] There is a gap in the academic literature with respect to patient trust during encounters with complementary medicine practitioners generally and chiropractors specifically. The vast majority of research regarding patient trust pertains to physicians and nurses. The existing literature relies mostly on observational data and very few qualitative or mixed methods studies have evaluated individual experiences with trust. Chiropractic training on the topic of interpersonal skills and communication is sparse. Therefore, this study was intended to

bridge the current gap in knowledge and is expected to benefit both chiropractors and their patients. The purpose of this study was to explore how chiropractors in British Columbia (BC) understand the process of building trust with patients.

Methods

Study Design

A two-phase, sequential exploratory mixed methods design was conducted using semi-structured interviews followed by a survey. Sequential collection and analysis of both qualitative and quantitative data were used to gain a deeper understanding of how chiropractors perceive to build trust with patients. A mixed methods approach was used as it draws from the strengths of both methodologies, gaining insights into the target population through a humanistic, interpersonal approach, while also applying descriptive statistics to larger sample population findings.[10] The value of mixed methods is reinforced by findings and analysis that result from two strands of data.[10,11] In order to fully explore the research question, the proposed design aimed to capture contextual, field-based information to inform survey questioning of a larger sample population.[10]

The first phase of this study included an initial exploration of six chiropractors' perspectives of how trust is formed between patients and their chiropractors. A phenomenological approach was employed in order to capture subjective aspects of how chiropractors build trust with patients. The phenomenological strategy of inquiry attempts to capture the essence of human experiences through studying a small number of participants.[11] The second phase of this study incorporated an online survey which built on the interview findings to verify the results within a larger sample of chiropractors.

Interviews

Six chiropractors licensed with the College of Chiropractors of British Columbia were recruited using convenience sampling. This form of non-random sampling allowed participants to be selected for study participation based on availability and willingness to participate.[12] All twenty-five members of the Vancouver Chiropractic Practice-Based Research Network (PBRN) were invited to participate in the study by the PBRN administrative assistant. This population was selected for ease of recruitment given their commitment to research as evidenced in their participation in a PBRN. Potential participants received an invitation and a reminder email over two weeks to respond with interest in participation. Eight potential participants responded and agreed to participate in the interview process. Participants were located in a variety of geographic locations, primarily the Greater Vancouver area and Vancouver Island.

Semi-structured one-on-one interviews with six chiropractors were conducted, recorded, transcribed, and analyzed prior to the quantitative phase. Chiropractors were interviewed in a private setting of their choice for 30-60 minutes. Interview settings were either online through Skype or in person. Both participant and interviewer were in a private space away from colleagues to ensure that confidentiality was maintained. A phenomenological approach was employed; it assumes that knowledge comes from the subjectivity of participants, rather than an external source.[13] As such, the interview style included several open-ended questions to accommodate for exploration of unexpected findings. We employed a funnel structure in our interviews by initially asking broad questions, followed by questions based on four narrower priori codes; honesty, competence, fidelity, and confidentiality. Semi-structured interview questions were influenced by concepts from the modified Healthcare Relationship Trust Scale and the Wake Forest Scales Measuring Trust.[14,15] The interviewer practiced reflexivity during the course of the interview to maintain awareness of the possible effects that their clinical background as a chiropractor could lead to assumptions and interpretation of findings.[16] The interviewer also kept a journal of thoughts, impressions, and potential biases following each interview. Participants were asked for informed consent prior to commencement of the interview.

In-person interviews were recorded through the iPhone Voice Memo application and recordings during Skype interviews were enabled using Ecamm call recording software. The interview protocol can be found in Appendix 1. Audio recordings were immediately downloaded and saved to a password-encrypted computer and file names did not display any identifying information. Similarly, computerized files were saved to a password-encrypted computer. Participants were not offered any compensation for their time. The interviewer took hand-written notes to

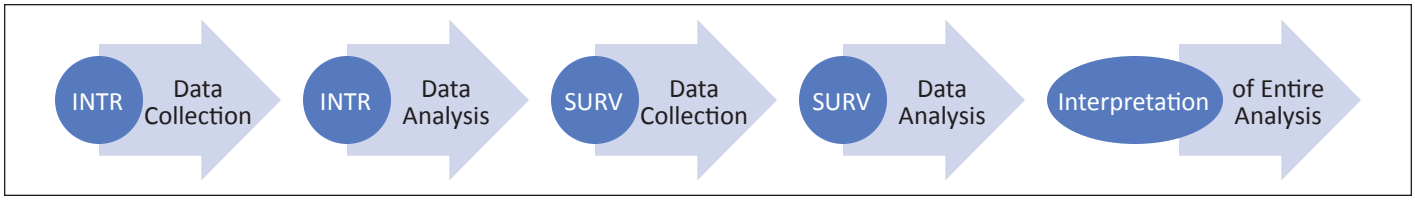

Figure 1.
Sequential Exploratory Design (from Cresswell (2009)[11] (INTR = Interviews SURV = Survey).

record salient points and observational data during and after the interviews. Audio recordings were transcribed verbatim by the interviewer and compared with handwritten notes in order to compile a draft transcript. Member checking was used, as participants received a copy of the transcripts and were asked to provide any corrections or feedback. A visual model of the sequential exploratory design is illustrated in Figure 1.[11] Thematic analysis was performed by one author (GC) and guided by the six-phase framework by Braun and Clarke (2006) in Table 1.[17] The aforementioned a priori coding framework was implemented to improve trustworthiness of our findings.[18]

Survey

There is no existing survey that assesses factors of perceived patient trust amongst chiropractors. Creating a novel survey based on interview findings ensured that our questions reflect the perspectives of chiropractors in BC. Therefore, a survey was created following qualitative analysis to verify emerging themes related to chiropractors' perceptions of trust. The survey consisted of questions regarding demographic data and factors relating to patient trust that emerged from our interviews (Appendix 2). Two chiropractors pilot tested the survey to ensure the appropriateness and feasibility of questions. Both chiropractors provided feedback on the format and content of the survey to ensure that the questions were not ambiguous and were understood in the same way by both chiropractors who tested them. All 1,154 registered members of the British Columbia Chiropractic Association (BCCA) were invited to participate in the survey. The BCCA agreed to distribute the survey to its members. The survey was emailed twice within one month by the BCCA, inviting members to complete the survey. The survey invitation accompanied an informed consent form.

Survey participants were directed to a UBC Survey Tool (Qualtrics) link. Qualtrics complies with the BC Freedom of Information and Protection of Privacy Act as data is kept secure and is stored and backed up in Canada. Participants had one month to complete the survey and no

Table 1.
Phases of thematic analysis adapted from Braun and Clarke (2006)[18]

Phase	**Description of the process**
Familiarizing yourself with your data	Transcribing data with audio and written notes, reading and re-reading the data, reflection of meaning, noting down initial ideas.
Generating initial codes	Coding interesting features of the data in a systematic fashion across the entire data set, identifying chunks of data relevant to each code.
Searching for themes	Collating codes into potential themes, gathering all data relevant to each potential theme.
Reviewing themes	Checking if the themes accurately represent the codes and entire data set.
Defining and naming themes	Ongoing analysis to refine the details of each theme and adequately categorize sub-themes. Generate clear definitions and names for each theme.
Producing the report	Selection of compelling quotes, final analysis of selected extracts, relating back to the research question and literature, producing a scholarly report of the analysis.

compensation was offered for participation in this survey. Descriptive statistics were used to provide observations, comparisons, and summaries of survey data.

Ethical Considerations

The University of British Columbia Ethics Review Board approved this research. Participants received information about the study procedures, confidentiality and each participant provided informed consent. Written and verbal consent was obtained prior to interviews. Survey participants were expected to read the study preamble and provided implied consent by voluntarily participating.

Results

Demographic Data

Interview participants self-reported chiropractic college dates of graduation ranged from 1988-2010 and the mean graduation date was 2000. Four participants practice in urban locations, one practices in a suburban location, while one other participant practices in both urban and suburban locations.

Themes

From the interview analysis, four main themes emerged. These were honesty, communication, perceived competence, and caring. They provided insights into strategies to foster trust with patients and provided the basis for the survey questions. Interviews were coded with the letter I, followed by an interview number (1-6).

Theme 1: Honesty

The concept of honesty involves telling the truth and avoiding intentional falsehoods.[5] In several interviews, honesty emerged as a foundation for establishing trust. Participants suggested that a trusting relationship would be established more quickly if they admit to mistakes and acknowledge their own limitations; which sometimes resulted in a referral. Providing a realistic prognosis, regardless of severity was seen as important to establishing an honest dialogue with patients. When participants discussed honesty, they often described scenarios where they were acknowledging points of conflict with patients in a humble and genuine manner. Participants described that patients would be able to tell if their chiropractor is being honest. Participants felt that honesty would allow patients to feel an increased level of confidence in their chiropractor. It was also suggested that patients would often reciprocate the honesty that was portrayed by their chiropractor. One participant (I4) mentioned that they establish a better relationship with patients when they combine honesty and compassion. Honesty also helped patients understand what to expect from their chiropractor.

> *"I just try to figure out all their points are of negativity and I address them as opposed to pretending they're not there. Because if you chicken out, you lose them." [I4]*

> *"…if you're honest with them (patients) and you tell them 'I'm going to do my best to get you better, no matter what'. What I always say is that 'We're going to try to get you better, it might not be me. I might need help with other people. But the end result is that I'll do everything I can to help you out'." [I1]*

A sub-theme of honesty that arose from the interviews was authenticity. This was not significant enough to include as an independent theme, but it appeared to fit within the context of honesty. One participant (I2) expressed the belief that chiropractors demonstrating authenticity will have greater success in developing trust with patients. Another participant (I5) felt that displaying genuine interest in the patient helped establish rapport. They mentioned that "trying to exist at a human level with them" (I5), would build trust. When asked about characteristics of an authentic chiropractor, one response was:

> *"I think they're very direct. I think they're not afraid to be themselves. So, they're staying human." [I2]*

Theme 2: Communication

In a healthcare setting, the exchange of information can be a complex interaction, involving verbal and non-verbal communication. The concept of communication was discussed during the interviews and importance was placed on listening to patients as well as clearly setting expectations. Uninterrupted listening provides an opportunity for patients to feel engaged and was described as a method of forming meaningful connection.

"…I think it's a lot of listening and not interrupting so they can tell their story and I think it's about yes making some sort of connection that's other than their healthcare." [I3]

Participant 2 (I2) described that listening at the beginning of a new patient encounter can inform whether follow-up questioning will be close-ended or open-ended. Interactions with patients often involve education regarding their condition, their practitioner's scope of practice, procedural or safety of interventions. For example, participants mentioned that they describe a manipulative procedure to patients before they are performed on a patient for the first time. Participants also noted that they try to avoid technical jargon and speak in plain language that the patient will understand. Clear and timely communication is an opportunity for chiropractors to understand patient expectations and assure patients that they are in a safe environment.

"I tell them at the very beginning that I will never do things by surprise. I will always explain things before I do it. You are always the boss, I'm not. This visit is about you not me." [I5]

Important aspects of patient communication also occur outside the treatment room. One participant mentioned her front desk staff would warn patients if the chiropractor was running late, which helps patients manage their expectations. Despite the emphasis on verbal communication and listening, there was acknowledgement that non-verbal communication plays an important role in the clinical encounter. A handshake, a smile, and eye contact can help establish rapport but importantly, understanding when it is and isn't appropriate to touch a patient given the intimate nature of manual therapy. During patient encounters, identifying body language can be a helpful tool to understand patient comfort. Participant 3 (I3) described crossing legs, how patients hold their hands, and whether they look at you as non-verbal indicators of patients' level of trust. Participant 4 (I4) described a mirroring technique which matches the patients' body language and communication style in order to build trust.

"Eye contact, firm handshake, knowing when and when not to touch somebody, because obviously it's a really an intimate experience when you're seeing a chiropractor" [I3]

Theme 3: Perceived competence

During our interviews, most chiropractors felt that trust would be enhanced when patients believe that their chiropractor is competent. The perception of competence was thought to contribute to confidence in one's chiropractor. There was emphasis on the portrayal of competence or "perceived competence" to patients which appeared to be important to establishing trust. Appearing competent was not solely based on technical skills but also interpersonal skills, cognitive skills, ethics, and appearances. Chiropractors believe that their competence is demonstrated in a variety of ways including professional attire, online reviews or in-person recommendations, difficulty booking appointments, and clinical outcomes. Perception of competence is also likely influenced by the chiropractor's ability to effectively communicate and educate their patients. Patients likely have varying expectations of their chiropractor, based on preconceived ideas or past experiences with healthcare providers. If patients had seen a chiropractor in the past it could influence their ability to trust a new practitioner; however, our interviews did not uncover any consensus on this topic. It appeared that it was more difficult to build trust with some patients who have seen chiropractors before, while it may be easier with others. Patient education was mentioned as a method of demonstrating cognitive competence as one participant reported using a computer tablet to review relevant anatomy with patients. It was also reported by participants that creating a professional clinic environment helped portray competence to patients, which was expected to build trust.

"What I need, is I need by the second visit, by the third time I see them, I need a noticeable improvement or I'm going to lose them. Because now you're just another person taking their money, doing something that is not going to work." [I4]

Theme 4: Caring

Participants described the importance of demonstrating a caring demeanor; although, they also expressed the importance of demonstrating empathy and commitment to the best interest of the patient. The term "caring" was used to describe this theme, although this theme represents

more than just caring. This theme represents a genuine interest in a patient's well-being and avoiding or disclosing conflicts of interest. Many of our interviewees identified that patients can be vulnerable and that demonstrating empathy and placing patient needs above self-serving motives help establish trust. Participants have stated that they avoid coercive marketing tactics, often finding that aggressively marketing products can deter patients from developing a therapeutic alliance. Participants reported that products such as pillows and orthotics they were sold in their clinic for convenience and recommended based on clinical need, rather than financial motivation.

Patients can be financially vulnerable and may have difficulties paying for chiropractic services. Participant 1 (I1) ensures his fee structure is considerate of individuals who may have financial barriers to care, for example: students, elderly, or individuals on welfare. Demonstrating a consideration for patient vulnerabilities can help portray a caring and respect for patients. Participants mentioned that chiropractors can demonstrate a caring demeanor by offering tea or water in their waiting rooms, hiring and training friendly staff, and collaborating with other healthcare professionals.

> *"When I refer them out to another discipline, another chiropractor or something like that, that actually they trust me more than anything else." [I1]*

Additional observations

Participants were asked whether time spent with patients influences the formation of trust. Time spent with patients was not a theme; however, it was an important component of building trust. One participant discussed the need to increase time spent with patients over the years as it became difficult to provide a comprehensive approach during short periods of time. As mentioned by two participants, having too little or too much time with a patient can negatively impact trust.

> *"It's one of those scenarios where if you're literally in and out, there's not enough interaction for people to get to know you. (Conversely, there is) an osteopath in town that spends two hours with their patients. And most people were just like, 'That was way too much'. It actually eroded their credibility." [I5]*

Table 2.
Survey demographic variables (n=97).

	Mean	Mode
Date of birth	1969	1971
Date of graduation from chiropractic college	1997	2000
Urban Practice setting	53 (54.6%)	
Suburban Practice setting	38 (38.2%)	
Rural Practice setting	6 (6.2%)	
What is the main focus of your chiropractic care?		
General musculoskeletal care (spine and extremities)	67	69.1%
Subluxation-based	13	13.4%
Wellness/Prevention	7	7.2%
Family care	5	5.2%
Pediatrics	2	2.1%
Sports	2	2.1%
Spine	1	1.0%
What is the average length of your patient interactions?		
11-15 minutes	41	42.3%
16-20 minutes	23	23.7%
5-10 minutes	23	23.7%
21-25 minutes	4	4.1%
26-30 minutes	4	4.1%
Less than 5 minutes	2	2.1%

The concept of vicarious trust arose when discussing how trust had been broken or gained by interactions with other individuals. Front desk staff, referring healthcare providers, family and friends all have the ability to influence trust on a particular chiropractor, to varying degrees.

Survey data analysis

1,154 practicing chiropractors are members of the BCCA and 97 responded to the survey (8.4%). As seen in Table 2, chiropractors most frequently identified their practice as "General musculoskeletal care (spine and extremities)" (69.1%). Forty-two percent of respondents spend between 11-15 minutes during patient interactions and 89.7% of respondents spend between 5-20 minutes with patients

Table 3.
Survey Likert questions.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Chiropractors who are honest are more likely to form trust with their patients. (n=97)	3 (3.1%)	0 (0.0%)	2 (2.1%)	11 (11.3%)	81 (83.5%)
My patients are more likely to trust me if I'm authentic. (n=97)	3 (3.1%)	0 (0.0%)	1 (1.0%)	12 (12.4%)	81 (83.5%)
Understanding my patient's body language can help me understand if they trust me. (n=96)	2 (2.1%)	0 (0.0%)	2 (2.1%)	27 (28.1%)	66 (68.8%)
I believe that clear communication is a way to build trust with patients. (n=97)	2 (2.1%)	0 (0.0%)	1 (1.0%)	12 (12.4%)	82 (84.5%)
Patients are more likely to form a trusting relationship when they are referred to their chiropractor. (n=97)	3 (3.1%)	2 (2.1%)	24 (24.7%)	41 (42.2%)	27 (27.8%)
My patients need to see a clinical improvement in the first three visits, otherwise they won't trust me. (n=97)	12 (12.4%)	21 (21.6%)	26 (26.8%)	27 (27.8%)	11 (11.3%)
Interprofessional communication builds trust with my patients. (n=97)	1 (1.0%)	1 (1.0%)	13 (13.4%)	58 (59.8%)	24 (24.7%)
Selling products (i.e. orthotics, pillows, braces etc.) negatively influences trust between patients and their chiropractor. (n=97)	7 (7.2%)	46 (47.4%)	35 (36.0%)	6 (6.2%)	3 (3.1%)
Respecting patient privacy and confidentiality is important to developing trust. (n=97)	2 (2.1%)	0 (0.0%)	1 (1.0%)	13 (13.4%)	81 (83.5%)
It's more difficult to form trusting relationships when appointments are booked by someone other than the patient (i.e. spouse or parent). (n=96)	2 (2.1%)	30 (31.2%)	37 (38.5%)	20 (20.8%)	7 (7.3%)

(Table 2). Table 3 demonstrates findings from Likert scale questions regarding themes and key concepts derived from interviews. Table 3 demonstrates the general acceptance of honesty, authenticity, patient communication, interprofessional communication, and patient privacy as factors that influence the formation of trust between chiropractors and patients. Less agreement was found regarding whether patients were more likely to form trust with their chiropractor if they were referred, if they noted a clinical improvement within the first three visits, or if their appointment was booked by someone else. In contrast to interview findings, the majority of respondents stated that selling products did not negatively influence trust between patients and their chiropractor.

Discussion

The objective of this study was to explore how chiropractors understand the process of building trust with patients. There are very few studies evaluating how healthcare providers can build trust with patients. Specifically, there are no studies to our knowledge that investigate how chiropractors form trust with their patients; particularly in the context of Canadian chiropractors. During this study, we discovered that chiropractors viewed interpersonal skills as an important driver of trust. Patient trust in their healthcare provider has been shown to stem from knowledge sharing, professional and emotional connection, partnership, respect, and honesty.[8]

Four concepts of honesty, competence, fidelity, and confidentiality were discussed during the interviews; however, some of these concepts were interpreted differently by participants. For example, competence was defined by Hall *et al*.[5] by admitting to a lack of knowledge or experience, yet participants interpreted the concept as how patients perceive practitioner competence. This emerged as an important theme throughout the interviews. Similarly, fidelity was described to participants as disclosing conflicts of interest but was interpreted as selflessness

and benevolence. Furthermore, participants specifically discussed the importance of caring for patients, rather than using the term fidelity. Confidentiality was not seen as important for building trust throughout the interviews.

The sequential exploratory mixed-method design was implemented in order to use survey results to either support or refute interview findings. A recently published Canadian chiropractic survey recorded a response rate of 8%.[19] As we surveyed a similar population, it was expected that we would achieve a similar response rate. We aimed to ensure similarities between the interviewees and survey participants, yet also represent the diverse viewpoints within the profession. The mean chiropractic college graduation dates between interview and survey participants were similar; 2000 and 1997, respectively. The majority of interview participants practice in an urban setting, similar to most survey respondents. Despite the majority of survey respondents practicing general musculoskeletal care and spending five to 20 minutes with patients, there was still diversity in practice style (e.g. general musculoskeletal, wellness, family care etc…) and length of patient interactions (<5 minutes to 30 minutes).

Despite the variability in practice style and length of patient interactions, there was still considerable agreement among several components of trust. Interview and survey findings confirmed the importance of honesty, communication (verbal and non-verbal), perceived competence, and authenticity. Caring was a theme that was supported by our interviews but was unintentionally omitted in the survey. Privacy and confidentiality were important to survey respondents but not interview participants. Interview participants often felt that privacy and confidentiality weren't as important to the formation of trust as other healthcare professionals. Aggressively marketing products to patients was perceived as a negative influencer of trust by interviewees, whereas survey respondents did not find a negative association with development of trust and selling products to patients. Interview participants may have associated selling products with coercive marketing tactics whereas survey respondents may have associated selling products with conveniently providing necessary products for patients.[20] Also, survey respondents did not believe that it was more difficult to form trust with patients when appointments were booked by someone other than the patient.

Overall, the findings in our study demonstrate that there are several similarities between nurse-patient trust and physician-patient trust. Bell and Duffy[4], conducted a study with nurses emphasizing the expectation of competence and benevolence as antecedents of trust, which emerged as themes in during our interviews. However, they also emphasized antecedents of trust that did not emerge as main themes during our study; for example: goodwill, fragility/vulnerability, and an element of risk.[4] Hall *et al*.[5] reported components of physician-patient trust that were similar to chiropractor-patient trust, such as competence and honesty. Despite the reported importance of confidentiality and fidelity in physician-patient trust by Hall *et al*.[5], our participants did not perceive these to be important antecedents of trust amongst chiropractors. Given the overwhelming proportion of chiropractors practicing in community-based clinics, it is reasonable that these differences in chiropractor-patient trust were observed in comparison to nurses and physicians.

Limitations

This study has several limitations which may impact the validity and reliability of our findings. One limitation is that chiropractors recruited for the interviews come from a PBRN, a somewhat homogeneous group. All interviewees were recruited from a local PBRN and it might be reasonable to expect that PBRN members who demonstrate a commitment to research may express views that are different than the general population of chiropractors in BC. This general homogeneity may explain why we achieved saturation after just five interviews. It may also limit the generalizability of the results of the interview process outcomes, from which the survey was constructed, to those of the general chiropractic population, to which it was administered. It is possible that recruitment of participants outside of the PBRN could have led to a greater diversity of responses which may have influenced our findings. A survey response rate of 8.4% was low and may limit the generalizability of our findings. Ascertaining the interviewees' practice style and time spent with patients would have helped us understand whether the survey sample characteristics were similar to the interview sample. Another limitation of our study is that data saturation may not have been reached after six interviews. Conducting additional interviews would have improved confidence that saturation had been achieved.

The coding and analysis process were performed by

one investigator which could have introduced bias. The investigator kept a reflexivity journal in an effort to identify biases throughout the interview process. Member checking also occurred after interview transcription to ensure accuracy. Data analysis in pairs would have improved the trustworthiness of our findings; however, these tasks were only performed by one investigator.

The purpose of evaluating chiropractors' perception of patient trust is important initial research. This study does not include the viewpoint of patients and findings from this study should be used to inform future patient-oriented research on trust with healthcare providers.

Conclusion

The findings in this study provide an opportunity for chiropractors to reflect on their clinical encounters and assess whether there are opportunities to improve therapeutic alliances by implementing strategies to build trust. Chiropractors can employ a variety of interpersonal strategies to foster trust with patients. Interview participants appeared to place value on humanistic values when interacting with patients. Chiropractors perceive that trust can be fostered with patients by demonstrating characteristics of competence, honesty, caring, and communication. The purpose of this study was to explore how chiropractors build trust with patients; however, future studies should explore patient perspectives of trust. Findings from this study may influence future patient-oriented research which may further explore patient perspectives.

References

1. Pinto RZ, Ferreira ML, Oliveira VC, Franco MR, Adams R, Maher CG, et al. Patient-centred communication is associated with positive therapeutic alliance: a systematic review. J Physiother. 2012; 58(2): 77-87.
2. Stilwell P, Harman K. Contemporary biopsychosocial exercise prescription for chronic low back pain: Questioning core stability programs and considering context. J Can Chiropr Assoc. 2017; 61(1): 6-17.
3. McCabe TJ, Sambrook S. The antecedents, attributes and consequences of trust among nurses and nurse managers: a concept analysis. Int J Nurs Stud. 2014; 51(5): 815-827.
4. Bell L, Duffy A. A concept analysis of nurse–patient trust. Br J Nurs. 2009; 18(1): 46-51.
5. Hall MA, Dugan E, Zheng B, Mishra AK. Trust in physicians and medical institutions: What is it, can it be measured, and does it matter? Milbank Q. 2001; 79(4): 613-639.
6. Plomp HN, Ballast N. Trust and vulnerability in doctor–patient relations in occupational health. Occup Med. 2010; 60(4): 261-269.
7. Birkhauer J, Gaab J, Kossowsky J, Hasler S, Krummenacher P, Werner C, et al. Trust in the health care professional and health outcome: A meta-analysis. PLoS ONE. 2017; 12(2): 1-13.
8. AlRuthia Y, Almalag H, Sales I, Albassam AA, Alharbi FA, Almutairi AM., et al. The relationship between trust in primary care physicians and medication knowledge among diabetic patients. Res Social Adm Pharm. 2018; 15(6): 656-661.
9. Crom A, Paap D, Wijma A, Dijkstra PU, Pool G. Between the lines: A qualitative phenomenological analysis of the therapeutic alliance in pediatric physical therapy. Phys Occup Ther Pediatr. 2019; 40(1): 1-14.
10. Hanson WE, Creswell JW, Plano Clark VL, Petska KS, Creswell JD. Mixed methods research designs in counseling psychology. J Couns Psychol. 2005; 52(2): 224-235.
11. Creswell JW. Research design: Qualitative, quantitative, and mixed methods approaches. 3rd ed. SAGE publication, 2009: 3-21.
12. Etikan I. Comparison of convenience sampling and purposive sampling. Am J Theoret Appl Stat. 2016; 5(1): 105-111.
13. Englander M. The interview: Data collection in descriptive phenomenological human scientific research. J Phenomenol Psychol. 2012; 43(1): 13-35.
14. Bova C, Route PS, Fennie K, Ettinger W, Manchester GW, Weinstein B. Measuring patient–provider trust in a primary care population: Refinement of the health care relationship trust scale. Res Nurs Health. 2012; 35(4): 397-408.
15. Kidd K, Dugan E, Hall M, Zheng B, Levine D. Development of the wake forest university patient trust scale. Gerontologist. 1999; 39: 517.
16. McNair R, Taft A, Hegarty K. Using reflexivity to enhance in-depth interviewing skills for the clinician researcher. BMC Med Res Methodol. 2008; 8(1): 73.
17. Braun V, Clarke V. Using thematic analysis in psychology. Qual Res Psychol. 2006; 3(2): 77-101.
18. Castleberry A, Nolen A. Thematic analysis of qualitative research data: Is it as easy as it sounds? Curr Pharm Teach Learn. 2018; 10(6): 807-815.
19. Bussieres AE, Evans R, Leach M, Schneider MJ, Stuber K, Terhorst L. Self-reported attitudes, skills and use of evidence-based practice among Canadian doctors of chiropractic: a national survey. J Can Chiropr Assoc. 2015; 59(4): 332-348.
20. Page SA, Grod JP, McMorland DG. A descriptive study of chiropractors' opinions and practices regarding office-based health product sales. Chiropr Man Therap. 2012; 20(10).

Appendix 1.
Chiropractor Interview Guide

Welcome
Introductions and project overview

Before we begin, I would like to review a few items from our consent form:
- Your participation in this project is voluntary and you are free to leave the discussion at any time.
- Our discussion will not last more than one hour.
- You can choose not to answer any question.
- All of your answers are private and anonymous.
- I will be recording our discussion so that all of your ideas are captured.

Introduction
Trust is a complex concept but can be a valuable component of building a therapeutic relationship with patients. Trust between patients and physicians has been shown to improve satisfaction with care and health outcomes. I'd like to understand how you form trusting relationships with your patients.

Let's get started:
1. What is your practice location (Urban, Suburban, or Rural)?
2. What year did you graduate from chiropractic college?
3. Which patient characteristics do you believe contribute to a trusting therapeutic relationship?
4. Conversely, which chiropractor characteristics contribute to a trusting therapeutic relationship?
5. How do you, specifically, build trust with your patients?
6. How quickly do you feel patients form impressions of their chiropractors?
7. How do you know when a trusting bond has been formed with a patient?
   Probe: Can you think of a time when a patient trusted you? How did you know that they trusted you?
8. In your opinion, how do the total number of visits or length of therapeutic relationship affect trust?
9. To what extent do you believe patients are more or less likely to trust their chiropractor if they've seen other practitioners for the same condition?
10. To what extent do you believe patients are more likely to trust their chiropractor if they've been referred from another health care provider or chiropractor?

Dimensions of the Wake Forest Scales Measuring Trust

Ask participants if/how they incorporate fidelity, competence, honesty, or confidentiality into their interactions with patients.

Fidelity is defined as pursuing a patient's best interests and not taking advantage of their vulnerability. This often consists of caring, respect, advocacy, and avoiding conflicts of interest.
11. How do you incorporate fidelity into your patient interactions?

Competence is defined as avoiding mistakes and producing the best achievable results. Mistakes can be cognitive (errors in judgement) or technical (errors in execution).
12. How do you incorporate competence into your patient interactions?

Honesty is defined as telling the truth and avoiding intentional falsehoods. Providing false hopes or failing to admit mistakes.
13. How do you incorporate honesty into your patient interactions?

Confidentiality is defined as protection of private and sensitive information
14. How do you incorporate confidentiality into your patient interactions?

Appendix 2.
Survey

Study Title: Understanding How Chiropractors Build Trust with Patients

Your support in completing this questionnaire is greatly appreciated. **If the questionnaire is completed and submitted, it will be assumed that consent has been given.**
The following questionnaire aims to identify components of the chiropractor-patient relationship associated with trust. This questionnaire should take approximately 10 minutes to complete. Please use the drop-down menu or click the circle next to your best selection.

What is your year of birth?
What is your year of graduation from chiropractic college?
In which geographic setting is your main practice?
What is the average length of your patient interactions?
What is the main focus of your chiropractic care?
To what extent do you agree with the following statements?

- Chiropractors who are honest are more likely to form trust with their patients.
- My patients are more likely to trust me if I'm authentic.
- Understanding my patient's body language can help me understand if they trust me.
- I believe that clear communication is a way to build trust with patients.
- Patients are more likely to form a trusting relationship when they are referred to their chiropractor.
- My patients need to see a clinical improvement in the first three visits, otherwise they won't trust me.
- Interprofessional communication builds trust with my patients.
- Selling products (i.e. orthotics, pillows, braces etc.) negatively influences trust between patients and their chiropractor.
- Respecting patient privacy and confidentiality is important to developing trust.
- It's more difficult to form trusting relationships when appointments are booked by someone other than the patient (i.e. spouse or parent).

ISSN 0008-3194 (p)/ISSN 1715-6181 (e)/2020/109–118/$2.00/©JCCA 2020

A pilot study of the effects of suboccipital fascial release on cortisol levels in workers in the clothing industry – randomized clinical trial

Bruna Luísa Silva, PT[1]
Lara Alves de Oliveira, PE[1]
Camila Medeiros Costa, BS[1]
Cristiano Queiroz Guimarães, PT, MsD[2,3]
Leonardo Sette Vieira, PT[3]
Andrei Pereira Pernambuco, PT, PhD[1,4]

Introduction: *Repetitive and time sensitive demands of clothing workers has been associated with higher salivary cortisol levels that may reflect the stress experienced by the worker.*

Objective: *This trial evaluates if suboccipital fascial release (SFR) is associated with reduced salivary cortisol levels.*

Methods: *Randomized controlled trial with 40 workers, divided into: untreated group (UG, n = 15) and treated group (TG, n = 25). Both were removed from the*

Introduction : *Les exigences aiguës imposées aux travailleurs de l'industrie du vêtement ont été associées à de fortes concentrations de cortisol salivaire pouvant traduire le stress vécu par ces travailleurs.*

Objectif : *Cet essai vise à savoir si le relâchement des fascias des muscles sous-occipitaux est associé à une réduction des concentrations de cortisol salivaire.*

Méthodologie : *Essai comparatif avec répartition aléatoire mené auprès de 40 travailleurs répartis en deux groupes: groupe non traité (GNT, n = 15) et groupe traité (GT, n = 25). Les sujets des deux groupes ont été retirés de leur milieu de travail. La technique ci-haut mentionnée a été utilisée sur les sujets du GT alors*

[1] Centro Universitário de Formiga – UNIFOR-MG, Formiga, Minas Gerais, Brazil.
[2] Faculdade Ciências Médicas de Minas Gerais – CMMG, Belo Horizonte, Minas Gerais, Brazil.
[3] Academia Brasileira de Fáscias (ABFascias), Belo Horizonte, Minas Gerais, Brazil.
[4] Universidade de Itaúna – UIT, Itaúna, Minas Gerais, Brazil.

Corresponding author: Bruna Luísa Silva, Av. do Contorno, 1638; 37280-000 Candeias – MG.
Tel: +55 35 999185656.
E-mail: brunaluisilva@hotmail.com

This study was funded by the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq), with logistical support from Centro Universitário de Formiga – MG (UNIFOR-MG).
Potential conflicts of interest: We declare that the authors CQG and LSV have a school that specializes in the study of fascia and that the results of this study may be of economic interest to them. We emphasize, however, that the authors mentioned only had access to the results at the end of the manuscript writing phase and that no data was altered or manipulated in order to satisfy any interest.

work environment. The TG received the above technique and the UG remained lying at rest, both for five minutes. Salivary cortisol levels were measured by a commercial enzyme-linked immunosorbent assay (ELISA) kit. Statistical analysis of data distribution, intragroup and intergroups, were performed with α adjusted to 0.05.

Results: *Pre / post intragroup analyses showed significant differences in cortisol levels in both groups, as well as intergroup analyses with lower values in favor of TG (p = 0.014).*

Conclusion: *The reduction in salivary cortisol levels in TG suggests that SFR may be more effective than rest in reducing stress. Future studies with increased experimental rigor are necessary to confirm this conclusion.*

Clinical trial registration number: REBEC – RBR – 56yk9m.

(JCCA. 2020;64(2):109-118)

KEY WORDS: autonomic nervous system, cortisol, massage, musculoskeletal manipulations, occupational stress

que les sujets du GNT sont restés au repos: pour les deux groupes, l'intervention a duré cinq minutes. Les concentrations de cortisol salivaire ont été mesurées à l'aide d'une trousse pour dosage d'immunoabsorption par enzyme liée (ELISA) offerte dans le commerce. L'analyse statistique de la distribution des données intra-groupes et inter-groupes a été effectuée avec α ajusté à 0.05.

Résultats : *L'analyse des données prétraitement et post-traitement à l'intérieur des groupes a révélé des différences appréciables de concentration de cortisol dans les deux groupes, les analyses entre les groupes montrant des concentrations plus faibles dans le GT (p = 0.014).*

Conclusion : *La réduction des concentrations de cortisol salivaire dans le GT semble indiquer que le relâchement des fascias de muscles sous-occipitaux peut être plus efficace que le repos pour réduire le stress. Il faut mener d'autres études expérimentales plus rigoureuses pour confirmer cette conclusion.*

Numéro d'enregistrement de l'essai clinique : REBEC – RBR – 56yk9m.

(JCCA. 2020;64(2):109-118)

MOTS CLÉS : système nerveux autonome, cortisol, massage, manipulations musculosquelettiques, stress professionnel

Introduction

Workers in the clothing industry are exposed to several stressful factors in their work environment. They face precarious work conditions, which involve infrastructure, hygiene, repetitive movements, and ergonomic risks, among others.[1] All these factors, alone or in combination, are seen as stressing agents and tend to disrupt the body's homeostasis, triggering an organic response called stress response.[2]

Physiologically, the response to stress is important, and it is a fight or flight reaction against the stressor agent. This response should last for seconds, minutes, or a few hours, but, when sustained, a series of physiological dysfunctions may occur from chronic stress.[2] These dysfunctions are related to the prolonged hyperactivation of the Hypothalamic-Pituitary-Adrenal axis (HPA) as well as the Sympathetic Autonomic Nervous System (SANS).[3]

Stress presents itself biologically and physiologically in the human organism.[4] According to Selye, a pioneer in the study of stress, this is an inherent phenomenon on the whole disease, since it produces certain modifications in the structure and chemical composition of the body, that can favor the installation of diseases and dysfunctions. Stress can manifest itself differently, depending on the stage of the general syndrome of adaptation in which the individual presents.[5]

The general adaptation syndrome comprises a set of non-specific responses to a stressor, whether physical or psycho-emotional, and develops in three phases: 1) alarm phase, characterized by acute manifestations; 2) resistance

phase, when the acute manifestations disappear and; 3) exhaustion phase, when there is the return of the reactions of the first phase and can be the collapse of the organism. Regardless of the individual's stage of development levels of cortisol, a hormone produced by the cortex of the adrenal glands, is considered the gold standard marker of stress response.[6]

At the onset of stress, in response to hyperactivation of the HPA axis, the adrenal glands increase cortisol production.[7] In a second moment, if the agents that cause the stress response are not eliminated, an adaptation phase of the organic systems begins and the cortisol levels become stable (adrenal desensitization).[7] Finally, failure of the response system occurs and cortisol levels tend to fall, even in the face of more severe stressors (adrenal fatigue).[7]

Changes in cortisol levels related to stress response are associated with several diseases and disorders such as: sleep disorders, depression, anxiety, obesity, fibromyalgia, chronic fatigue, immunosuppression, coronary diseases, cerebral ischemia, thrombosis, among others.[8-11]

A possible way of minimizing stress-related reactions in workers would be to stimulate the performance of the Autonomous Parasympathetic Nervous System (APNS), in order to modulate the performance of the SANS and to minimize the effects resulting from the hyperactivation of the HPA axis.[12] In this sense, the suboccipital fascial release (SFR) could be considered a therapeutic alternative. According to literature, this technique may contribute to the release of endorphins and serotonin, neurotransmitters that have an important action on the psycho-emotional aspect and on well-being.[13]

In SFR, the suboccipital region is gently pressed and massaged. Its effects can be explained by three mechanisms: 1. Due to the anatomical proximity to the jugular foramen, the vagus nerve passageway (the main nerve of the APNS), it is believed that by releasing the tensions in the occipital region, it would also be possible to release the nerve tract, decreasing the pressure in the endoneural compartment and thus improving vagal function; 2. The SFR, when touching the muscular fascia, could be able to stimulate the dura mater by means of myodural bridges (two fascial connections are described: one between the minor posterior rectus fascia and the dura mater; and another between the nuchal ligament and the dura mater, passing between C1 and C2). In the brain, the dura mater remains in the cerebellum tent and the pituitary tent – which surrounds the pituitary, the central component of the HPA axis. In addition, the dura mater at the base of the skull is innervated by the vagus nerve[14-17]; 3. It has been proposed that soft and slow techniques have the potential to stimulate the parasympathetic autonomic nervous system.[18] The soft touch can stimulate free nerve endings present in the fascia, which send information to the left insular cortex, stimulate the left hypothalamus and generate a parasympathetic response.[19]

From the foregoing, a positive SFR response is expected at stress levels and consequently over cortisol levels. However, no clinical studies have investigated this hypothesis. Therefore, the objective of the study was to evaluate if the SFR is capable of reducing salivary cortisol levels in clothing industry workers.

Methods

Ethical considerations

This study was initiated after approval by the Human Research Ethics Committee under Opinion nº. 2.439.896. For participation, the volunteers signed the Informed Consent Form (ICF). The research protocol was submitted and approved by the Brazilian Registry of Clinical Trials, under the number REBEC – RBR – 56yk9m. All ethical standards were based on the Declaration of Helsinki and Resolution 466/12 of the National Health Council. Finally, for this study, the CONSORT guidelines were followed.

Study design

Two-arm randomized controlled trial.

Participants

The sample was formed in a non-probabilistic way and for convenience no sample size calculation was previously performed. After active recruitment through contacts with clothing industry owners from a city in Minas Gerais, Brazil, 15 participants were selected for the untreated group (UG) and 25 participants for the treated group (TG), totaling 40 individuals.

Inclusion criteria were: being a clothing industry worker in a specific city in the Minas Gerais state; being female; aged between 20 and 50 years; having any educational level; working for eight hours a day; accepting to participate voluntarily in the research; score more than 13

points in the Mini Mental State Examination (MMSE), if illiterate and 18 points if literate.

Exclusion criteria were: employees who were pregnant or breastfeeding, who were using or who used any non-contraceptive drug in the past month, who did not achieve a minimum score in MMSE (13 points if illiterate or 18 points if literate); those with history of autoimmune diseases; those who used steroidal anti-inflammatory drugs or anxiolytics in the last year; those who had deficiencies in the upper and lower limbs (congenital or acquired); workers with a history of migraine or recurrent headache; those with type 1 or 2 diabetes and those with more than one job. Also excluded from the study were those who did not feel well during the technique and those who for whatever reason wished to withdraw from the research, regardless of the phase of the study.

Randomization

The participants recruited for the study were workers from three different factories and were randomly divided into two groups. Randomization was performed by opaque, sealed and numbered envelopes. By means of software, a note was randomly generated with the allocation, which was inserted inside the envelopes. Each participant selected an envelope that contained the type of intervention that would be offered to them. Twenty-five participants composed the TG and 15 participants composed the UG. The allocation concealment was conducted, and the participants were not aware of the type of intervention that would be offered to others.

The imbalance between the number of participants in the groups was generated by the randomization method, since at the beginning of the study the researchers prepared 60 opaque and numbered envelopes, but at the participants' presentation only 40 volunteers were enrolled.

Data collection

All data were collected by an independent evaluator who did not know the objectives of the study and the allocation of the participants. Even before randomization, the ICF was presented and the volunteers' signature was collected. Those who agreed to participate in the survey completed the identification form and the MMSE used for cognitive screening. In order to characterize the sample in the pre-intervention period, two other questionnaires were used: Work Stress Scale (WSS) and World Health Organization Disability Assessment Schedule (WHODAS 2.0).

The Mini Mental State Examination (MMSE) is one of the most widely used and studied tests in the world, which allows the assessment of cognitive function and tracking of dementia. The original instrument consists of two sections that measure cognitive functions. The first section contains items that evaluate orientation, memory and attention, totaling 21 points; the second measures naming ability, obedience to a verbal command, and the free writing of a sentence, in addition to copying a complex drawing (polygons), making up nine more points. The total score is 30 points and the higher the MMSE score, the better the cognitive state of the participant. The following cutoff points are used: 13 points for illiterate people, 18 points for literate people and 26 points for high school students.[20] This questionnaire was used for ethical reasons, in order to determine whether the participant had sufficient cognitive ability to choose to participate in the research.

The WSS is an instrument used to measure perceived stress in the occupational environment. It can be applied in different work environments and in different occupations. It was initially proposed with 31 items. In 2004, Paschoal and Tamayo created a reduced version of the Work Stress Scale (WSS), which includes 23 items that represent the main organizational stressors and general psychological reactions. The expanded version has a Cronbach's alpha coefficient equivalent to 0.91, while the reduced version is 0.85. Despite the lower Cronbach's alpha coefficient, the 23-item scale was used in this study. Each item is scored from one to five, the maximum possible score is 115 points. The score should be interpreted as: below 46 points (low stress), 47 to 69 points (medium stress) and 70 to 115 points (high stress). In this sense, higher scores represent worse levels of worker stress.[21]

The WHODAS 2.0 is an assessment tool developed by the World Health Organization (WHO) that covers several items of the International Classification of Functioning, Disability and Health (CIF). WHODAS 2.0 provides the level of functionality / disability after analyzing six domains of life: cognition, mobility, self-care, interpersonal relationships, life activity and participation. The questionnaire consists of 36 questions and each one is scored from one (no difficulty) to five (extreme difficulty or is unable to do). The score is calculated by domains, the sum of all

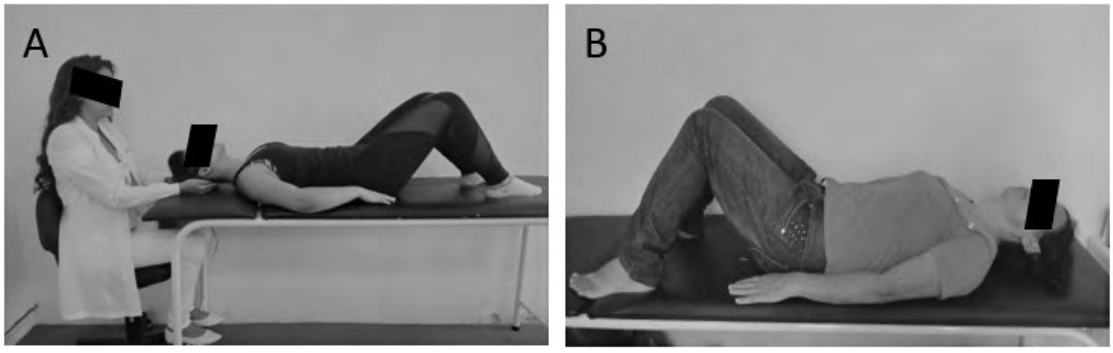

Figure 1.
(A) depicts the positioning of the therapist and a treated group (TG) participant during the suboccipital fascial release technique. (B) represents the positioning of an untreated participant (UG) who remained lying down for five minutes and did not receive the suboccipital fascial release technique.

items that are contained in each domain is converted into a percentage value from 0 to 100. The higher the score, the greater the disability presented by the participant. The questionnaire presents the following percentage cut-off points: 0- 4% (no difficulty) 5-24% (mild difficulty), 25-49% (moderate difficulty), 50-95% (severe difficulty), 96-100% (complete difficulty / does not). The score can be expressed for each domain and total score on the instrument.[22]

For cortisol analysis, saliva samples were collected during the five minutes preceding the intervention and during the first five minutes after the end of the intervention, with the volunteers sitting quietly in a room next to the intervention site. The experiments were performed in the morning. Therefore, a piece of cotton was under the tongue of the volunteers for a period of five minutes before the application of the technique. After this time, the cotton was carefully removed and kneaded by the researcher in order to transfer the cotton saliva into a 1.5 ml Eppendorf® tube. The research volunteers were instructed not to eat, drink, smoke or use oral hygiene products during the time preceding the data collection, thus avoiding contamination of the samples. Then the tubes were centrifuged, the supernatant was aspirated and stored in a freezer at -20ºC until the time of analysis.

Cortisol levels were measured using a commercial ELISA kit with plates previously sensitized with anti-cortisol antibodies according to the manufacturer's recommendations (Salimetrics, State College, Pennsylvania, USA). It should be noted that saliva cortisol analysis is a widely used, easily performed, noninvasive and non-painful technique. It differs from plasma analysis mainly because there is no need for venipuncture, which is a stressor and cause increases in cortisol levels. Salivary analysis is valid and reliable.[11,23,24]

Intervention

SFR was applied only once to each of the TG participants. The intervention lasted five minutes and could supposedly influence certain physiological mechanisms and contribute to neurological or psychophysiological aspects.[25]

In this study the technique was actively performed by one of the researchers, skilled and trained for this. The technique used was adapted from the studies conducted by Figueiredo and Oliveira.[26] In the TG, the volunteer remained lying on a stretcher, supine, with hips and knees bent, feet flat, arms beside the body and eyes closed.

The researcher remained seated close to the patient's cephalic region, with her hands positioned in the patient's suboccipital region, between the occiput and the C1 vertebra (Figure 1A). The maneuvers used by the researcher included counterclockwise circular sliding and very slow shear techniques, with both hands in prayer position, with the palm up, relaxed and with the volunteer's head resting on the palms of the researcher.

This maneuver is indicated to induce relaxation, as it helps to improve blood and lymphatic flow by reaching both deep and superficial tissues.[27] These movements are capable of generating a pressure that is transmitted to the underlying tissues by means of biotensegrity, a mechan-

ism capable of harmonically and dynamically transmitting force.[28] Soft pressure, using the last four digits of each hand, is a technique used to increase local circulation, stimulate nerve endings, release fascia and suboccipital tissues, and tone soft tissue regions.[29]

UG participants were also absent from their jobs during the day and remained lying down for the same time period and in the same position as the TG participants. However, the SFR technique was not applied to the UG participants (Figure 1B). Participants in this group provided saliva samples before and after the five-minute rest period, respecting the same collection protocol used for the TG.

Regardless of the number of participants completing the study, intention-to-treat analysis would be used, and all participants would be evaluated within the original allocation group.

Statistical analysis

Shapiro-Wilk test was used to verify data distribution. For data with normal distribution, intergroup comparisons were performed using the independent T-test and descriptive statistics were expressed as mean, standard deviation and 95% confidence interval (95% CI). For data with non-normal distribution, the comparative test was the Mann-Whitney test, and the descriptive statistics was expressed as median and interquartile range (P25% – P75%). Intragroup analyses were performed using the Wilcoxon test. All analyses were performed using GraphPad Prism v.6.0 software with significance level of all tests adjusted to $\alpha = 0.05$ ($p \leq 0.05$).

Results

Forty women participated in the study, divided into two groups. The UG consisted of 15 participants, aged 36.5 ± 10.5 years, time in the company of 44.7 ± 43.4 months. The TG consisted of 25 women, age 33.1 ± 9.8 years, time in the company 22 ± 38.1 months. The scores obtained by both groups in the MMSE, WSS and WHODAS 2.0 (domains and total score) are shown in table 1. Clinically no disparities were observed between the groups at baseline, however the working time in the company was longer among the UG participants (Table 1).

The results regarding the analyses within the groups over the study period are summarized in Table 2. In both groups there were significant differences in cortisol levels when comparing the data obtained in the pre and post intervention phase.

Table 1.

*Characterization of study participants at baseline (n = 40). Untreated Group (UG), Treated Group (TG), Work Stress Scale (WSS), World Health Organization Disability Assessment Schedule (WHODAS 2.0). Data are expressed as mean ± standard deviation and 95% confidence interval (95% CI). The analysis was performed using the independent T test. * p ≤ 0.05.*

Parameters	**UG (n=15)**	**TG (n=25)**	**p-value**
Age	36.53 ± 10.52 (30.71 to 42.36)	33.16 ± 9.87 (29.08 to 37.24)	0.31
Time in the company (months)	44.73 ± 43.36 (20.72 to 68.75)	22.00 ± 38.16 (6.24 to 37.75)	0.02*
MMSE	26.20 ± 2.65 (24.73 to 27.67)	25.44 ± 2.80 (24.28 to 26.60)	0.33
WSS	63.47 ± 9.05 (58.45 to 68.48)	57.24 ± 18.70 (49.52 to 64.96)	0.23
WHODAS 2.0			
Cognition	19.44 ± 13.05 (12.22 to 26.67)	27.66 ± 15.40 (21.31 to 34.02)	0.09
Mobility	6.61 ± 10.33 (0.88 to 12.33)	12.40 ± 14.37 (6.46 to 18.33)	0.10
Self-care	5.58 ± 16.80 (-3.72 to 14.89)	2.25 ± 5.67 (-0.09 to 4.59)	0.76
Interpersonal relationships	10.33 ± 9.72 (4.94 to 15.72)	12.60 ± 12.43 (7.47 to 17.73)	0.77
Activity	18.75 ± 22.35 (6.37 to 31.13)	21.63 ± 13.74 (15.96 to 27.31)	0.20
Participation	20.85 ± 14.96 (12.56 to 29.13)	23.00 ± 19.35 (15.02 to 30.99)	0.97
Total	13.32 ± 10.63 (7.44 to 19.21)	16.59 ± 8.91 (12.91 to 20.27)	0.17

The results for the analyses between the two study groups are summarized in Table 3. They demonstrate that prior to intervention in the TG there were no significant differences between the cortisol levels of UG and TG participants. The post-intervention analyses in the TG pointed to a significant difference in the levels of this marker ($p = 0.014$) with significantly lower salivary cortisol levels in the participants exposed to the intervention.

Table 2.
*Intragroup Comparison of Cortisol Levels in UG (n = 15) and TG (n = 25). Untreated Group (UG), Treated Group (TG). Data are expressed as median and interquartile range (P25% – P75%). Intragroup analysis was performed using the Wilcoxon test. * p ≤ 0.05.*

	UG (n = 15)			TG (n = 25)		
Parameter	**Before**	**After**	**p-value**	**Before**	**After**	**p-value**
Salivary Cortisol	1.40 (1.20 to 1.76)	0.61 (0.54 to 0.65)	0.0001*	1.34 (1.11 to 1.71)	0.49 (0.42 to 0.59)	0.0001*

Table 3.
*Intergroup comparison of cortisol levels before and after light release intervention. Untreated Group (UG), Treated Group (TG). Data are expressed as median and interquartile range (P25% – P75%). Intergroup comparison was performed using the Mann-Whitney test. * p ≤ 0.05.*

	Pre-intervention			Post-intervention		
Parameter	**UG**	**TG**	**p-value**	**UG**	**TG**	**p-value**
Salivary cortisol (pg/ml)	1.40 (1.20 to 1.76)	1.34 (1.11 to 1.71)	0.448	0.61 (0.54 to 0.65)	0.49 (0.42 to 0.59)	0.014*

Discussion

The study results suggest that SFR may contribute to the treatment of stress experienced by clothing industry workers, since significant differences were observed in the analyzed outcome in favor of the TG when compared to the UG.

This is an unprecedented study, developed with workers in the clothing industry, especially due to the history of this sector, which, since the 19th century to the present day, employs a large number of women in unfavorable environmental conditions.[30] Unexperienced workers were not included in the study; after all, a new work experience could, by itself, act as a stressor, capable of generating the HPA axis and SANS hyperactivation.[31,32]

At the beginning of the study, the working time of participants in both groups was different. UG participants had nearly twice as many years of work as TG participants. This fact could interfere with the participants' cortisol levels and generate bias in the study, since the work environment can be seen as a stress-generating agent[1] and, by staying in contact with such agent for a longer time, cortisol levels could be higher. However, pre-intervention WSS score and salivary cortisol analysis showed no significant difference between the two groups. The questionnaire scores and similar salivary levels of cortisol ensure that the stress levels were similar at baseline.

Another hypothesis that should be considered is that the group exposed to the work environment for a longer period could be in the adaptation or exhaustion phase of the stress response[7] and, consequently, would have lower cortisol levels. This hypothesis was also discarded by checking similar levels of cortisol and WSS score in both groups at baseline. Thus, working time in the company, although different between groups, did not cause changes in participants' salivary cortisol levels. It is important to mention that the functional levels (WHODAS 2.0), as well as the cognitive levels (MMSE) were also similar in both groups at baseline.

Salivary cortisol levels were selected as a stress marker, mainly because they are measurable and objective data, independent of the participant's perception or opinion.[33] Most studies investigating interventions to minimize the effects of stress use questionnaires or interviews[34] and, therefore, are subjective and more prone to failure.

Cortisol measurement could be performed in several body solutions, such as blood, urine, saliva, among others. The choice for saliva occurred because it is a noninvasive collection method and the fact that venipuncture may result in acute cortisol release due to stress caused by vein puncture.[35] In addition, salivary cortisol levels are highly correlated with plasma levels of this hormone[35], making it a more methodologically and biologically viable alternative.

In this study, gentle touch was used instead of deep touch, this option was due to the fact that, possibly, the intensity of touch can activate different receptors and neurophysiological pathways and, consequently, result in different organic effects.[14,18,19,36] Previous studies demonstrate that the deep and strong touch is captured by tactile receptors and proprioceptive receptors, such as: Meissner's corpuscles, mechanically sensitive tactile receptors, Ruffini's corpuscles and Pacini's corpuscles, among others. The stimulus captured by these receptors is projected into the medulla by neurons type I and II (highly myelinated) and from there the stimulus ascends to the somatosensory cortex.[18] The gentle touch, on the other hand, is mainly captured by free nerve endings, the stimulus captured is carried to the medulla by neurons type III and IV (slightly myelinated or demyelinated) and from there they ascend to the insular cortex where it stimulates parasympathetic activity.[18,19] Unlike deep touch, which follows a tactile pathway, gentle touch follows an interoceptive pathway.[14,18,36,37] In this study, no group was treated with deep touch, so it is not possible to say whether the observed effects could be different from the ones presented here. It is also important to mention that it is not possible to determine whether light touch activated other types of receptors in the conjunctive tissue or others neurophysiological pathways.

Intragroup analysis showed a significant reduction in cortisol levels in both groups, when comparing the pre and post-intervention situation. These data indicate that the environment and the work routine act as an activating and/or perpetuating mechanism of the stress response; after all, the withdrawal of the worker from his/her activities, even for a short period of time, reduced circulating cortisol levels. In this assumption, it is also important to emphasize the importance of pauses, recreational activities or therapeutic programs implemented by some companies with the objective of improving the health and quality of life of their employees.[38]

Such actions can, at least in theory, minimize the effects of stress and reduce the organic effects associated with increased cortisol, such as reduced muscle mass, weight gain, water retention, bone demineralization and altered immunological activity, among others.[38] In this study, such questions were not addressed.

It is also important to mention that the within group differences, although clinically important, may not be related exclusively to the intervention offered, since in this type of experiment it is practically impossible to control some confounding factors, such as: the placebo effect, Hawthorne effect, return to average, natural history of the disease, spontaneous improvement, among others.[39] However, it should be noted that the outcome used was an objective biomarker, and the variances of this variable are not dependent on the participant's opinion or perception of the intervention used. In addition, a non-active control group (UG) was used which allowed fairer interpretations of the results.

Data between the groups from the post-intervention period showed that the TG ended the study period with significantly lower salivary cortisol levels than the UG. However, the mechanisms involved in reducing cortisol levels in individuals undergoing SFR are not yet understood. It is possible that the neuroendocrine system is related to such changes.[12,14-16] The decline in cortisol levels observed in this investigation cannot necessarily be attributed to the fascial release technique used, as it could equally be due to the act of touching. In this sense the inclusion of an appropriate sham intervention would have been informative.

No other studies were found that aimed to minimize the stress experienced by workers, through fascial release techniques. This fact prevents the comparison of the results of the present study with other findings, especially if we consider the objective marker of stress as a variable, such as cortisol levels.

The main limitations of the study were: the small sample size that can cause type II errors and the absence of a follow-up period, which could contribute to the understanding of long-term responses. Another important flaw of the study is that, although there was an untreated group, there was no group that received a sham treatment. This fact prevents us from claiming that the effects observed in TG were truly provided by the method used. In this

sense, there is no way to say whether the technique used would be superior to any other type of manual stimulus in the occipital region. The limitations mentioned, as well as other issues not addressed here should be addressed in future studies, such as the organic reactions presented by individuals exposed to suboccipital fascial release and the duration of these reactions.

Conclusion

The reduction in salivary cortisol levels in TG suggests that SFR is more effective than rest in reducing stress experienced by clothing industry workers. However, the unprecedented nature of this study makes the comparison of the results with the literature difficult. Studies with greater methodological power, designed to include a sham intervention group, and extended follow-up periods should be conducted to clarify issues not addressed here.

Acknowledgments

We thank the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) for the financial support and the Centro Universitário de Formiga – MG (UNIFOR-MG) for logistical support to the project.

References

1. Augusto VG. Diagnóstico das condições de trabalho, saúde e capacidade para o trabalho de trabalhadoras da indústria do vestuário. In: Universidade Federal de Minas Gerais, Belo Horizonte, Minas Gerais, Brazil. 2013. www.eeffto.ufmg.br/eeffto/DATA/defesas/20151009133022.pdf. Accessed September 27, 2019.
2. Arantes MJFV. Estresse. 3rd ed. São Paulo: Casa do Psicólogo, 2002.
3. Zuardi AW. Fisiologia do estresse e sua influência na saúde. In: Academia. 2010.https://www.academia.edu/8514738/FISIOLOGIA_DO_ESTRESSE_E_SUA_INFLU%C3%8ANCIA_NA_SA%C3%9ADE. Accessed September 27, 2019.
4. Santos AF. Determinantes psicossociais da capacidade adaptativa: um modelo teórico para o stress. In: Universidade Federal da Bahia, Salvador, Bahia, Brazil. 2010. ri.ufs.br/bitstream/riufs/1898/1. Accessed September 27, 2019.
5. Selye H. Stress, a tensão da vida. 2nd ed. São Paulo, SP: Ibrasa, 1965.
6. Kudielka BM, Gierens A, Hellhammer DH, Wust S, Schlotz W. Salivary cortisol in ambulatory assessment – some dos, some don't, and some open questions. Psychosom Med. 2012; 74: 418-431.
7. Gallo O. Influência do hormônio cortisol nos trabalhadores durante o trabalho: um estudo teórico. Rev Conhec Int. 2017; 11: 2-11.
8. Amenábar JM. Níveis de cortisol salivar, grau de estresse e de ansiedade em indivíduos com Síndrome de Ardência Bucal. In: Universidade Católica do Rio Grande do Sul, Porto Alegre, Rio Grande do Sul, Brazil. 2006. tede2.pucrs.br/tede2/bitstream/tede/1291/1/382742.pdf. Accessed September 27, 2019.
9. Borges FZ, Danieli RV, Naves AA, Kretly LC, Guimarães LC, Almeida MA, Souza OER. Síndrome de Cushing subclínica relacionada à hipertensão arterial secundária e tireoidite autoimune. Rev Soc Bras Clin Med. 2012; 10: 361-366.
10. Cantos GA, Duarte MFS, Dutra RL, Silva CSM, Waltrick CDA, Balen MG et al. Prevalência de fatores de risco de doença arterial coronária em funcionários de hospital universitário e sua correlação com estresse psicológico. J Bras Patol Med Lab. 2004; 40: 240-247.
11. Campos JF, David HMSL. Análise de cortisol salivar como biomarcador de estresse ocupacional em trabalhadores de enfermagem. Rev Enferm. 2014; 22: 447-453.
12. Dalton E. Dynamic Body: Exploring Form, Expanding Function. Freedom From Pain Institute; Oklahoma: 2011 http://axissyllabus.org/assets/pdf/Schleip_Fascia_as_a_sensory_organ.pdf. Accessed September 27, 2019.
13. Santos GJB, Severiano MIR. A importância do toque terapêutico. FIEP Bulletin. 2011; 81: 1-7.
14. Bordoni B, Marelli F. Emoticons in Motion: Myofascial Interoception. Complement Med Res. 2017; 24: 110-113.
15. Enix DE, Scalli F, Pontell ME. The cervical myodural bridge, a review of literature and clinical implications. J Can Chiropr Assoc. 2014; 58: 184-192.
16. Pontell ME, Scali F, Marshall E, Enix D. The obliquus capitius, inferior myodural bridge. Clin Anat. 2013; 26: 450-454.
17. Adeeb N, Mortazavi MM, Tubbs RS, Cohen-Gadol, AA. The cranial dura mater: a review of its history, embryology, and anatomy. Childs Nerv Syst. 2012; 28: 827- 837.
18. Olausson HW, Cole J, Vallbo A, Mcglone F, Elam M, Kramer HH. et al. Unmyelinated tactile afferents have opposite effects on insular and somatosensory cortical processing. Neurosci Lett. 2008; 436: 128-132.
19. Schleip R, Findley TW, Chaitow L, Huijing PA. Fascia: The Tensional Network of the Human Body. London: Churchill Livingstone Elsevier, 2012.
20. Folstein MF, Folstein SE, Mchugh PR. Mini-Mental, um método prático para a classificação do estado cognitivo dos pacientes para o clínico. J.Psychiatr Res. 1975; 12: 189-198.
21. Paschoal T, Tamayo A. Validação da Escala de Estresse no Trabalho. Estudos de Psicologia. 2004; 9(1): 45-52.
22. De Castro SS, Leite CF. World health assessment disability schedule "WHODAS 2.0"- apresentação de instrumento de

aferição de funcionalidade. Cadernos De Educação. Saúde e Fisioterapia. 2015; 2(3).
23. Raff H, Raff JL, Findling JW. Late-night salivary cortisol as a screening test for Cushing's syndrome. J Clin Endocrinol Metab. 1998; 83: 2681-2686.
24. Sakihara S, Kageyama K, Oki Y, Doi M, Iwasaki Y, Takayasu S. et al. Evaluation of plasma, salivary, and urinary cortisol levels for diagnosis of Cushing's Syndrome. Endocr J. 2010; 57: 331-337.
25. Schulz AP, Genske JH, Rezende MJ, Genske RD. Efeito de técnicas de terapia manual sobre a dor e a amplitude de movimento na região cervical. Fiep Bulletin. 2012; 82.
26. Figueiredo GS, Oliveira LK. O efeito imediato da técnica de inibição dos músculos suboccipitais em indivíduos com encurtamento de isquiotibiais. In: Centro Universitário de Brasília – UniCEUB, Brasília. 2011. repositorio.uniceub.br/jspui/handle/123456789/4493. Accessed September 27, 2019.
27. Rechtien JJ, Andary M, Holmes TG, Wieting JM. Manipulação, massagem e tração In: DeLisa JA, Gans BM (Eds.), Tratado de medicina de reabilitação – princípios e prática. Barueri: Manole, 2002: 549-581.
28. Levin S, Martin D. Biotensegrity the mechanics of fascia. In: Schleip R, Findley T, Chaitow L, Huijing P, editors. Fascia: the tensional network of the human body. Edinburgh, Escócia: Churchill Livingstone Elsevier, 2012: 137-142.
29. Kavanag W. Exercícios básicos de massagem. Barueri, SP: Manole. 2006.
30. Rodrigues PJ, Milani DRC, Castro LLO, Celeste FM. O trabalho feminino durante a revolução industrial. In: Universidade Estadual Paulista "Júlio de Mesquita Filho", Araraquara, São Paulo, Brazil. 2015. www.marilia.unesp.br/Home/Eventos/2015. Accessed September 27, 2019.
31. Tanno AP, Marcondes FK. Estresse, ciclo reprodutivo e sensibilidade cardíaca às catecolaminas. Rev Bras Cienc Farm. 2002; 38: 273-289.
32. Malta MB. Efeitos adaptativos induzidos pelo estresse crônico imprevisível nos receptores do fator liberador de corticotrofina tipo 2 e de glicocorticoides no sistema nervoso central de ratos. In: Universidade de São Paulo, São Paulo, Brazil. 2012. www.teses.usp.br/teses/disponiveis/42/42136/tde-13112012.... Accessed September 27, 2019.
33. Gonsalves R, Lages AC, Rodrigues H, Pedrozo AL, Coutinho ESF, Neylan T. et al. Potenciais biomarcadores da terapia cognitivo-comportamental para o transtorno de estresse pós-traumático: uma revisão sistemática. Rev Psiq Clin. 2011; 38: 155-160.
34. Sousa AC, Alexandre NMC, Guirardello EB. Propriedades psicométricas na avaliação de instrumentos: avaliação da confiabilidade e da validade. Epidemiol Serv Saude. 2017; 26: 649-659.
35. Castro M, Moreira AC. Análise Crítica do Cortisol Salivar na Avaliação do Eixo Hipotálamo-Hipófise-Adrenal. Arq Bras Endocrinol Metab. 2003; 47: 358-367.
36. McGlone F, Cerritelli F, Walker S, Esteves J. The role of gentle touch in perinatal osteopathic manual therapy. Neurosci. Biobehav. Rev. 2017; 72: 1-9.
37. Strigo IA, Craig AD. Interoception, homeostatic emotions and sympathovagal balance. Philos Trans R Soc Lond B Biol Sci. 2016. 19; 371.
38. Silva RC. Ginástica laboral – um instrumento de melhoria ergonômica e do bem-estar da saúde dos colaboradores do Polo Industrial de Manaus. In: Universidade Federal do Amazonas, Manaus, Amazonas, Brazil. 2017.
39. McCall WV, D'Agostino RJr, Rosenquist PB, Kimball J, Boggs N, Lasater B, Blocker J. Dissection of the factors driving the placebo effect in hypnotic treatment of depressed insomniacs. Sleep Med. 2011; 12: 557–564.

ISSN 0008-3194 (p)/ISSN 1715-6181 (e)/2020/119–130/$2.00/©JCCA 2020

Attitudes, beliefs, and practices regarding medication prescribing for musculoskeletal conditions: a protocol for a national Q-methodology study of Swiss chiropractors

Peter C. Emary, DC, MSc[1-3]
Mark Oremus, PhD[4,5]
Taco A.W. Houweling, DC, PhD[6]
Martin Wangler, DC, MME[7]
Noori Akhtar-Danesh, PhD[8,9]

Background: *Since 1995, chiropractors in Switzerland have been licensed to prescribe medications for treating musculoskeletal conditions. However, controversy remains over whether or not medication prescribing should be pursued within the chiropractic profession internationally.*

Objective: *To assess Swiss chiropractors' attitudes, beliefs, and practices regarding their existing medication prescription privileges.*

Methods: *A Q-methodology approach will be used to collect data for the assessment. In addition,*

Contexte : *En Suisse, depuis 1995, les chiropraticiens sont autorisés à prescrire des médicaments pour traiter des affections musculosquelettiques. Cependant, la prescription de médicaments par les chiropraticiens à l'échelle internationale fait toujours l'objet d'une controverse.*

Objectif : *Évaluer les attitudes, les croyances et les pratiques des chiropraticiens suisses en ce qui concerne leur droit actuel de prescrire des médicaments.*

Méthodologie : *Une méthodologie Q sera utilisée pour recueillir les données nécessaires à l'étude. En*

[1] PhD Student, Department of Health Research Methods, Evidence and Impact, McMaster University, Hamilton, ON, Canada
[2] Adjunct Assistant Professor, Chiropractic Department, D'Youville College, Buffalo, NY, USA
[3] Private Practice, Cambridge, ON, Canada
[4] School of Public Health and Health Systems, University of Waterloo
[5] Department of Health Research Methods, Evidence and Impact, McMaster University
[6] Private Practice, Faubourg de l'Hôpital, Neuchâtel, Switzerland
[7] Private Practice, Bern, Switzerland
[8] School of Nursing, McMaster University
[9] Department of Health Research Methods, Evidence and Impact, McMaster University

Corresponding author: Peter C Emary, 1145 Concession Road, Cambridge, Ontario N3H 4L5
Tel: (519) 653-1470 ext. 352
E-mail: pcemary@hotmail.com

The authors have no competing interests to report in the preparation of this manuscript. PCE is supported by research grants from McMaster University and the NCMIC Foundation for graduate studies.

scope expansion and frequency of prescribing by Swiss chiropractors will be queried using a 13-item questionnaire. Recruitment will be conducted by e-mail and all members of the Swiss Chiropractic Association will be eligible to participate. Data will be analyzed using by-person factor analysis and descriptive statistics.

Discussion: *This will be the first national update on attitudes toward prescribing medications among Swiss chiropractors since 2003, and the first using Q-methodology. The results of this study are important as they will inform future directions and research regarding chiropractic prescription rights.*

(JCCA. 2020;64(2):119-130)

KEY WORDS: chiropractic, attitudes, beliefs, drug prescription, Switzerland, Q-methodology

outre, l'élargissement du champ de pratique et la fréquence de prescription chez les chiropraticiens suisses seront étudiés à l'aide d'un questionnaire comprenant 13 questions. Le recrutement sera effectué par courriel et tous les membres de l'Association suisse chiropratique pourront participer à l'étude. Les données seront analysées par une analyse de facteurs personnels et par statistique descriptive.

Discussion : *Il s'agira de la première mise à jour nationale sur les attitudes des chiropraticiens suisses à l'égard de leur droit de prescrire des médicaments depuis 2003, et la première étude à utiliser la méthode Q. Les résultats sont importants car ils permettront d'éclairer les orientations et les recherches futures sur le droit de prescrire des chiropraticiens.*

(JCCA. 2020;64(2):119-130)

MOTS CLÉS : chiropratique, attitudes, croyances, prescription de médicaments, Suisse, méthode Q

Introduction

Prescribing medications remains a contentious issue within the chiropractic profession.[1,2] At present, less than five percent of countries worldwide allow for such privileges.[3] However, chiropractors who have medication prescribing rights, such as in Switzerland, perceive these privileges as an advantage for the profession.[4,5] Moreover, Swiss chiropractors view continuing education in pharmacology as a necessary component of this privilege.[5] In contrast, there is a general split in opinion among chiropractors regarding medication prescription rights in countries where chiropractors are not currently licensed to prescribe medications.[1,2] Previous literature indicates that much of this disagreement stems from philosophical differences within the profession.[6,7] Findings from Emary and Stuber[7,8] also suggest that aspects of this division may be reflective of the number of years a chiropractor has been in clinical practice[7] or the educational institution where s/he received training[8].

Even if granted limited prescriptive authority (i.e., limited to prescribing non-steroidal anti-inflammatory drugs [NSAIDs], analgesics, and muscle relaxants), evidence suggests chiropractors could have a positive influence on public health.[2] Arguably, with such privileges, chiropractors would be in a position to help patients with musculoskeletal (MSK) pain avoid overusing or over-relying on medications commonly prescribed by general practitioners to treat their condition. For example, with limited prescription rights, chiropractors could recommend more conservative first-line treatment options such as manipulation, exercise, education, and possibly short-term use of non-opioid analgesics or simple NSAIDs, hence reducing the consumption of opioid analgesic medication. In fact, chiropractors in Switzerland can already prescribe from a limited formulary of muscle relaxants, anti-inflammatories, and analgesics, and studies have shown they exercise judicious use of prescribing in clinical practice.[5,9,10] In one study, Swiss chiropractors were shown to prescribe medications less frequently than requested by their patients.[5] Despite this, the clinical circumstances under which Swiss chiropractors prescribe medications are largely unknown. Rates of prescribing medications for MSK conditions across the Swiss chiropractic profession have also not been rigorously assessed.

The purpose of this study is to assess Swiss chiropractors' current attitudes and beliefs toward, and frequency

of, medication prescribing for MSK conditions in clinical practice. Clinicians and health policy makers could use the results of this assessment to inform potential chiropractic prescribing practices in their jurisdictions. The results of this survey are timely since reports indicate that a growing number of chiropractors from countries outside Switzerland are also interested in expanding their scopes of practice to include similar prescription privileges.[7,8,11-16]

Research Questions

1. What are the current attitudes of Swiss chiropractors toward using prescription medications for MSK conditions?
2. What indications do Swiss chiropractors use when prescribing medications for MSK conditions in clinical practice?
3. How frequently do Swiss chiropractors prescribe medications for MSK conditions in clinical practice?
4. What are Swiss chiropractors' beliefs toward the adequacy of their current pharmacology training for prescribing medications?
5. Are Swiss chiropractors interested in expanding the range of current medications available to prescribe for MSK or non-MSK conditions?

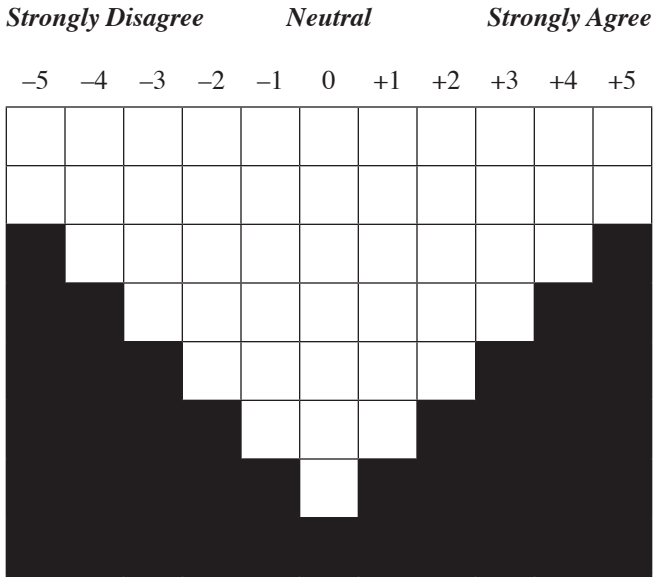

Figure 1.
Example of a Q-sort table for rank-ordering Q-sample statements. This particular Q-sort has 47 spaces (or ranking positions), anchored from -5 to +5, and is designed to be used with a set of 47 statements.

Methods

Study Design

We will conduct a cross-sectional study of chiropractors across Switzerland and employ a Q-methodological approach to address the aforementioned research questions.[17,18] The study will be conducted in two phases. First, we will develop a study instrument, or Q-sort table[17,18] (Figure 1), and pair it with a demographic questionnaire (Appendix 1). Second, these two instruments will be employed to collect data. The instruments will be developed in English because the target population is able to communicate well in this language.

Q-Methodology

Q-methodology was first introduced by William Stephenson in 1935.[19,20] Although used sporadically since its inception, Q-methodology has recently become a more widely utilized and accepted research method, in large part due to advances in statistical analysis techniques and the development of new analytical software programs.[17,18,21] Q-methodology combines qualitative and quantitative methodologies and is a useful means of identifying alternate viewpoints, as well as commonly shared views or attitudes on a research topic.[17,18] In practice, Q-methodology is employed to identify typologies of individuals within groups.[18]

Despite numerous chiropractic surveys on medication prescription rights internationally,[1,6-8,16,22-24] there is still no consensus on this topic within the profession.[1,2] Moreover, many of these surveys have been limited by low response rates,[1,7,8,23,24] leaving their findings open to question. An important advantage of Q-methodology is that low response rates do not bias a study's results. This is because the primary objective of using Q-methodology is to identify the existence of one or more typologies (e.g., commonly shared views on a given topic) in a study population, not to test the typology's proportional distribution in that or other populations.[17,25] As such, Q-methodology can be a useful alternative to traditional quantitative sur-

vey methods when elucidating chiropractors' attitudes toward prescribing medications.

To date, Q-methodology has been used in many health-related research disciplines, including psychology[26], health economics[27], nursing[17,28], social work[29], palliative medicine[30], occupational therapy[31], disability research[32], public policy analysis[33], and attitudinal research[34,35]. However, Q-methodology has not yet been used for research within the chiropractic profession. For a more complete review and practical guide about Q-methodology and its use, we refer readers to the paper by Akhtar-Danesh *et al*.[17]

Population

All active registered members of the Swiss Chiropractic Association (ChiroSuisse[36]) will be eligible to participate. ChiroSuisse is Switzerland's national chiropractic association and represents more than 98% of all practising chiropractors in the country.[9,36] ChiroSuisse has agreed to support the study as described in 'Recruitment' below.

Recruitment

To recruit participants for this study, an information letter containing electronic links to the survey will be disseminated from the administrative offices of ChiroSuisse, via e-mail, to all ChiroSuisse members. As per the Dillman method[37], this will be preceded by a notification letter, sent one week prior to the start of the survey, followed by three reminder notifications, sent one week, two weeks and then four weeks apart, for a total of five survey contacts. There will be no financial compensation or reimbursement for participation. However, the association will reward participants with one hour of continuing education (CE) credit for completing the questionnaires.

Sample Size

We require between 40 and 60 completed surveys to ensure that our sample size is sufficient for a Q-methodology study.[17] What is of most interest are the factors (i.e., the key viewpoints held in common among the group) defined by at least four or five participants.[17,18] A higher number of subjects per factor adds little additional value.[17,38] However, our sampling frame will include the entire population of ChiroSuisse members (n = 286).[36] In this case, because we are including the whole population, the expected sample size will be large enough to address our main objectives. Previous research utilizing e-mail recruitment of Swiss chiropractors suggests we can expect a response proportion of 0.70 or more.[5,9] In the event the response proportion is lower, we will assess possible threats to internal validity by comparing the demographic characteristics (i.e., age, gender, school of graduation, region and number of years in practice) of respondents to the characteristics of all ChiroSuisse members.

Phase 1. Instrument Development

The Concourse

In this phase, we will recruit a purposive sample of 30 ChiroSuisse members to develop a comprehensive list of statements (i.e., the concourse) that broadly represents the viewpoints of Swiss chiropractors regarding attitudes and beliefs toward prescribing medications for MSK conditions.[17,18] To represent the two most populous regions of Switzerland, 15 of the 30 invited chiropractors will be from the German-speaking region of the country, and the remaining 15 will be from the French-speaking region. Two study investigators (TAWH, MW), who are also ChiroSuisse members, will invite their colleagues to participate in this stage of instrument development.

Each chiropractor will be asked to provide 10 statements describing their personal experiences with prescribing medications in clinical practice. In line with previous literature on the topic,[1,4,5,9,10] participants will be encouraged to provide statements around the following three themes: (i) attitudes toward using prescription medications for MSK conditions, (ii) beliefs regarding the adequacy of their current pharmacology training for prescribing medications, and (iii) indications they use when prescribing medications for MSK conditions in clinical practice. Participants will be asked to return their 10 statements to TAWH and MW via e-mail, and a complete list of anonymized statements will then be provided to the lead author (PCE). Although there is no set number of required statements,[17] the list should be comprehensive enough to cover all major aspects of the research topic. We will solicit additional items from a second purposive sample of ChiroSuisse members in the event there is a high non-response or incompletion rate. The authors may add additional items to the compiled list of returned statements, informed from previous literature[1,2,4,5,7-10,16] and their content expertise, and the final list of statements in the concourse

will then be consolidated into a Q-sample[17,18], as detailed below. Examples of possible statements to be used in the final Q study instrument are presented in Table 1.

Table 1.
Examples of statements to be used in the Q study instrument.

Statement
I think medications are a useful addition to chiropractic practice.
I believe medications do not belong to chiropractic practice.
I am pleased with the current prescription rights in Switzerland.
I think adding new drug classes (opioids) to our prescription rights would be useful.
I feel that medication prescription rights give chiropractors better credibility among their medical colleagues.
I think medication prescribed by chiropractors is not appreciated by general practitioners.

The Q-Sample

Using a structured approach,[18] two of the authors, including a Q-methodologist (NAD) and a chiropractor (PCE) with content expertise in the subject area, will categorize the statements under the three aforementioned themes. The lead author (PCE) will review each item in the concourse list, and statements corresponding with attitudes to medication prescription privileges, beliefs regarding pharmacology training, or indications for prescribing will be grouped within these respective themes. An inductive approach[17] will then be used to identify any additional themes or sub-themes from the remaining statements, and these items will be categorized accordingly. The structured concourse will be reviewed by a second author (NAD), and disagreements regarding themes, sub-themes, and categorized statements will be resolved through discussion to achieve consensus. A third reviewer (TAWH) will adjudicate as necessary.

The categorized statements will be reviewed for similarities and differences by the three authors using a similar process as described above. Repetitive statements will be deleted and disagreements will be resolved through consensus. The review process will continue in this manner through multiple rounds until a more consolidated list of statements is achieved.[17,18] Statements that are distinct, concise, and representative of the major themes will be chosen for the final Q-sample. While too few statements would provide inadequate coverage of the topic, too many would burden participants when completing the Q-sorting process.[18] In most Q-methodology studies, a Q-sample of between 40 and 80 statements, with at least five or six statements covering aspects of each major theme, is generally recommended.[18] This list will represent all of the key conceptual and emerging themes about Swiss chiropractors' attitudes and beliefs toward prescribing medications for MSK conditions. The statements will then be randomly numbered from one to the total number of Q-sample statements.

The Q-Sort Table

After assembling the final Q-sample, a grid or Q-sort table will be developed.[17,18] The number of cells to be placed in the Q-sort table will be equal to the number of statements in the Q-sample (see Figure 1). The Q-sort table will consist of empty cells or boxes, arranged in rows and columns of differing lengths, resembling the shape of a quasi-normal distribution. As shown in Figure 1, anchors of -5 (least agree or most disagree) and +5 (most agree) will be assigned to the extreme scores of the Q-sort table. The precise range to be used for the Q-sort table anchors in the current study will depend on the total number of statements included in the final Q-sample. In general, anchor ranges of between -4 to +4 and -6 to +6 are recommended for Q-samples of ≤ 40 items and ≥ 60 items, respectively.[18,38] The columns between the anchors will then be numbered sequentially, moving in from the anchors toward the middle column, which is given a scale step label of zero.

To measure attitudes and beliefs, we will ask participants to rank order[17,18] the Q-sample list of statements about medication prescribing for MSK conditions based on the extent to which they agree or disagree with each statement. A description of the rank-ordering process is provided in Phase 2 below. We will pilot test the Q-sort table and statements by having two Swiss chiropractors review the study materials and work through the Q-sorting process and assign the statements to the Q-sort table. This process will be conducted to achieve content validity, as well as clarity and readability.[17,39] Face validity will be promoted by using ChiroSuisse participants' exact word-

ing of their concourse statements, with slight editing for grammar and comprehension.[17] The test-retest reliability of the Q-sorting process has been shown to be 0.80 or higher in various contexts.[17]

Phase 2. Data Collection

ChiroSuisse administration will disseminate electronic links to the data collection instruments to all ChiroSuisse members via an e-mail information letter. The first instrument will implement the Q-methodology using a freely downloadable app (i.e., Lloyd's Q Sort Tool [www.nowhereroad.com/qsort/]). The second instrument will be a demographic questionnaire administered through SurveyMonkey (www.surveymonkey.com). For the Q study, a set of instructions will be available to explain the process to participants.

The Q-sort table will be completed by each participant independently. Participants will be asked to read the list of statements and then place each statement into an empty cell corresponding with the amount of agreement they have with each statement. The Q-sort table, as presented in Figure 1, is constructed in a prearranged 'forced-choice' frequency distribution,[18] such that only two statements can be placed under -5 and two under +5; three statements can be placed under -4 and three under +4; four statements can be placed under -3 and +3, and so on; and the highest number of statements (e.g., seven, in this case) can be placed under the central column, 0. Any statement placed under a negative number on the Q-sort table will indicate disagreement (or less agreement), and any statement placed under a positive number will indicate agreement. Participants will be instructed to sort the statements in this manner until all cells on the Q-sort table are filled.[17,18]

In addition to the Q-sort table, and after each participant's Q-sorting process is complete, the final Q study instrument will include three open-ended questions asking participants about why they sorted the items in the manner in which they did. For example, participants will be asked to respond to the following three questions: 1) Please explain why you chose those particular statements for your highest ratings; 2) Please explain why you chose those particular statements for your lowest ratings; and 3) Please provide any other comments you wish to help explain your thinking when completing this Q sort. The purpose of these questions will be to explore each participant's wider understanding of the topic, as well as to elucidate the meaning of the items to the participant, particularly those placed at the extremes of the distribution. Participants will then be asked one final Likert-style question about their general attitude towards the topic. For instance, participants will be asked to rate their level of agreement with the following statement: "I think that medication prescription privileges are an advantage for the chiropractic profession in Switzerland."

For the demographic questionnaire, participants will be asked to report their age, sex, chiropractic school of graduation, number of years in practice, region of practice, postgraduate qualifications (if any), and type of practice (e.g., solo, multidisciplinary, or hospital-based). In addition, there will be five items asking participants about frequency of medication prescribing and scope of practice (see Appendix 1). We will use complete case analysis to address missing data. For example, any incomplete Q-sort tables will be excluded from the Q-methodology analysis. Demographic questionnaires with more than 10% missing data (i.e., ≥ 2 items) will also be omitted.[40]

Data Analysis

We will generate frequencies for all collected data from the demographic questionnaire (including proportions for categorical data, means and standard deviations for normally distributed continuous data, and medians and inter-quartile ranges for non-normally distributed continuous data) and compare responders with non-responders using chi-squared and t-tests (or Fisher's exact and Wilcoxon-Mann-Whitney tests when appropriate). All data and comparative analyses will be performed using Stata[21] and the statistical significance level (α) for quantitative analyses will be 0.05.

For the Q-methodology analysis, a by-person factor analysis[17,18] of the completed Q-sorts will be used to investigate salient viewpoints, as well as shared viewpoints, among participants. The statistical analysis in a by-person factor analysis is performed by person rather than by variable, trait, or statement. Therefore, each completed Q-sort represents one person's point of view on the topic of study, and each group (or factor) represents individuals with similar viewpoints, feelings, or experiences about the topic. If an individual significantly loads ($p \leq 0.05$) on a particular factor, they are then counted as a member of that group. In essence, all respondents who load on

Table 2.
Summary of measurement variables and data collection methods to be used in this study. (GP = general practitioner)

Variables	**Data Collection Method**
Attitudes toward current prescription privileges	Q-methodology
Beliefs about current pharmacology training	Q-methodology
Indications used for prescribing	Q-methodology
Interest in expanding current formulary	Questionnaire (binary, yes/no)
Frequency of prescribing	Questionnaire (%, open-ended)
Number of years in practice	Questionnaire (years, open-ended)
School of graduation	Questionnaire (school, multiple choice)
Scope of practice (i.e., hospital-based practice, daily collaboration with GPs)	Questionnaire (binary, yes/no)

one factor constitute a group of like-minded individuals. A summary of the measurement variables and data collection methods to be used for this study are listed in Table 2.

Participants' demographic information and written comments obtained in the survey will be triangulated to their completed Q-sort data to aid in factor interpretation.[18] For instance, relationships between factors and demographic variables (i.e., age, sex, number of years in practice, chiropractic school of graduation, postgraduate qualifications, frequency of prescribing, and scope of practice) will be explored using chi-squared and one-way analysis of variance (ANOVA) tests (or Fisher's exact and Kruskal-Wallis tests as appropriate). Similar to previous research,[8] chiropractic school of graduation will be dichotomized into two groups: (i) 'American' (i.e., graduates from chiropractic programs within the United States) and (ii) 'non-American' (i.e., including graduates from programs in Europe, Canada, or elsewhere), in order to explore differences in attitudes, beliefs, and practices (if any) toward medication prescription between the two groups. Pertinent comments provided by significantly loading participants will also be presented alongside factor scores and distinguishing statements using a weaving narrative approach.[18]

Factor Extraction and Rotation

We will use the qfactor command in Stata[21] for our factor-extraction and factor-rotation procedures. In Q-methodology, two of the most commonly used techniques for factor extraction include the principal component method and the centroid method.[17,18] A more recently developed factor-extraction method, the principal axis factor method, is also available to users in Stata.[21] The main difference between these three methods is that the variance of factor loadings is maximized in the principal component method, the average of the loadings is maximized in the centroid method, and the sum of squares of the loadings (i.e., the communality) is maximized in the principal axis factor method. Although all three factor-extraction methods have been shown to produce similar results,[18,39] we will use the principal axis factor method because it allows for greater data exploration and interpretability, particularly for theoretical purposes.[18,21,41] In Q-methodology, a factor is usually considered significant if it has a eigenvalue (or Kaiser-Guttman criterion) of greater than one.[17,18]

For factor rotation, two common techniques used in Q-methodology include varimax and manual (or theoretical) rotation.[17,18,41,42] Because unrotated factors typically are not meaningful or easily interpretable, factor-rotation methods are used to identify factors with more simple structures, allowing for easier interpretation.[17,18,41,42] Furthermore, manual rotation is normally used when there is a theoretical framework for the underlying factors. As we are interested in current attitudes and beliefs toward medication prescribing for MSK conditions among Swiss chiropractors, and this is the first study of its kind where there is no relevant pre-determined theory or hypothesis in the Q-methodology literature, we will use an exploratory approach with varimax rotation.

Following factor extraction and factor rotation, a weighted (or synthetic) Q-sort will be produced for each rotated factor by using a weighted averaging method to

calculate the score for each statement for that factor.[18,25] These scores will be calculated as normalized z scores, and then converted to within the bounds of the aforementioned Q-sort anchor range (i.e., -5 to +5). For instance, the two statements with the highest z scores will be awarded a ranking of +5, the next three highest will be ranked at +4, and so on; and the pair of statements with the lowest z scores will be ranked at -5. Each factor will then be assigned a name that reflects the factor configuration. Names are typically assigned to each factor based on the factor's distinguishing statements,[17,18] which are statements that score statistically significantly different on that factor compared with any of the other factors. We will calculate Cohen's d for each factor-factor pair to identify distinguishing statements.[21,43] Because we expect there to be general consensus among the majority of ChiroSuisse members regarding viewpoints toward statements related to their existing medication prescription privileges,[1,4,5,9] we will use a Cohen's medium effect size of 0.5. For this study, the lead investigators (PCE, NAD) will meet to interpret and name the factors.

Ethical Considerations

In this study, the identified risks to participating Swiss chiropractors are deemed minimal. The greatest risk to participants is anonymity. The only other identifiable disadvantage of taking part in this study will be the time involved in completing the survey questionnaires. To minimize and manage these risks, all survey data collected for this study will be confidential and stored securely in a password protected electronic database. Consent to participate will be implied upon completion of the survey questionnaires.

Participants will be asked to provide their full name (first and last) when initially signing in to the Q study. This information will be kept confidential, as only the lead authors (PCE, NAD) will have access to these names. Participants will be asked to provide a non-identifying username if they wish to keep their responses anonymous from other participants in the group. Participants will also complete a demographic questionnaire on SurveyMonkey. For comparative purposes, each participant's name from the Q study will be matched to their corresponding name used in completing the demographic questionnaire. A list of names of ChiroSuisse members who completed both the Q study and demographic questionnaire will be created, and this will be sent to ChiroSuisse for the purposes of awarding CE credit.

This study has received ethical approval from the Hamilton Integrated Research Ethics Board at McMaster University (approval number 2019-7612). Local approval in Switzerland was also obtained from the Swiss Cantonal Ethics Commission (approval number 2019-00926).

Discussion

This will be the first national study of chiropractors in Switzerland on attitudes, beliefs, and practices regarding medication prescription for MSK conditions conducted since the year 2000.[4] In the previous national study of Swiss chiropractors by Robert,[4] 61% of respondents indicated prescribing MSK medications to patients in clinical practice. Eighty-two percent felt that limited prescribing rights were an advantage for the Swiss chiropractic profession, and 76% wanted to see these privileges extended to include additional analgesic and muscle relaxant medications.[4] The chiropractic formulary in Switzerland was recently extended in January 2018.[44] As such, the current study will provide an update on Swiss chiropractors' attitudes toward these privileges. In addition, it will be the first such study to inquire about attitudes toward prescribing additional MSK (e.g., opioid) and non-MSK medications, as well as indications for prescribing, and the first to do so using Q-methodology.[17,18]

Because Swiss chiropractors share primary care status with general practitioners,[9,10] the results of the current study may also have future implications warranting further investigation. For instance, prior to this study, the role of "medication counselling"[5] will not have been explored across the Swiss chiropractic profession. In only one small pilot study,[5] from Bern, Switzerland, have chiropractors been queried about their ability to reduce medication use among patients with MSK conditions. If practiced across the chiropractic profession, such a role could very well have public health implications in light of the growing opioid crisis in Switzerland[45] and elsewhere[46,47]. The assumption is that the more 'conservative' prescribing attitudes of chiropractors, relative to medical doctors, might help mitigate the overprescribing of opioids for MSK conditions. Indeed, the expanded set of results from the current study will be of interest to stakeholders within and outside the profession. However, outside of Switzerland, there is still controversy over medication prescrib-

ing among chiropractors who are not currently licensed to use this modality within the profession. For instance, a common argument against prescribing rights in the profession internationally is that chiropractic clinicians have inadequate training in pharmacology.[1,2] There is also concern that, with prescription privileges, chiropractors will stop using spinal manipulation to treat their patients.[1,2] Therefore, because the results of this research project will be obtained directly from chiropractic clinicians with experience in prescribing pharmaceuticals, the findings will inform the discourse on whether other jurisdictions should extend prescribing rights to chiropractors.

Limitations

A limitation of this study is that two separate instruments will be utilized for data collection. Moreover, participants will be required to download an app prior to completing the Q-sort table. It may also take participants between 30 to 60 minutes to complete the Q-sort table, depending on the total number of included Q-sample statements.[17] These limitations will increase the level of participant burden and result in potential recruitment and completion challenges. However, as described in the methods above, we will employ the Dillman method[37] to increase the response proportion. Dillman's method contains a host of procedures designed to increase the attractiveness of responding to surveys, including the type and frequency of reminders, layout of surveys, and the wording to use in contacts with prospective participants.[37] Dillman initially developed his methods for mail surveys, and later revised and adapted them for internet surveys.

Knowledge Translation

The results of this study will be made public through a peer-reviewed publication, oral conference presentation at the ChiroSuisse Annual General Conference to be held on September 10-12, 2020 in Lugano, Switzerland, as well as through other invited or accepted conference presentations. Aside from academic presentations, we will provide a summary of the study results to ChiroSuisse members. We will also approach the World Federation of Chiropractic, and offer to present our findings to their member associations via webinar format.

Acknowledgement

The authors would like to acknowledge Dr. Jason Busse, DC, PhD for his constructive feedback and manuscript revisions on the original proposal for this study.

References

1. Emary PC, Stuber KJ. Chiropractors' attitudes toward drug prescription rights: a narrative review. Chiropr Man Ther. 2014; 22:34.
2. Emary PC, Houweling TA, Wangler M, Burnie SJ, Hood KJ, Erwin WM. A commentary on the implications of medication prescription rights for the chiropractic profession. Chiropr Man Ther. 2016; 24:33.
3. Stochkendahl MJ, Rezai M, Torres P, Sutton D, Tuchin P, Brown R, Côté P. The chiropractic workforce: a global review. Chiropr Man Ther. 2019; 27:36.
4. Robert J. The multiple facets of the Swiss chiropractic profession. Eur J Chiropr. 2003; 50:199-210.
5. Wangler M, Zaugg B, Faigaux E. Medication prescription: a pilot survey of Bernese doctors of chiropractic practicing in Switzerland. J Manipulative Physiol Ther. 2010; 33(3): 231-237.
6. McDonald WP, Durkin KF, Pfefer M. How chiropractors think and practice: the survey of North American chiropractors. Semin Integr Med. 2004; 2: 92-98.
7. Emary PC, Stuber KJ. Attitudes toward drug prescription rights: a survey of Ontario chiropractors. Chiropr Man Therap. 2015; 23:22.
8. Emary PC, Stuber KJ. Relationship between Ontario chiropractors' attitudes toward drug prescription rights and Canadian versus non-Canadian college of graduation: results from an online survey. J Can Chiropr Assoc. 2016; 60(1): 13-20.
9. Humphreys BK, Peterson CK, Muehlemann D, Haueter P. Are Swiss chiropractors different than other chiropractors? Results of the job analysis survey 2009. J Manipulative Physiol Ther. 2010; 33(7):519-535.
10. Houweling TA, Braga AV, Hausheer T, Vogelsang M, Peterson C, Humphreys BK. First-contact care with a medical vs chiropractic provider after consultation with a Swiss telemedicine provider: comparison of outcomes, patient satisfaction, and health care costs in spinal, hip, and shoulder pain patients. J Manipulative Physiol Ther. 2015; 38(7):477-483.
11. Erwin WM, Korpela AP, Jones RC. Chiropractors as Primary Spine Care Providers: precedents and essential measures. J Can Chiropr Assoc. 2013; 57(4):285-291.
12. Wisconsin Chiropractic Association. Filling the shortage of primary care health care providers in Wisconsin: the Primary Spine Care Physician, a new class of health care provider. Madison; 2015 [Available at: https://dta0yqvfnusiq.cloudfront.net/aapcm45500321/2015/10/WSC-White-Paper-Primary-Spine-Care-Physician.pdf (Accessed December 17, 2019)].
13. Alberta College and Association of Chiropractors. Scope update: scope expansion vote results. ACAC Member

e-Newsletter [Industry Mailout]. Edmonton; December 2, 2015.
14. Alberta College and Association of Chiropractors. Comprehensive care for chiropractic patients: better access to diagnostic procedures and treatment options. Edmonton; 2015 [Available at: https://dta0yqvfnusiq.cloudfront.net/aapcm45500321/2015/10/Alberta-College-and-Association-of-Chiropractors-White-Paper.pdf (Accessed December 17, 2019)].
15. Walker BF. The new chiropractic. Chiropr Man Ther. 2016; 24:26.
16. Emary PC, Lamont H, Taylor JA. Attitudes toward medication prescription rights: a survey of chiropractic students and faculty at D'Youville College. J Chiropr Med. 2019; [In press].
17. Akhtar-Danesh N, Baumann A, Cordingley L. Q-methodology in nursing research: a promising method for the study of subjectivity. West J Nurs Res. 2008; 30(6):759-773.
18. Watts S, Stenner P. Doing Q methodological research: theory, method, and interpretation. London: Sage; 2012.
19. Stephenson W. Correlating persons instead of tests. Character Pers. 1935; 4:17-24.
20. Stephenson W. Technique of factor analysis. Nature. 1935; 136:297.
21. Akhtar-Danesh N. qfactor: a command for Q-methodology analysis. Stata Journal. 2018; 18(2):432-446.
22. Gliedt JA, Briggs S, Williams JSM, Smith DP, Blampied J. Background, expectations and beliefs of a chiropractic student population: a cross-sectional survey. J Chiropr Educ. 2012; 26(2):146-160.
23. Gliedt JA, Hawk C, Anderson M, Ahmad K, Bunn D, Cambron J, Gleberzon B, Hart J, Kizhakkeveettil A, Perle SM, Ramcharan M, Sullivan S, Zhang L. Chiropractic identity, role and future: a survey of North American chiropractic students. Chiropr Man Ther. 2015; 23:4.
24. de Luca KE, Gliedt JA, Fernandez M, Kawchuk G, Swain MS. The identity, role, setting, and future of chiropractic practice: a survey of Australian and New Zealand chiropractic students. J Chiropr Ed. 2018; 32(2):115-125.
25. Brown SR. A primer on Q methodology. Operant Subjectivity 1993; 16:91-138.
26. Watts S, Stenner P. The subjective experience of partnership love: a Q methodological study. Br J Soc Psychol. 2005; 44(1):85-107.
27. Baker RM. Economic rationality and health and lifestyle choices for people with diabetes. Soc Sci Med. 2006; 63(9):2341-2353.
28. Akhtar-Danesh N, Baumann A, Kolotylo C, Lawlor Y, Tompkins C, Lee R. Perceptions of professionalism among nursing faculty and nursing students. West J Nurs Res. 2013; 35(2):248-271.
29. Ellingsen IT, Størksen I, Stephens P. Q methodology in social work research. Int J Soc Res Methodol. 2010; 13(5):395-409.
30. Gaebler-Uhing G. Q-methodology: a systematic approach to assessing learners in palliative care education. J Palliat Med. 2003; 6(3):438-442.
31. Corr S. An introduction to Q methodology: a research technique. Br J Occup Ther. 2001; 64(6):293-297.
32. McKenzie J, Braswell B, Jelsma J, Naidoo N. A case for the use of Q-methodology in disability research: lessons learned from a training workshop. Disabil Rehabil. 2011; 33(21-22):2134-2141.
33. Durning D. The transition from traditional to postpositivist policy analysis: a role for Q-methodology. J Policy Anal Manage. 1999; 18(3):389-410.
34. Cross RM. Exploring attitudes: the case for Q methodology. Health Educ Res. 2005; 20(2):206-213.
35. Müller FH, Kals E. Sort technique and Q-methodology: innovative methods for examining attitudes and opinions. Forum Qual Soc Res. 2004; 5(2): Article 34.
36. Organisation: ChiroSuisse. Bern; 2019 [Available at: https://www.chirosuisse.ch/de (Accessed November 17, 2019)].
37. Dillman DA. Mail and internet surveys: the tailored design method. Hoboken: John Wiley & Sons, Incorporated; 2006.
38. Brown SR. Political subjectivity: applications of Q methodology in political science. New Haven: Yale University Press; 1980.
39. Burns KE, Duffett M, Kho ME, Meade MO, Adhikari NK, Sinuff T, Cook DJ; ACCADEMY Group. A guide for the design and conduct of self-administered surveys of clinicians. Can Med Assoc J. 2008; 179(3):245-252.
40. Bennett DA. How can I deal with missing data in my study? Aust N Z J Public Health. 2001; 25(5):464-469.
41. Akhtar-Danesh N. A comparison between major factor extraction and factor rotation techniques in Q-methodology. Open J Appl Sci. 2017; 7:147-156.
42. Akhtar-Danesh N. An overview of the statistical techniques in Q methodology: Is there a better way of doing Q analysis? Operant Subjectivity. 2016; 38:29-36.
43. Akhtar-Danesh N. Using Cohen's effect size to identify distinguishing statements in Q-methodology. Open J Appl Sci. 2018; 8:73-79.
44. Federal Council: Ordinance on medicinal products. Art. 46 Medicines prescribed by chiropractors (Art. 24 para. 1 let. A no. 1 HMG). Bern; 2020 [Available at: https://www.admin.ch/opc/de/classified-compilation/20173471/index.html#fn-#a46-1 (Accessed February 6, 2020)].
45. Opioid painkiller prescriptions surge in Switzerland. Bern, Switzerland: SWI swissinfo.ch; July 10, 2018 [Available at: https://www.swissinfo.ch/eng/addiction-_opioid-painkiller-prescriptions-surge-in-switzerland/44248400 (Accessed August 28, 2019)].

46. Manchikanti L, Helm S 2nd, Fellows B, Janata JW, Pampati V, Grider JS, Boswell MV. Opioid epidemic in the United States. Pain Physician. 2012; 15(3 Suppl):ES9-38.

47. Belzak L, Halverson J. The opioid crisis in Canada: a national perspective. Health Promot Chronic Dis Prev Can. 2018; 38(6):224-233.

Appendix 1.
Demographic questionnaire.

Swiss Chiropractic Q-Methodology Study. Demographics and Scope of Practice

1) What is your age? _____

2) What is your gender?
- ❒ Female
- ❒ Male

3) What chiropractic school did you graduate from?
- ❒ Anglo-European College of Chiropractic (AECC University College)
- ❒ Canadian Memorial Chiropractic College
- ❒ Cleveland Chiropractic College
- ❒ Institut Franco-Européen de Chiropratique
- ❒ Logan College of Chiropractic
- ❒ Los Angeles College of Chiropractic, Southern California University of Health Sciences
- ❒ National College of Chiropractic, National University of Health Sciences
- ❒ New York Chiropractic College
- ❒ Northwestern College of Chiropractic, Health Science University
- ❒ Palmer College of Chiropractic
- ❒ Palmer College of Chiropractic West
- ❒ Syddansk Universitet Odense (University of Southern Denmark)
- ❒ Texas Chiropractic College
- ❒ Université de Québec à Trois Riviéres, Départment de chiropratique
- ❒ University of Zürich, Faculty of Medicine
- ❒ Welsh Institute of Chiropractic, University of South Wales
- ❒ Western States Chiropractic College
- ❒ Other: _____

4) In which region do you practice/work as a chiropractor?
- ❒ Swiss-German
- ❒ Swiss-French
- ❒ Swiss-Italian

5) How many years have you been a chiropractor? _____

6) Do you have any postgraduate university degrees outside of the usual chiropractic qualifications (e.g., PGCert/PGDip, MSc, PhD)?
❒ Yes ❒ No

7) Do you work in a multidisciplinary practice/hospital setting?
❒ Yes ❒ No

8) Do you collaborate with other medical professionals (e.g., GP and/or specialists) **on a daily basis**?
❒ Yes ❒ No

9) How often do you prescribe **analgesic** medications to patients in clinical practice?
_____% of patients

10) How often do you prescribe **non-steroidal anti-inflammatory (NSAID)** medications to patients in clinical practice?
_____% of patients

11) How often do you prescribe **muscle relaxant** medications to patients in clinical practice?
_____% of patients

12) Are you interested in expanding the current formulary to include additional classes of medication for treating **musculoskeletal** conditions (e.g., opioids, corticosteroids)?
❒ Yes ❒ No

13) Are you interested in expanding the current formulary to include additional medications for treating **non-musculoskeletal** conditions (e.g., antibiotics, anti-hypertensives, anti-depressants, etc.)?
❒ Yes ❒ No

ISSN 0008-3194 (p)/ISSN 1715-6181 (e)/2020/131–138/$2.00/©JCCA 2020

A case report on the delayed diagnosis of transverse myelitis in a 61-year-old male farmer

Jocelyn Cox, DC, FCCS[1,2]
Alena Russo, DC[2]

Transverse myelitis is a neurological disorder that results in acute focal inflammation of the spinal cord. It can present with a varied spectrum of neurological signs and symptoms which can make diagnosing a challenge, and delayed diagnosis a frequent complication. This is a case of a 61-year-old male who presented with back pain complicated by neurological symptoms that should have warranted immediate referral to a neurologist. It took approximately five weeks from the onset of his symptoms to be referred to a neurologist, and a further four months to the diagnosis of transverse myelitis. The authors hope to stress the importance of thorough evaluations including neurological exams when new symptoms present and to emphasize regular interprofessional collaboration, that may have prevented the delay in diagnosis seen in this case.

(JCCA. 2020;64(2):131-138)

KEY WORDS: collaboration, diagnosis, management, myelitis, myelopathy, neuropathy

La myélite transverse est un trouble neurologique se manifestant par une inflammation focale aiguë de la moelle épinière. Le sujet peut présenter divers signes et symptômes neurologiques qui peuvent rendre le diagnostic difficile. Un diagnostic tardif entraîne de fréquentes complications. Il s'agit d'un homme de 61 ans ayant des dorsalgies et des symptômes neurologiques qui auraient dû justifier son renvoi immédiat à un neurologue. Environ cinq semaines après l'apparition des symptômes se sont écoulées avant le renvoi à un neurologue, et par la suite quatre mois se sont écoulés avant qu'un diagnostic de myélite transverse ne soit établi. Les auteurs de l'étude espèrent souligner l'importance des évaluations poussées, y compris des examens neurologiques lorsque de nouveaux symptômes apparaissent, et l'importance d'une collaboration régulière entre professions, ce qui aurait permis d'éviter le retard de diagnostic dans le cas de ce patient.

(JCCA. 2020;64(2):131-138)

MOTS CLÉS : collaboration, diagnostic, gestion, myélite, myélopathie, neuropathie

[1] Canadian Memorial Chiropractic College
[2] Private practice

Corresponding author:
Jocelyn Cox, 6100 Leslie Street, Toronto ON, M2H 3J1
Tel: 416-200-2101
E-mail: drjocelyncox@gmail.com

The authors have no disclaimers, competing interests, or sources of support or funding to report in the preparation of this manuscript.
The involved patient's wife provided consent for case publication.

Introduction

Transverse myelitis (TM) is defined as a neurological disorder of focal inflammation in the spinal cord that can result in motor, sensory, and autonomic dysfunction below the level of the lesion.[1,2] It is considered rare, with a prevalence of one to eight people per million, and a yearly incidence of 1400 in the United States.[1] As with many spinal cord pathologies, morbidity is common.[1] While TM has no race, genetic, or geographic predispositions, it is bimodal in classic age presentation, appearing in the second or fourth decades.[1] Like multiple sclerosis (MS), it tends to affect females more than males.[1] It is considered more common if it is acquired after the diagnosis of MS or neuromyelitis optica.[4] TM can be diagnosed as primary or idiopathic in nature, or secondary to another disease. There is debate, however, as to whether TM is truly a primary disease or if it is always secondary to another disease process. Some suggest that >50% of all cases are the result of an infection (such as a flare up of varicella zoster, cytomegalovirus, Epstein-Barr or influenza) that preceded the presentation of symptoms.[1,3] Further, it is often difficult to establish the preceding infection or cause; as such, up to 60% of TM cases are diagnosed as idiopathic, with the understanding the antecedent cause may be missed.[3] There are three main categories of differential diagnoses for TM, including demyelination (ie MS, neuromyelitis optica, and idiopathic transverse myelitis), infection (ie varicella zoster, herpes simplex virus), and inflammatory autoimmune disorders (ie systemic lupus erythematosus, neurosarcoidosis).[5] There is some suggestion that this disease is not a purely demyelinating disorder, but a mix of all three.[6] Given this, diagnostic accuracy is challenging.[6] There are a few suggested mechanisms of neural injury in the process of TM[7]: the bystander effect, molecular mimicry, and humoral response. These mechanisms can result in compressive or non-compressive spinal cord injury.

The bystander effect results in damage to the spinal cord through direct or indirect interaction of the microbial infection and the immune-mediated response against the agent. Molecular mimicry is the process of the body creating antibodies to a bacterial cross-reactive antigen causing B-cells to produce an anti-ganglioside response against human peripheral nerves. Humoral response frequently occurs as a result of the previous processes, resulting in blurred distinction between self and non-self cells.[7,8]

The pathology of the disease process causes inflammation and destruction of the myelin (white matter) supporting the spinal cord, swelling and inflammation of the spinal cord tissue (grey matter), and results in scarring within and around the spinal cord itself. While the inflammatory process causes the acute symptoms that lead to

Table 1.

Criteria for the diagnosis of Idiopathic Transverse Myelitis (Adapted from: Transverse Myelitis Consortium Group. Barnes, G, et al. Proposed diagnostic criteria and nosology of acute transverse myelitis. Neurology 59:499-505, 2002.)

Inclusion Criteria	**Exclusion Criteria**
Development of sensory, motor, or autonomic dysfunction attributable to the spinal cord	History of prior radiation to the spine within ten years
Bilateral signs and/or symptoms (not necessarily symmetric)	A clear distribution of clinical deficits consistent with anterior spinal artery thrombosis
Clearly defined sensory level	Abnormal flow voids on the surface of the spinal cord that could be consistent with arteriovenous malformations
Exclusion of extra-axial compressive aetiology by neuroimaging	Serologic or clinical evidence of a systemic autoimmune disease
Inflammation in the spinal cord demonstrated by CSF pleocytosis, elevated IgG or gadolinium enhancement on MRI within the first seven days	CNS manifestation of an infectious cause
Clinical progression to nadir between 4 days and 21 hours after onset	Brain lesions on MRI that are suggestive of multiple sclerosis
	Prior history of optic neuritis

Table 2.
Subclasses of Transverse Myelitis.

Subclass	Imaging Findings	Presentation
Acute Flaccid Myelitis	Bilateral, symmetric and widespread lesions in the grey matter at the affected level on MRI	Neurological disease that manifests with clinical syndromes similar to poliomyelitis
Acute partial transverse myelitis	Mildly or grossly asymmetric with an MRI lesion extending one or two vertebral segments	Spinal cord dysfunction causing symmetric, complete (or near complete) neurological deficits (paresis, sensory loss, and autonomic dysfunction) below the level of the lesion that onsets between 4 and 21 days. Signs and symptoms may include pain, weakness, uncoordinated movements, numbness, dysaethesia, bowel and bladder dysfunction, sexual dysfunction depending on level affected
Acute complete transverse myelitis	Mildly or grossly asymmetric lesions extending more than one to two vertebral segments on MRI	
Longitudinally extensive transverse myelitis	Mildly or grossly asymmetric lesions that extend three or more vertebral segments on MRI.	

the diagnosis, the lasting pathology is thought to be as a result of the scarring within the spinal cord interfering with nerve signalling.

The classic symptoms of this disease exist on a continuum of myelopathy that present over the course of days to weeks. This most commonly includes back pain (30-50%), paraparesis (50%), lower limb paraesthesiae (80-95%), allodynia (80%), sensory level changes (80%), and bladder symptoms (nearly 100%).[1,2,9] TM most commonly occurs in the thoracic spine, although there is no clear reason for this.

The current diagnostic criteria was completed in 2002 (see Table 1).[9] The recommended approach for the diagnosis of TM should be based off the principle of exclusion including: the patient's clinical presentation, spinal magnetic resonance imaging (MRI), and serological evaluation, cerebrospinal fluid evaluation, neuroimaging, and possible others (i.e. positron emission tomography, biopsy) to exclude other differential diagnoses.[3,6,9]

The presentation and prognosis of TM differs greatly, with some patients recovering with little to no problems, while others experience permanent impairments that have a large impact on their quality of life, and ability to perform their activities of daily living.[1,10] There are three sub-classes of transverse myelitis that are delineated based on severity of symptoms and longitudinal extent of involvement in the spinal cord (see Table 2).[2,3]

Given the array of symptoms that are possible with TM, it is crucial to get advanced imaging of the spine within three weeks to help rule out other possible differentials diagnoses and direct treatment accordingly. Differential diagnoses include vascular myelopathies, vitamin deficiencies (vitamin B12, vitamin E), and neoplasms.[3] In those who are not aware of the possible implications, this array of symptoms can lead to misdiagnosis, delay in diagnosis, and in turn, delayed recovery.

According to sources,[1,3,11-13] common medical management is to prescribe high dose steroids and immunosuppressants to mitigate the acute inflammation process from occurring if possible. High dose intravenous steroids and immunosuppressants should be started as soon as possible, as they are effective in acute inflammatory central nervous system diseases like TM, MS, and Guillain-Barre Syndrome.[12,13] There is no standard approach or framework for conservative management and rehabilitation of transverse myelitis, and most practitioners rely on guidelines for other spinal cord pathologies.[12] Incorporating aggressive physical therapy and rehabilitative exercises appear to improve patient function and prognosis in the long-term.[1,10]

The prognosis for TM is variable, though most with idiopathic TM can expect at least partial recovery.[14] Symptoms that onset rapidly, and those who are younger at onset, tend to have a poorer prognosis.[1,10] Recovery can be anticipated if significant progress is made in the first three months, however, 40% will have persistent morbidity.[10,14] Common contributors to morbidity include motor weakness, paraesthesia, bowel and bladder dysfunction, and pain.

Chiropractors and other rehabilitation providers would be remiss if they do not perform and record through baseline neurological evaluations and compare regularly in

future visits to prevent missed recurrences.[3] Most patients will have a monophasic disease process, while 20% may will have recurrent inflammatory episodes within the spinal cord.[8] There is limited preliminary evidence that in approximately 5% of cases, patients with acute complete TM may progress to MS, further underlining the value of regularly tracked neurological evaluations.

Case Presentation

A 61-year-old cattle farmer presented to a rural chiropractic clinic in April 2017 for an initial evaluation. He did not smoke or use recreational drugs. He had no history of systemic illness or recent infection. There were no signs of neurological involvement or red flags, though there was a history of a C4-6 anterior fusion of the cervical vertebrae due to anterolisthesis performed in 1997. The physical exam included a neurological screen (deep tendon reflexes, motor testing of the upper and lower limbs, and crude touch sensory testing of the upper and lower limbs, and straight leg raise) which was normal, as well as appropriate orthopaedic testing of the involved joints and muscles. He was diagnosed with mechanical neck and low back pain. He was treated twice with spinal manipulation, soft tissue therapy and rehabilitative exercises. The managing chiropractor (JC) went on maternity leave in April 2017. In May 2017 she received an email from the patient's wife indicating for the past ten days he had experienced 'very bothersome' back pain and was having difficulty walking properly and coordinating his feet. In late April, he missed steps and fell down the stairs at home, which alarmed him greatly. He reported having interscapular pain and numbness bilaterally in the fingers. The patient reported the most aggravating behaviour was getting in and out of cars and chairs, and when he would relax in the evening, his left arm and leg would jerk involuntarily. If he were to get onto the ground to work with his calves while on the farm, he would be unable to stand again. Due to concern about the surgical plate, they went to their medical doctor (MD). After a brief examination that did not include a neurological screen, the doctor suggested it was likely viral and advised him to rest and wait at home for a week.

According to emails exchanged at this time and the patient's diary, the patient and his wife went to a new chiropractor in the interim in hope of relief from the interscapular and low back pain. The chiropractor also did not perform a neurological screen, yet treated him with interferential current to the low back, traction to the low back, manual and drop piece adjustments. After the initial treatment, the patient reported feeling improvement for two to three hours before all of the symptoms returned, including feeling 'cold on the inside' of his now mostly flaccid right leg. The chiropractor saw the patient three more times that week, changing the diagnosis from mechanical back pain to 'a locked hip'. In the meantime, the initial chiropractor (JC) offered to contact the family doctor to arrange interprofessional collaboration, which was denied by the patient citing minor improvements in the leg pain. He would quickly deteriorate throughout that day and would be in severe pain throughout the shoulders, low back, and left leg. The numbness in the fingers had now spread proximally to include the hands. He also began to lose control of his bowels and experience overflow incontinence. By late May, after very regular care, the second chiropractor advised the patient to return to the MD as there was no improvement in his condition and new symptoms suggesting cauda equina syndrome. This was three weeks from the initial presentation at the chiropractor's office, and four weeks from the onset of symptoms. The timeline of the patient's presentation has been compiled in the table below from the patient's wife, his diary, and the medical reports from the hospital that treated him (Table 3).

The MD did a thorough neurological exam and wrote an urgent neurology referral allowing the patient to see a neurologist in late May. The subject had an MRI of the thoracic spine without contrast that found no bony anomalies, but found moderate degenerative changes (multilevel osteophytes causing foraminal stenosis) and an osteochondral bar mildly indenting the spinal cord assumed to be from the cervical fusion performed in 1997. Further, there was a high T2 signal in the thoracic spine at T5 and T6 suggestive of edema. From the neurologist notes, the patient had normal upper limb neurological testing. Lower limb testing revealed motor weakness (4/5 bilaterally), brisk hyperreflexia (3+ bilaterally), and an upgoing plantar response. The neurologist sent him for plain film imaging of the cervical and thoracic spine and a full spine MRI on the same day. Based on the subject's imaging and presentation, the neurologist notified the family to prepare for emergency surgery the next morning to remove the osteochondral bar and sent him to the emergency department for an MRI with gadolinium contrast and ce-

Table 3.
Timeline of the patient's presentation.

Month	Notable event	Outcome
April 2017	Original chiropractor (JC) initial assessment	Mechanical back pain.
May 2017	Email from spouse re: new onset symptoms	Advised to go to MD, who suggested it was viral. Went to a second chiropractor instead.
May 2017	Original chiropractor offered to notify MD of severity of symptoms	Patient denied, citing it was feeling better. Continued being seen by second chiropractor.
May 2017	Second chiropractor referred back to family MD	Full neurological assessment, urgent neurological referral.
May 2017	MRI without contrast	Degenerative changes, osteochondral bar, notable cord edema at T5-T6.
May 2017	Neurology consult	Plantar response upgoing bilaterally No clonus, no ataxia No bulbar or cranial deficits
May 2017	MRI with contrast Emergency neurology assessment	Two tiny enhancing foci in the T2 area on the anterior right lateral surface with decreased edema than May 29th, ruling out primary malignancy Upper extremity neurological exam normal Lower extremity: bilateral spasticity, no clonus, 3+ reflexes in lower limb (more prominent distally), 2- 3/5 strength in lower limb (left weaker than right) Plantar response upgoing bilaterally Good rectal tone and sensation Admitted for intravenous steroids (Solu-Medrol) while additional panels were being run (autoimmune, infectious, metabolic)
June 2017	Discharged	Notable improvement in sensation and motor function, not advised to continue medication at home and follow up with community neurologist.
June 2017		Began to notice symptoms develop over 2-3 hours while driving his tractor. Progressive weakness in leg over the next three days.
June 2017	Emergency neurology	Unable to ambulate Cranial nerves normal, cerebellar testing normal Unable to lift left leg off stretcher more than 10°, right leg could elevate to 45° Serological testing returned normal (CBC, electrolytes, BUN, creatinine, CRP, ESR, thyroid) Negative for lupus, ANA, ANCA, RF, infectious agent antibodies Cerebrospinal fluid was grossly normal Indication of progression of transverse myelitis Sent for contrast MRI of brain, cervical and thoracic spine
June 2017	Brain MRI without contrast Neurology	Non-specific white matter abnormalities in brain Considerable progression of the cervical cord lesion extending C2-C7 with significant cord edema throughout. No abscess or epidural collection. Thoracic spine remained stable with two high signal foci noted at T5 and T6. Left leg is plegic (1/5 motor), 3+ reflexes bilaterally, plantar response upgoing Upper limb strength is 3-4/5 bilaterally Bladder retention visualised, therefore a catheter was inserted Diagnosis of longitudinally extensive transverse myelitis rendered Patient re-started on steroids and intravenous immunoglobulin therapy.

rebrospinal fluid testing. The contrast MRI identified two tiny enhanced foci on the right anterior spinal cord, with reduced edema compared to the MRI performed the day prior. The differentials at this point were broad, including metabolic, infectious, and autoimmune-related TM, MS, sarcoidosis, and paraneoplastic disease. The imaging identified it the patient did not have a compressive lesion in the spine, therefore he did not receive surgery. Instead, he was put on high-dose intravenous corticosteroids to try to reduce the inflammation seen in his spinal cord. He responded well to the steroids and was discharged in early June to his community neurologist. Within three days his symptoms began to onset again after driving his tractor. He reported sensory disturbances, but denied incontinence or vision problems. He returned to the emergency department four days later, unable to walk. On evaluation, his left leg was plegic and both legs were spastic. He had begun to develop symptoms of upper motor weakness. Serological testing, cerebrospinal fluid testing, cerebellar testing and cranial nerve testing were all within normal limits. He was sent for a follow-up MRI and by the middle of June was diagnosed with longitudinally extensive transverse myelitis of idiopathic origin having ruled out neoplastic and auto-immune causes, and with no evidence of infectious agents. He was re-started on intravenous steroid therapy and started intravenous immunoglobulin (IVIG) therapy. Approximately one week after receiving his diagnosis, the clinical note indicates that despite the IVIG and steroid therapy, the patient's presentation was progressively declining. At this point, he was plegic bilaterally and developing bilateral arm weakness and sensory loss. He was reliant on a catheter. Due to his lack of response to high-dose steroids, a referral was made to begin a new treatment of plasmapheresis at St Michael's Hospital in Toronto. Three days later the patient was transferred. Another contrast-enhanced MRI study was performed as well as a lumbar puncture, of which the results are not available to us. He was started on an immunosuppressant, Imuran, while continuing with steroid injections through the intravenous route, discontinuing IVIG therapy. Shortly after the middle of July, the patient was transferred to a spinal cord rehabilitation hospital. His diagnosis changed to acute complete transverse myelitis.

The patient was permanently wheelchair bound. He was reliant on a catheter, but did not need respiratory assistance. Over the next two years, the patient experienced a number of complications including autonomic dysreflexia, pneumonia, osteomyelitis, bed sores, hypotension, urinary tract infections, dysphagia, and chronic pain. The family relied heavily on community support as he was no longer able to work as a farmer. He lost nearly 100lbs and developed contractures in his shoulders, hips, and knees. He was able to move his left arm minimally, and lost use of the rest of his body below the site of the lesion in the cervical spine. He developed disuse atrophy in his left arm. Due to the frequency and duration of hospital stays from the complications, he was unable to receive regular physical rehabilitative therapy, nor care of his chronic pain and musculoskeletal complaints. The subject passed away from a host of complications in October 2019.

Discussion

According to the National Multiple Sclerosis Society, in >50% of cases the cause of TM is unknown.[1] It is thought to be caused by either an autoimmune response, bacterial or viral infection, or an active demyelinating disease process.[1-3] The signs and symptoms can present variably, within hours or over three weeks, which can significantly vary the prognosis. The presentation is bimodal (10-20 years, 30-39 years), which does not include our 61-year-old patient. As highlighted by Wei *et al*.[15] in 2019, collaboration and communication among healthcare providers is essential in creating a synergy to provide efficient, safe, and high-quality patient care. While the patient's MD in this case did not appear to do an appropriate neurological exam initially, it is possible that the signs and symptoms were not developed enough to give the MD an indication of neurological involvement. The authors feel a neurological exam was pertinent for the chiropractor to perform given the new patient status, as well as the symptoms described. Ideally, if the chiropractor had been regularly monitoring this patient's neurological signs and symptoms, the concerning progression would have warranted prompt and urgent contact with his MD within the appropriate time frame (within three weeks) for aggressive steroid intervention. Further, if the chiropractor had notified the MD immediately, the MD may have identified that the symptoms were not resolving within the week as he had anticipated and called the patient in to his office to commence further evaluation. The five-week delay in referral to a neurologist prevented early assessment and diagnosis for this patient, likely worsening his progno-

sis. Having a prompt and complete evaluation of cases presenting as myelopathy ensures that idiopathic TM is differentiated from other possible diagnoses in a timely manner to allow appropriate treatment of spinal cord edema, possibly reducing symptom severity and disease progression.[9,11] It is unclear in this case how much of an impact the delayed diagnosis had on the patient's disease severity and outcome.

There is no cure for TM[1], and while there are some proposed approaches for the treatment of this condition, there are no clinical guidelines for its acute or long term management[1,11]. The current standard of treatment includes initially treating with corticosteroids and immunotherapy in the acute phase of TM, with the goal to stop the progression and help decrease the inflammation at the spinal cord lesions.[1,3,11,12] Intravenous corticosteroids are the first-line of treatment, despite no randomized controlled study to support its effectiveness, this approach is backed by clinical experience, and evidence from related disorders.[11,12] If there is minimal improvement with corticosteroid use after five to seven days, or the patient has moderate to severe TM, plasma exchange is often used.[13]

Many patients require long term interdisciplinary management to address the spectrum of associated concerns of living with TM including physical rehabilitation, mental health, support for activities of daily living, accessible work and living spaces, and more.[1,10] In this case, it appears that there was minimal collaboration between any of the health care professionals involved prior to hospitalization. In cases such as these when non-specific clinical findings indicate a CNS pathology, chiropractors have a specific and important role: to identify it and refer immediately. The authors believe the patient's outcome would have been improved if the chiropractor opened lines of communication early in this patient's management. All patients affected with TM have notable physical and psychological challenges that require a full team of allied healthcare providers to address. Evidence suggests that early and aggressive rehabilitation therapy improves patient outcomes, though 40% will have persistent morbidity.[10] Manual therapists, such as chiropractors, can help in the rehabilitation process by improving joint range of motion, and through the prescription of stretching and strengthening exercises to allow for independent completion of activities of daily living.[16]

If the diagnosis of TM is rendered early in onset, it is conceivable that early intervention would decrease the severity and extent of spinal cord inflammation. Chiropractors are portal-of-entry practitioners and are well-suited to screen for and appropriately refer patients who appear to have a neuropathological presentation.

Summary

This study aims to provide an update in the current state of evidence of TM, as well as the role of interprofessional collaboration in patient care. The presentation and prognosis of TM differs greatly, with some patients recovering with little to no problems, while others experience permanent impairments that have a large impact on their quality of life, and ability to perform their activities of daily living. Practitioners require increased awareness of the presentation of spinal cord myelopathies to decrease misdiagnosis and/or diagnostic delay. Health care providers are remiss if they do not perform a neurological examination with each new patient. An accurate and time efficient diagnosis is the key to providing appropriate treatment methods to help minimize long term deficits. While current therapies are largely non-specific, it is important to have an established circle of care for health professionals to communicate openly about patient evaluation and management.

References

1. National Institute for Neurological Disorders and Stroke. Transverse Myelitis Fact Sheet NIH Publication 17-4841[Internet]. 2019 Aug[Cited 2019 Oct 30]. Available from:www.ninds.nih.gov/disorders/patient-caregiver-education/fact-sheets/transverse-myelitisfact-sheet/
2. Beh SC, Greenberg BM, Frohman T, Frohman EM. Transverse myelitis. Neurol Clin. 2013; 31:79.
3. Krishnan C, Kaplin AI, Deshpande DM, Pardo CA, Kerr DA. Transverse myelitis: pathogenesis, diagnosis and treatment. Front Biosci. 2005;9(1483): 99.
4. Wingerchuk DM, Banwell B, Bennett JL, Cabre P, Carroll W, Chitnis T, De Seze J, Fujihara K, Greenberg B, Jacob A, Jarius S. International consensus diagnostic criteria for neuromyelitis optica spectrum disorders. Neurol. 2015; 85(2): 177-189.
5. Jacob A, Weinshenker BG. An approach to the diagnosis of acute transverse myelitis. Semin Neurol. 2008; 28(1): 105-120.
6. Zalewski NL, Flanagan EP, Keegan BM. Evaluation of idiopathic transverse myelitis revealing specific myelopathy diagnoses. Neurol. 2018. 90(2): e96-102

7. Rodríguez Y, Rojas M, Pacheco Y, Acosta-Ampudia Y, Ramírez-Santana C, Monsalve DM, Gershwin ME, Anaya JM. Guillain–Barré syndrome, transverse myelitis and infectious diseases. Cell Molec Immunol. 2018;15(6): 547-562.
8. Kaplin AI, Krishnan C, Deshpande DM, Pardo CA, Kerr DA. Diagnosis and management of acute myelopathies. Neurologist. 2005; 11: 2–18.
9. Transverse Myelitis Consortium Working Group. Proposed diagnostic criteria and nosology of acute transverse myelitis. Neurol. 2002; 59(4): 499-505.
10. Defresne P, Hollenberg H, Husson B, et al. Acute transverse myelitis in children: clinical course and prognostic factors. J Child Neurol. 2003; 18: 401.
11. Frohman EM, Wingerchuk DM. Transverse myelitis. N Engl J Med. 2010; 363(6): 564-572.
12. Scott TF, Frohman EM, De Seze J, Gronseth GS, Weinshenker BG. Evidence-based guideline: clinical evaluation and treatment of transverse myelitis: report of the Therapeutics and Technology Assessment Subcommittee of the American Academy of Neurology. Neurol. 2011; 77(24): 2128-2134.
13. Awad A, Stuve O. Idiopathic transverse myelitis and neuromyelitis optica: clinical profiles, pathophysiology and therapeutic choices. Curr Neuropharmacol. 2011; 9(3): 417-428.
14. Young J, Quinn S, Hurrell M, Taylor B. Clinically isolated acute transverse myelitis: prognostic features and incidence. Mult Scler. 2009; 15(11): 1295-1302.
15. Wei H, Corbett RW, Ray J, Wei TL. A culture of caring: the essence of healthcare interprofessional collaboration. J Interprof Care. 2019: 34(3): 324-331.
16. Sadowsky CL, Becker D, Bosques G, Dean JM, McDonald III JW, Recio A, Frohman EM. Rehabilitation in transverse myelitis. CONTINUUM: Lifelong Learning in Neurology. 2011; 17(4): 816-830.

ISSN 0008-3194 (p)/ISSN 1715-6181 (e)/2020/139–143/$2.00/©JCCA 2020

Presumptive spondylogenic pruritus: a case study

Leonard J. Faye, DC[1]
Brian S. Budgell, DC, PhD[2]

Objective: *To describe a case of a patient with chronic pruritus of the upper back and arms who underwent complete resolution of his complaint following a short course of chiropractic care.*

Case Presentation: *A 36-year-old male suffering with chronic, severe pruritus affecting the upper back and both arms, presented for chiropractic treatment after pharmacological treatment and dietary restrictions failed to resolve his complaint. Physical examination revealed restrictions of thoracic and cervical intervertebral motion. However, radiological examination did not identify any substantial pathology of the spine. Following a short course of chiropractic treatment, which included spinal manipulation and home exercises, his complaint of pruritus resolved completely.*

Summary: *In this case, a severe and chronic complaint of pruritus which was refractory to other forms of care resolved quickly after the institution of chiropractic care. It is therefore hypothesized that the patient's pruritus was etiologically linked to biomechanical problems of the spine.*

(JCCA. 2020;64(2):139-143)

KEY WORDS: case report, pruritus, notalgia paresthetica, chiropractic, spinal manipulation

Objectif : *Décrire le cas d'un patient présentant un prurit chronique à la partie supérieure du haut du dos et aux bras qui est complètement disparu après une courte période de traitements chiropratiques.*

Exposé du cas : *Un homme de 36 ans souffrant d'un prurit chronique grave à la partie supérieure du dos et aux deux bras s'est présenté à une clinique chiropratique après avoir suivi un traitement pharmacologique et un régime alimentaire qui se sont avérés infructueux. L'examen physique a révélé une limitation de la mobilité articulaire de la colonne dorsale et de la colonne cervicale. L'examen radiologique n'a révélé aucune pathologie grave de la colonne vertébrale. Après une brève période de séances chiropratiques par manipulations vertébrales et un programme d'exercices à domicile, le prurit est complètement disparu.*

Résumé : *Dans ce cas, un prurit grave et chronique, réfractaire à d'autres formes de traitement, est disparu rapidement après le commencement des traitements chiropratiques. On peut donc supposer que le prurit du patient était lié à des troubles biomécaniques de la colonne vertébrale.*

(JCCA. 2020;64(2):139-143)

MOTS CLÉS : compte rendu de cas, prurit, notalgie paresthésique, chiropratique, manipulation Vertébrale

[1] Private practice, Los Angeles, CA
[2] Canadian Memorial Chiropractic College, Toronto, ON

Corresponding Author: Leonard J. Faye, 10801 National Blvd Ste. 340, Los Angeles, CA 90064, USA
E-mail: LJFaye@gmail.com

The authors have no disclaimers, competing interests, or sources of support or funding to report in the preparation of this manuscript.
The involved patient provided consent for case publication.

Introduction

Pruritus is a troubling symptom of a variety of diseases, with the prevalence of atopic dermatitis alone estimated at 230 million cases worldwide.[1] Pruritus is a noxious, non-painful cutaneous sensation which, when initiated peripherally, is transmitted via a sub-class of primary afferent neurons with small diameter axons to the central nervous system, and provokes scratching behaviour. The peripheral pruriceptor uses gastrin releasing peptide (GRP) to signal secondary neurons in the superficial dorsal horn.[2] While itching motivates scratching as a programmed response, a number of innocuous physical (non-pharmacological) modalities have also shown at least transient effects against pruritus [3,4] and it has been hypothesized that some of these effects may be mediated via peripheral TRP (transient receptor potential) receptors[5]. Transmission in the dorsal horn is inhibited by GABA (gamma aminobutyric acid) and glycine released by primary nociceptors in response, for example, to scratching or heat stimulation[6,7], indicating that the response to and inhibition of itching can be modulated by the spinal cord.

Pruritus is a common and troubling complaint, which often defies effective management.[1] This report describes the case of a patient who had failed to find relief with conventional medical management, but experienced rapid relief of pruritus following initiation of chiropractic care. The authors hypothesize that the patient's pruritus was related etiologically to biomechanical dysfunction of the spine.

Concerning this hypothesis, 11 previously published case reports contained specific information on the site of pruritus and the site of the spinal segment or nerve root which was implicated. [3,8-16] All 11 case reports involved female patients across the age range from 19 months to 74 years. In fact, the specific syndrome of brachioradial pruritus has been noted to be more prevalent in Caucasians and in females.[17] The duration of pruritus in the studies cited above ranged from 6 months to 10 years. As expected with case reports, all patients experienced improvement or complete resolution of their complaint following treatment, including those patients who underwent surgical interventions.[13,16] With spinal traction or manipulation, improvement or resolution was achieved with up to 2.5 months of treatment. In seven of 11 cases, the pruritus was confined to the upper back, shoulder or arm, and in each of these cases there was a history of spinal complaints in the neck or upper back.[8,9,12,13,15,16,18] One case of perineal/perianal pruritus was associated with an L4-5 disc herniation.[11] One case affecting the upper and lower limbs, and one case involving the pelvis and thighs were both associated with dyskinesia of the thoracic spine and were treated with spinal manipulation.[10,14] In one case, there was not a clear topographical relationship between the site of pruritus (lower thoracic) and the known spinal lesion (prior cervical disc surgery).[3] Thus, it does appear that frank impingement of the spinal cord or spinal nerves may be associated, etiologically or otherwise, with pruritus. In the majority of cases reported herein, there was a clear topographical association between the site of pruritus and a known spinal lesion. Others have reported similar cases[19], including cases where the pruritus resolved after surgical removal of spinal tumors[20].

Case Presentation

A 36-year-old male presented to his chiropractor complaining of chronic, severe pruritus affecting the torso, specifically the upper back, and both arms between the shoulders and the wrists. He was a smoker of less than a pack a day and he drank no alcohol. He was of mesomorphic build at 5 foot 8 inches (1.73 m) and 160 pounds (72.6 kg). Initially, he experienced pruritus across his back, but after three years the complaint spread to his arms. He was unaware of any initiating event or aggravating factors. The itching on his arms was so severe that he scratched through the skin and produced bleeding sores. The itching also prevented him from sleeping well at night, although the intensity of nocturnal itching, and so sleep disturbance, were variable. He had consulted several general physicians who advised him that he was suffering from allergies, and variously prescribed an anti-histamine, sleeping pills and moisturizing cream. At different times, he was put on gluten-free, dairy-free, and hot pepper-free diets, along with a five-day fast and a rotation diet, none of which helped him scratch less or sleep better. Once he began scratching his arms, he could not stop even after he caused bleeding. He was aware that his spine was unusually stiff, but could not recall when or how he first became aware of this, and he thought his discomfort contributed to his poor sleep.

Clinical findings

His upper extremity deep tendon reflexes were normal and

Figure 1.
Patient exercise: with elbows flexed and arms abducted and extended at shoulders, from left to right the patient (i) protracts the head, (ii) retracts the head, (iii) extends the neck to look up at the ceiling.

there were no abnormal sensory findings. He was so stiff that anterior-posterior and lateral x-rays of the cervical, thoracic and lumbar spine were ordered to rule out possible pathologies, such as ankylosing spondylitis, before completion of his physical examination. He was referred to an imaging center and the radiologist reported the following: 1) minimal dextrocurvature of the mid-thoracic spine without significant degenerative changes, 2) mild narrowing of the L1-L2 disc space with no additional manifestation of degenerative disc findings present, 3) mild straightening of the normal cervical curve with minimal degenerative changes seen at C4-C5 and C5-C6 with minimal anterior disc calcification. Soft tissues were unremarkable.

Seated motion palpation, a form of physical examination routinely employed in chiropractic, revealed restriction from T5 to T7, and stressing into the restriction produced widespread diaphoresis. His cervical ranges of motion were reduced substantially in all planes.

Therapeutic interventions and outcome:

The patient was advised that his pruritus might be due to or facilitated by disturbed spinal mechanics and that a trial course of chiropractic management involving spinal manipulation should be undertaken. The patient was treated ten times at weekly intervals due to travel constraints. He received chiropractic high-velocity, low-amplitude (HVLA) manipulations in the upper cervical region in both posterior to anterior (contact over the dorsal aspect of the articular pillars) and anterior to posterior (contact over the scalene muscles and ventral aspect of the articular pillars) directions. The diaphoretic reaction occurred for the first few visits. The upper thoracic region was also manipulated to increase the anterior glide of the vertebral and costo-transverse joints at T7 and above. By the fifth visit, his cervical spine was moving normally in all directions, however his thoracic spine was still not extending and gliding forward normally. The chiropractor applied moist hydroculator heat for 15 minutes before upper thoracic manipulation. On the sixth visit the patient was prescribed stretching exercises. He was shown how to raise his elbows to 90 degrees laterally (shoulder abduction) and then move his arms into extension to encourage anterior glide of the thoracic vertebra. Holding this position, he then had to protract his neck, retract his neck and then look up to the ceiling (Figure 1). He was to do this once every hour.

By the seventh visit his arms were healed, with no open sores or bleeding, and he was sleeping well without medication. He was treated twice more to continue reducing the upper thoracic restrictions and then he was discharged.

Discussion

The attribution of dermatomally distributed pruritus to spinal cord or spinal nerve root impingement does not appear to be controversial when a frank pathology is evident. Is it possible, however, that spondylogenic pruritus

could be triggered by relatively trivial anatomical changes in the vertebral column or by purely biomechanical changes as seen in this case? The distinction between structural and functional (biomechanical) disorders of the spine is, to a degree, arbitrary as illustrated by lumbar stenosis. While the term stenosis conjures the image of compression of neural structures, perhaps by a herniated disc or bony abnormality, posture and spinal movement have substantial effects on symptomatology. Could it therefore also be that a latent neurogenic pruritus could be brought to clinical threshold by the sorts of biomechanical changes which chiropractors variously term subluxation, restriction or fixation? In this regard, Heyl (1983) presented a series of 14 cases of brachioradial pruritus in which topical anti-pruritics were ineffective.[21] Five of the patients received x-ray examination of the neck, and of these four showed evidence of degenerative disease. Three of these patients underwent physical treatments – cervical traction, spinal manipulation or physiotherapy of the neck with substantial improvement in symptoms. In a cohort of 41 patients with brachioradial pruritus, Marziniak *et al*. (2010) reported that 80.5% showed imaging evidence of stenosis of the intervertebral foramen or protrusions of the cervical disc, and that the locations of the anatomical lesions corresponded to the dermatomes affected by pruritus.[22] They concluded that brachioradial pruritus may be provoked by subtle nerve compression which need not be accompanied by neck pain. Tait *et al*. (1998) reported on 14 patients with brachioradial pruritus who underwent cervical spinal manipulation.[23] The six patients who reported previous complaints in the cervical spine all experienced resolution of their pruritus, as did four of the eight patients who did not have a prior history of cervical spinal pain or injury. Collectively, these studies suggested that biomechanical treatments of the spine have the potential to relieve neurogenic pruritus where gross anatomical abnormalities of the spine are absent.

This report describes a patient with severe and long-standing pruritus of the upper back and arms, who experienced complete relief of his complaint coincident with receiving chiropractic care. A small number of reports have previously linked resolution of chronic pruritus to spinal manipulative care. These include i) a case of a 37 year-old female who suffered with bilateral brachioradial pruritus for nine months, recovering after 2.5 months of care involving upper cervical spinal manipulation[18], ii) a 34 year-old female with a two year history of daily upper and lower limb itching relieved after four treatments incorporating spinal manipulation[14], and iii) a 59 year-old woman with chronic left scapular pruritus who experienced substantial relief of her symptoms following a single osteopathic manipulative treatment[9]. An advantage of spinal manipulative care is that serious adverse events are relatively uncommon[24,25] and compliance is immediately obvious to the clinician – the patient either does or does not attend their treatment session.

While it is not within the scope of this paper to defend a specific hypothetical mechanism at the molecular or cellular level, it has been suggested that neurogenic pruritus in general and notalgia paresthetica and brachioradial pruritus in particular, are in some cases caused by physical impingement of a peripheral nerve.[26] In this regard, readers will see a parallel in neuropathic pain, and recall that both pruritic and nociceptive sensation are transmitted by small diameter, unmyelinated axons. Hence, in broad strokes, the mechanism(s) of neuropathic pain in nociceptor axons may well be the mechanism(s) of neuropathic pruritus in pruritic axons.

Summary

While a single case report does not provide strong evidence of causality, in the present case and a number of other studies, the temporality of events is quite convincing.[9,14,18] In each case, a condition which was severe, chronic and refractory to other treatments resolved quickly when the novel treatment, spinal manipulation, was introduced. On the other hand, the small number of similar cases, and the lack of specificity – apparently many people with biomechanical problems of the spine do not complain of pruritus – argue against a cause-effect relationship between biomechanical problems of the spine and pruritus. Thus, in this case, we are left to wonder whether the patient's vertebral complaints led to pruritus, and whether spinal manipulation was the principal cause of relief. Notwithstanding the limited evidence in favour of a distinct entity of spondylogenic pruritus, practitioners may wish to consider the possibility when confronted with a pruritic patient with biomechanical problems of the spine and no other apparent etiology for their pruritus.

References:

1. Tsai TF, Rajagopalan M, Chu CY, et al. Burden of atopic dermatitis in Asia. J Dermatol. 2019;46(10): 825-834.
2. Sun YG, Chen ZF. A gastrin-releasing peptide receptor mediates the itch sensation in the spinal cord. Nature. 2007;448(9): 700-704.
3. Ricciardo B, Kumar S, O'Callaghan J, Boyce Z. Peripheral nerve field stimulation for pruritus relief in a patient with notalgia paraesthetica. Australas J Dermatol. 2010;51: 56-59.
4. Stellon A. Neurgenic pruritus: an unrecognized problem? A retrospective case series of treatment by acupuncture. Acupunct Med. 2016;20(4): 186-190.
5. Lucaciu OC, Connell GP. Itch sensation through transient receptor potential channels: a systematic review and relevance to manual therapy. J Manipulative Physiol Ther. 2013;36: 385-393.
6. Akiyama T, Carstens MI, Carstens E. Transmitters and pathways mediating inhibition of spinal itch-signaling neurons by scratching and other counterstimuli. PLoS One. 2011;6(7): e22665.
7. Chuquilin M, Alghalith Y, Fernandez KH. Neurocutaneous disease; cutaneous neuroanatomy and mechanisms of itch and pain. J Am Acad Dermatol. 2016;74:197-212.
8. Alai NN, Skinner HB, Nabili ST, Jeffes E, Shahrokni S, Saemi AM. Notalgia paresthetica associated with cervical spinal stenosis and cervicothoracic disk disease at C4 through C7. Cutis. 2010;85(2): 77-81.
9. Richardson BS, Way BV, Speece AJ. Osteopathic manipulative treatment in the management of notalgia paresthetica. J Am Osteopath Assoc. 2009;109(11): 605-608.
10. Eldred DC, Tuchin PJ. Treatment of acute atopic eczema by chiropractic care. Austral J Chiro Osteopath. 1999;8(3): 96-101.
11. LaBan MM, Weinerman Z. Urogenital pruritus in association with lumbar spinal stenosis. Am J Phys Med Rehab. 2015;94(2): e19.
12. Carvalho S, Alves R. Brachioradial pruritus in a patient with cervical disc herniation and Parsonage-Turner syndrome. As Bras Dermatol. 2015;90(3): 401-402.
13. Binder A, Folster-Holst R, Sahan G, et al. A case of neuropathic brachioradial pruritus caused by cervical disc herniation. Nature Clin Pract Neurol. 2008;4(6): 338-342.
14. Hochman J. Chiropractic intervention for pruritis: a case study. J Chiropr Educ. 2009;23(1):109.
15. Low R, Swanson LA, Swanson DL. Notalgia paresthetica relieved by cervical traction. J Am Board Fam Med. 2017;30: 835-837.
16. Soltani-Arabshahi R, Vanderhooft S, Hansen.D. Intractable localized pruritus as the sole manifestation of intramedullary tumor in a child. JAMA Dermatol. 2013;149(4): 446-449.
17. Pinto AC, Wachholz PA, Masuda PY, Martellli AC. Clinical, epidemiological and therapeutic profile of patients with brachioradial pruritus in a reference service in dermatology. An Bras Dermatol. 2016;91(4): 549-551.
18. Davis WR, Basillio RF. Resolution of brachioradial pruritus, vertigo and neck pain following introduction of upper cervical chiropractic care: a case study. J Upper Cerv Chiropr Res. 2011;April 18, 2011:22-24.
19. Grob JJ, Bonerandi JJ. Dermatomal pruritus of the upper limb: a manifestation of nerve root compression due to degenerative spine disease? J Dermatology. 1987;14: 512-513.
20. Wolking S, Lerche H, M. D. Episodic itch in a case of spinal glioma. BMC Neurol. 2013;13:124.
21. Heyl T. Brachioradial pruritus. Arch Dermatol. 1983;119: 115-116.
22. Marziniak M, Phan NQ, Raap U, et al. Brachioradial pruritus as a result of cervical spine pathology: the results of a magnetic resonance tomography study. J Am Acad Dermatol. 2011;65: 756-762.
23. Tait CP, Grigg E, Quirk CJ. Brachioradial pruritus and cervical spine manipulation. Austral J Dermatol. 1998;39: 168-170.
24. Paanalahti K, Holm Lw, Mordin M, Asker M, Lyander J, Skillgate E. Adverse events after manual therapy among patients seeking care for neck and/or back pain; a randomized controlled trial. BMC Musculoskelet Disord. 2014;15.
25. Paige NM, Miake-Lye IM, Booth MS, et al. Association of spinal manipulative therapy with clinical benefit and harm for acute low back pain: systematic review and meta-analysis. JAMA. 2017;317(14): 1451-1460.
26. Muir B. Dorsal scapular nerve neuropathy: a narrative review of the literature. J Can Chiropr Assoc. 2017;61(2): 128-144.

ISSN 0008-3194 (p)/ISSN 1715-6181 (e)/2020/144–154/$2.00/©JCCA 2020

Routine screening for developmental dysplasia of the hip by chiropractors: a case report of late diagnosis in an infant

Christian J. Fludder, BChiroSc, MChiro[1]
Braden G. Keil, BAppSc, MChiroSc(Paeds)[1]

Background: *Developmental Dysplasia of the Hip (DDH) is a common musculoskeletal condition of infancy, but diagnosis can be delayed. In parts of Australia, after the four-month routine assessment, there is a 16-week interval before the next well-child assessment. This may result in a delay in diagnosing late developing DDH.*

Case Presentation: *This case report describes the diagnosis and management of an 18-week old infant with late-onset DDH who was successfully managed with simultaneous Pavlik harnessing with Denis Browne Bar.*

Summary: *This case underscores the importance of routine ongoing hip joint screening, inter-professional collaboration of all health care practitioners, and the importance of appropriate training of all practitioners seeing infants, to reduce instances of undetected*

Contexte : *La dysplasie développementale de la hanche (DDH) est une affection musculosquelettique courante chez les enfants en bas âge. Il arrive que le diagnostic de cette maladie soit tardif. Dans certaines régions de l'Australie, après l'examen de routine à l'âge demquatre mois, 16 semaines s'écoulent avant le prochain examen de l'enfant bien portant. Par conséquent, le diagnostic d'une DDH à évolution tardive risque d'être retardé.*

Exposé du cas : *Ce compte rendu présente le cas d'un nourrisson de 18 semaines présentant d'une DDH à évolution tardive, qui a été traitée avec succès par le port du harnais de Pavlik et de l'attelle de Denis-Browne.*

Résumé : *Ce cas souligne l'importance d'un dépistage systématique et continu de la dysplasie de la hanche, de la collaboration entre tous les praticiens de santé et d'une formation appropriée pour tous les praticiens traitant des nourrissons et ce, pour réduire le nombre de cas de DDH non détectés, réduire le fardeau pour*

[1] Private practice, Victoria, Australia

Corresponding author:
Christian Fludder, 9 Lower Plenty Road, Rosanna, VIC, Australia, 3084
E-mail: christianfludder@gmail.com
Tel: 061 40 081 4388

The authors have no disclaimers, competing interests, or sources of support or funding to report in the preparation of this manuscript.
The involved patient's guardian provided consent for case publication.

DDH, reduce medical burden, and prevent otherwise unnecessary surgical intervention.

(JCCA. 2020;64(2):144-154)

KEY WORDS: chiropractic, screening, developmental dysplasia

les services médicaux et prévenir une intervention chirurgicale autrement inutile.

(JCCA. 2020;64(2):144-154)

MOTS CLÉS : chiropratique, dépistage, dysplasie développementale

Introduction

Developmental dysplasia of the hip (DDH) is one of the most common musculoskeletal conditions of infancy[1,2], and can range in severity from instability that may spontaneously resolve to dislocation requiring surgical intervention. DDH may present with varying degrees of acetabular dysplasia.[3–5] A South Australian centre reported an incidence of seven per 1000 live births.[6] Of concern is the incidence of late-detection, defined as DDH diagnosed at older than 12 weeks of age, which has increased from 0.22 per 1000 live births in 1988-2003 to 0.7 per 1000 in 2003-2009.[7,8] One cause is suggested to be swaddling practices aimed at reducing unsettled behaviour.[7]

In the presence of abnormal examination findings on hip screening or surveillance, infants should be referred to their General Medical Practitioner (GP) or paediatrician for further evaluation or imaging.[9,10] The purpose of this case report is to chronicle the diagnosis and management of an 18 week of age infant with late-diagnosed DDH. This case report was prepared following CARE guidelines.[11]

Case Presentation

Patient history

An infant presented at a chiropractic clinic for assessment and management of breastfeeding difficulty involving bilateral arching off the breast, and general fussiness at four weeks of age. She was a first-born female. Oligohydramnios, a condition of reduced amniotic fluid, was diagnosed at 41 weeks prompting an emergency caesarean section at 41 weeks gestation after 36 hours of labour. She was not in breech position. Her parents were not aware of a family history of DDH at time of birth, but subsequently informed their GP of a family history of DDH after it was diagnosed. Birth weight was above average at 3.91kg, length was 49.5cm, head circumference 35cm, and both 1- and 5-minute Apgar scores were nine.

Physical examination

On initial examination, at four weeks of age, there was a leftward head rotation positional preference (torticollis). Passive range of motion assessment revealed restriction in normal cervical spine range of motion. Age appropriate tone was present on Ventral and Vertical suspension tests, as well as age appropriate Galants and Perez primitive reflex responses. Muscle stretch reflexes (C6, C7, L4 and S1 nerve roots) were symmetrical, age appropriate, and brisk. Cranial examination revealed normal appearing sutures with no evidence of synostosis, the premature closure of one or more cranial sutures, or head asymmetry. Extremity examination was unremarkable. Hip joint assessment incorporating supine straight leg length, Allis, Thomas, Barlow, Ortolani, Telescoping and Abduction tests was unremarkable (Appendix 1).

Management

A course of treatment to correct the upper cervical spine joint dysfunction was commenced. The upper cervical spine joints were treated with age-modified spinal manipulative therapy. As a part of periodic surveillance, the treating chiropractor performed hip joint screening (Allis, Ortolani, Thomas, Telescoping and Abduction tests) at four, six, and eight weeks of age, yielding no abnormality. Beyond 12 weeks of age, hip screening was altered to exclude Ortolani test, but Allis, Thomas, Telescoping and Abduction tests were all continued to be used. Hip joint assessment by her MCHN occurred at birth, two, four, and eight weeks of age, and 16 weeks of age, and by her GP at six weeks of age with no abnormality found. Hip joint screening by the treating chiropractor at 18 weeks of age found decreased left hip abduction of greater than 20

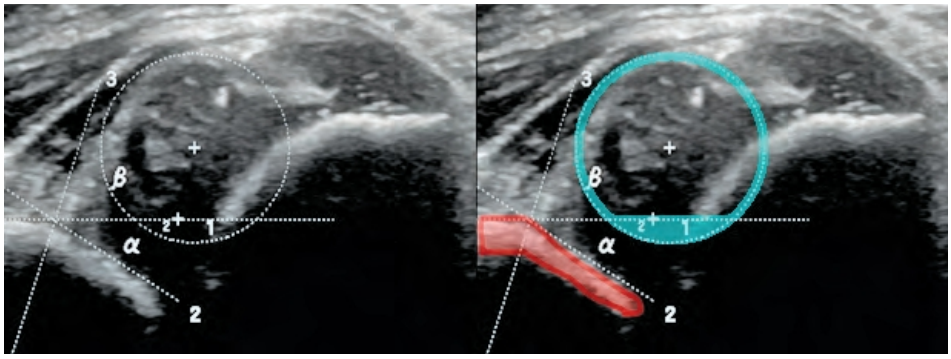

Figure 1A.
Initial ultrasound performed at 18 weeks of age (left hip - dysplastic). Red area indicates iliac bone, blue indicates femoral head. Blue shaded region indicates bony coverage (12%).

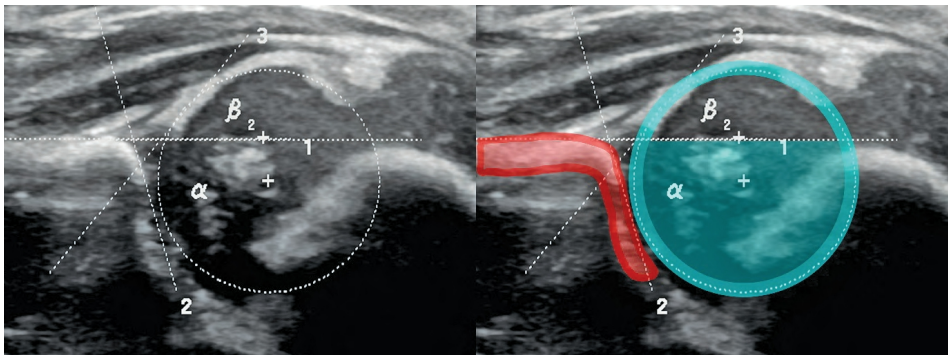

Figure 1B.
Initial ultrasound performed at 18 weeks of age (right hip - normal). Red area indicates iliac bone, blue indicates femoral head. Blue shaded region indicates bony coverage (69%).

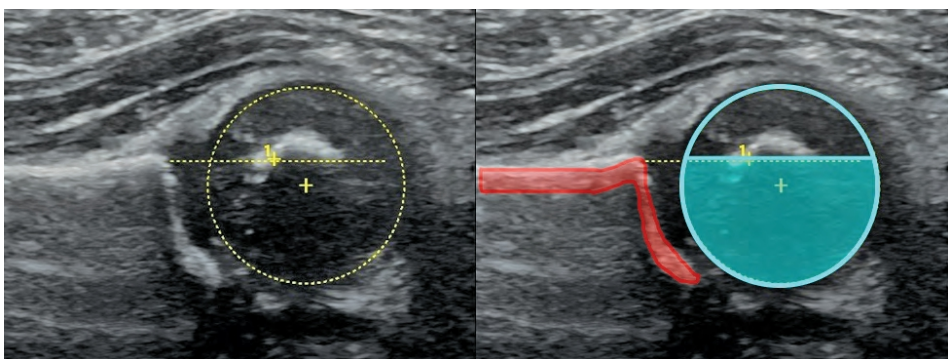

Figure 2.
Repeat left hip ultrasound performed eight weeks post-diagnosis. Red area indicates iliac bone, blue indicates femoral head. Blue shaded region indicates bony coverage (67%).

degrees difference with an accompanying "unusual sensation", along with a shortened appearance of the left leg and positive Galeazzi sign on Allis test on the left leg. The findings of asymmetry greater than 20 degrees on hip abduction test, a shortened appearance of the leg on leg length testing, and a positive Galeazzi sign suggest the diagnosis of DDH.[12,13] Standard procedure upon identification of potential DDH is referral to a GP for further evaluation, but as this patient had a pre-existing appointment with a paediatrician for reflux within two days, the paediatrician was notified of the concerns. The paediatrician referred for hip joint ultrasound.

Imaging and treatment

Ultrasonography performed at 18 weeks of age revealed marked left hip dysplasia with the left hip markedly subluxated; bony coverage was 12%, alpha angle was 33° and the beta angle 72° (Figure 1A). The right hip, in comparison, was considered normal with a bony coverage of 69%, alpha angle of 74° and beta angle of 50° (Figure 1B). Prompt management involving simultaneous Pavlik harnessing with Denis Browne Bar for 24 hours per day for six weeks was initiated after consulting with a paediatric orthopaedic specialist (Appendix 2). This was followed by 22 hours per day of bracing for an additional eight

Table 1.
Risk factors and patient history factors associated with DDH

Common history factors associated with DDH[12]	Risk Factors for Late Developing DDH[18,21]
• Breech Presentation • First-Degree Relative treated for DDH • Breech presentation in utero, born by vertex delivery • Any family history of hip dysplasia • Oligohydramnios • Female gender • First-born baby girl • Birth weight greater than 4000g • Multiple births or pregnancies of mother • Born by Caesarean section	• Rural birth • Female gender • Infants discharged from hospital in under four days • History of swaddling

weeks. Repeat ultrasound eight weeks post-diagnosis demonstrated persistent irregularity of the left acetabulum but improved femoral head coverage and stability under stress testing suggesting a reduction in subluxation. Bony coverage had improved to 67%, alpha angle 61° and the beta angle 36° (Figure 2). An ultrasound performed 11 weeks post-diagnosis indicated that the left hip showed restoration of acetabular morphology to within normal limits with good femoral head coverage.

Discussion

This case report details an 18-week old infant with late diagnosed DDH. The patient presented with five of the 10 history risk factors for DDH listed by Roposch[12], in addition to the risk factor of torticollis[14,15]. Breech position, female gender, and a positive family history are well defined risk factors associated with DDH.[5,9,16] Roposch discussed whether infants should undergo more thorough or frequent hip screening based on history items suggestive of increased risk of DDH (Table 1).[12] However, there can be a variation in risk factors for both late-diagnosis DDH[17] and gender.[18,19] In the presence of risk factors for DDH, more regular screening is recommended to reduce the risk of missed or late diagnosis[9,18] even though most cases of DDH will occur in infants without risk factors present[20]. Enhanced screening or surveillance was indicated in this case.[6]

In Australia, it is recommended that General Medical Practitioners (GP) and Maternal and Child Health Nurses (MCHN) screen for DDH by performing Ortolani, Barlow, Abduction and Allis tests (Appendix A), as well as observing for leg length and thigh crease asymmetry.[22–25] This follows guidelines established by the American Academy of Orthopaedic Surgeons.[9,26] Studer discussed that even with the current screening and surveillance that occurs in South Australia, there has been an increase in the incidence of late onset DDH.[8] Regular screening is important as early management of DDH involves bracing and non-surgical intervention compared to potential surgical intervention for those older than six months of age.[6]

A review by Schaeffer and Mulpuri[27] highlighted the shortcomings of routine screening using ultrasound and x-ray imaging for developmental dysplasia of the hip. By delaying screening until after 28 days of age, the number of visits required to diagnose DDH was reduced[28], without increasing the late diagnosis of DDH or the need for surgery[29]. One of the main shortcomings with screening prior to 28 days of age is that normal ligamentous laxity may be present in infant hips until six weeks after birth[30], and this may present with false positive findings[31].

Clinical hip examination by the infants' GP and MCHN remains the primary screening method to identify infants with possible DDH who require further investigation.[3,12,32,33] Current routine screening in Victoria, Australia, occurs at two, four, and eight weeks of age, as well as four and eight months of age, and involves assessing for thigh crease asymmetry as well as performing Ortolani, Barlow, Abduction and Allis/Galeazzi tests (Appendix A).[25] The 16 week interval between assessments from four to eight months of age is a concern as late onset DDH identification is likely to be delayed.

Routine clinical screening utilises several hip ortho-

Table 2.
Comparison of Ortolani and Barlow with Hip Abduction test. Legend: PPV= Positive predictive value; NPV = Negative predictive value

	Testing	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
Jimenez[41]	Ortolani/Barlow	9.2-51.2	80.7-87.8	1.9-13.2	95.1-98.5
Padilla-Raygoza[42]	Ortolani	22.73	98.51	71.43	88.59
	Barlow	13.64	98.51	60	87.42
Jari[34]	Abduction (Unilateral)	23-42	99.1-99.9	Not listed	Not listed
Choudry[37]	Abduction (Unilateral)	14.4	99.3	40	97.3
Custovic[39]	Abduction	Not listed	Not listed	40.3	80.4

paedic tests which are listed in Appendix 1. Recent literature has questioned the sensitivity and specificity of these tests when used as individual hip tests, stressing the importance of compound findings incorporating multiple tests to reduce false negatives (Table 2).[34–39] As a single test, hip Abduction has high specificity and negative predictive value (Table 2) for unilateral DDH, making it ideal for screening in infants over eight weeks of age.[3,12,34,37,39,40]

In a 2009 study by Duni and Ruci, the reliability of Ortolani, Barlow and Abduction tests were retrospectively analysed.[43] Ortolani and Barlow testing were more sensitive when performed by an orthopaedic surgeon compared to other healthcare specialists, but Abduction testing was not statistically significantly different between the two groups. This suggests that adequate training and education in Abduction test interpretation may be an appropriate and effective surveillance test for other primary healthcare practitioners to adopt. Ortolani and Barlow may become less accurate as testing can become difficult for the untrained practitioner after two to three months of age due to muscular development and soft tissue contracture in the infant.[3] In contrast, unilateral limited hip abduction is an important clinical sign due to its high specificity for DDH, especially after three months of age.[3,34]

An observational study by Talbot *et al*. reported that 58% of all irreducible hip dislocations diagnosed and treated are detected after three months of age, despite the established hip screening and surveillance programs.[17] There are two proposed aetiologies for the development of late DDH; improper positioning of the hips, such as incorrect swaddling practice, promoting persistent lateral hip subluxation or dislocation[7,18], or false negative findings from testing performed prior to proper joint cavity development, resulting in undetected DDH that progresses[44].

In Australia, the developmental nature of DDH is well recognised, prompting recommendations of regular assessment until six to nine months of age,[5] and the use of multiple tests at each consultation to reduce the likelihood of false negative findings. Currently, with infant health appointments in Victoria, Australia, occurring at four and eight months of age[25] there is concern that the large time gap between appointments at four and eight months of age for surveillance of DDH may result in increased delayed diagnoses and increased need for surgical intervention. In Victoria there is a noticeable drop-off in attendance from the four month of age assessment (93.8%) to 84.3% at eight month of age assessment.[45] Data for New South Wales was limited; the most recent data available stating only 49.6% of infants up to 11 months of age attended an early child health centre on one or more occasions.[46] This indicates 50.4% of infants do not attend at all. Data regarding other states of Australia was unable to be obtained in a timely manner.

If the case presented in this report had been assessed as per government recommendation, it is unlikely that the hip pathology would have been detected prior to eight months of age, resulting in an increased likelihood of surgical intervention and increased medical costs.

This case presentation demonstrates the importance of all health care practitioners involved in the care of infants being adequately trained to assess infant hip joints. Infants attending primary health care practitioners, such as chiropractors, physiotherapists, and osteopaths, should undergo additional hip assessment between recommended MCHN and GP-based appointments. Williams (2018) discussed this point, raising a suggestion of regular GP surveillance to reduce the incidence of late-stage DDH diagnosis.[6] Expanding this surveillance net to incorporate all health practitioners would reduce the risk of delayed diagnosis further.

In addition to improved outcomes for the infant, early detection improves cost effectiveness while reducing medical burden.[28,39] Detection of DDH after three months of age was associated with a seven-fold increase in short-term costs when compared to those detected prior to three months of age.[47]

The typical management for hip dysplasia in infants under six months of age is sustained hip positioning of flexion and abduction in a Pavlik harness with a success rate of up to 99%.[48] After six months of age, the risk of permanent change to the shape of the acetabulum and the likelihood of non-improvement requiring surgical intervention increases.[5,17,47] Surgical intervention after failed closed reduction typically involves femoral or pelvic osteotomy.[48] The outcomes of surgical intervention have varied; Terjesen found that when open reduction for children with a late diagnosis of DDH was performed, fewer secondary procedures were required and by skeletal maturity, the hips had a better radiographic appearance[49], whereas Pollet determined that one in five children post-surgery had a poor radiological outcome, with one in five children experiencing pain or limitations of normal daily activities[50]. This suggests that early detection and management is associated with improved long-term outcomes. Surgery may be considered low-risk, but there are risks associated with surgical intervention that may be avoidable.[50–52]

The case presented in this report had several risk factors for DDH and had a normal screen at four months of age. The case was seen at a paediatric only chiropractic clinic where the policy reflects recommendations that all infants seen undergo hip joint screening at least every four weeks over the first 12 months of life when attending for other issues.[53] Screening frequency may be increased in cases identified as being at increased risk of DDH. Increased surveillance in this case prompted hip joint screening at 18 weeks of age allowing early detection of late onset DDH and prompt referral for appropriate management. Following normal recommendations relating to hip joint screening would have most likely delayed diagnosis until eight months of age, an age when surgical intervention is likely. The treatment provided in the form of bracing resulted in bony coverage after an eight-week period sufficient to avoid surgical intervention. Further research investigating the impact of chiropractic co-management in cases of DDH may be beneficial.

We acknowledge that this is a single case report, and therefore is not representative of all individuals with late-diagnosed DDH. A review of Pubmed, ChiroIndex, EBSCOhost, Embase and Scopus databases was unable to find case reports or case series detailing chiropractic clinical assessment, diagnosis, or management of DDH. This case report demonstrates the importance of regular hip assessment or screening by all primary health care practitioners to reduce the risk of delayed diagnosis, while highlighting the importance of adequate training and education in infant hip joint assessment.

Summary

This case report details the detection and successful management of an 18-week of age infant with DDH. Current recommended hip screening at four months of age and not again until eight months of age may be inadvertently creating a risk of late-developing DDH being delayed in diagnosis. Utilising primary health care practitioners adequately trained in paediatric hip assessment to provide additional screening may help to reduce instances of undetected DDH, reduce medical burden, and prevent otherwise unnecessary surgical intervention. This case underscores the necessity of appropriate training, education, and collaboration for all healthcare providers involved in the care of infants.

References

1. Gibson C, Scott H, Rice R, Scheil W. Birth Defects in South Australia 2013. SA Birth Defects Register, Women's and Children's Health Network. Adelaide, SA. 2017.
2. Swarup I, Penny CL, Dodwell ER. Developmental dysplasia of the hip: an update on diagnosis and management from birth to 6 months. Curr Opin Pediatr. 2018; 30: 84-92.

3. Sewell MD, Eastwood DM. Screening and treatment in developmental dysplasia of the hip-where do we go from here? Int Orthop. 2011; 35: 1359-1367.
4. Noordin S, Umer M, Hafeez K, Nawaz H. Developmental dysplasia of the hip. Orthop Rev (Pavia). 2010; 2: 73-78.
5. Shaw BA, Segal LS. Evaluation and referral for developmental dysplasia of the hip in infants. Pediatrics. 2016; 138: e1-e11.
6. Williams N. Improving early detection of developmental dysplasia of the hip through general practitioner assessment and surveillance. Aust J Gen Pract. 2018; 47: 615-619.
7. Williams N, Foster BK, Cundy PJ. Is swaddling damaging our babies' hips? Med J Aust. 2012; 197: 272.
8. Studer K, Williams N, Antoniou G, et al. Increase in late diagnosed developmental dysplasia of the hip in South Australia: risk factors, proposed solutions. Med J Aust. 2016; 204: 240.e1-240.e6.
9. American Academy of Orthopaedic Surgeons. Detection and nonoperative management of pediatric developmental dysplasia of the hip in infants up to six months of age: evidence-based clinical practice guideline. Rosemont, IL. 2014.
10. Jackson JC, Runge MM, Nye NS. Common questions about developmental dysplasia of the hip. Am Fam Physician. 2014; 90: 843-850.
11. Riley DS, Barber MS, Kienle GS, et al. CARE guidelines for case reports: explanation and elaboration document. J Clin Epidemiol. 2017; 89: 218-235.
12. Roposch A, Liu LQ, Hefti F, Clarke NMP, Wedge JH. Standardized diagnostic criteria for developmental dysplasia of the hip in early infancy. Clin Orthop Relat Res. 2011; 469: 3451-3461.
13. Terjesen T. Ultrasound as the primary imaging method in the diagnosis of hip dysplasia in children aged < 2 years. J Pediatr Orthop B. 1996; 5: 123-128.
14. Talmage MS, Nielson AN, Heflin JA, D'Astous JL, Fedorak GT. Prevalence of hip dysplasia and associated conditions in children treated for idiopathic early-onset scoliosis-don't just look at the spine. J Pediatr Orthop. 2020; 40: e49-e52.
15. Kural B, Devecioğlu Karapınar E, Yılmazbaş P, Eren T, Gökçay G. Risk factor assessment and a ten-year experience of DDH screening in a well-child population. Biomed Res Int. 2019; 2019: 1-6.
16. Ortiz-Neira CL, Paolucci EO, Donnon T. A meta-analysis of common risk factors associated with the diagnosis of developmental dysplasia of the hip in newborns. Eur J Radiol. 2012; 81: 344-351.
17. Talbot C, Adam J, Paton R. Late presentation of developmental dysplasia of the hip. Bone Jt J. 2017; 99-B: 1250-1255.
18. Mulpuri K, Schaeffer EK, Andrade J, et al. What risk factors and characteristics are associated with late-presenting dislocations of the hip in infants? Clin Orthop Relat Res. 2016; 474: 1131-1137.
19. Onay T, Gumustas SA, Cagirmaz T, Aydemir AN, Orak MM. Do the risk factors for developmental dysplasia of the hip differ according to gender? A look from another perspective. J Paediatr Child Health. 2019; 55: 168-174.
20. Schwend RM, Schoenecker P, Richards BS, Flynn JM, Vitale M. Screening the newborn for developmental dysplasia of the hip: now what do we do? J Pediatr Orthop. 2007; 27: 607-610.
21. Sharpe P, Mulpuri K, Chan A, Cundy PJ. Differences in risk factors between early and late diagnosed developmental dysplasia of the hip. Arch Dis Child Fetal Neonatal Ed. 2006; 91: F158-62.
22. Queensland Clinical Guidelines. Maternity and Neonatal Clinical Guideline: Routine Newborn Assessment. Queensland; 2014. www.health.qld.gov.au/qcg. Accessed June 11, 2019.
23. Royal Prince Alfred Hospital. Newborn Care Guidelines: Developmental Dysplasia of the Hip. Camperdown, NSW; 2004. https://www.slhd.nsw.gov.au/rpa/neonatal/html/docs/DDHips.pdf. Accessed June 11, 2019.
24. NSW Government. Screening, Assessment and Management of Developmental Dysplasia of the Hip. Clinical Practice Guideline, Resource Manual. Sydney; 2011. http://www.nchn.org.au/docs/Man-DDH.pdf. Accessed June 11, 2019.
25. Safer Care Victoria, Victorian Agency for Health Information. Developmental dysplasia of the hip in neonates | Better Safer Care. https://bettersafercare.vic.gov.au/resources/clinical-guidance/maternity-and-newborn-clinical-network/developmental-dysplasia-of-the-hip-in-neonates#goto-screening. Published 2018. Accessed June 11, 2019.
26. Homer CJ, Baltz RD, Hickson GB, et al. Clinical practice guideline: early detection of developmental dysplasia of the hip. Pediatrics. 2000; 105: 896-905.
27. Schaeffer EK, Mulpuri K. Developmental dysplasia of the hip: Addressing evidence gaps with a multicentre prospective international study. Med J Aust. 2018; 208: 359-364.
28. Lussier EC, Sun YT, Chen HW, Chang TY, Chang CH. Ultrasound screening for developmental dysplasia of the hip after 4 weeks increases exam accuracy and decreases follow-up visits. Pediatr Neonatol. 2019; 60: 270-277.
29. Shorter D, Hong T, Osborn DA. Screening programmes for developmental dysplasia of the hip in newborn infants. Cochrane Database Syst Rev. 2011:11-54.
30. Burnett M, Rawlings EL, Reddan T. An audit of referral time frames for ultrasound screening of developmental hip dysplasia in neonates with a normal antenatal clinical examination. Sonography. 2018; 5: 61-66.
31. Arti H, Mehdinasab SA, Arti S. Comparing results of clinical versus ultrasonographic examination in

developmental dysplasia of hip. J Res Med Sci. 2013; 18: 1051-1055.
32. Patel H. Preventive health care, 2001 update: screening and management of developmental dysplasia of the hip in newborns. Can Med Assoc J. 2001; 164: 1669-1677.
33. Sulaiman A, Yusof Z, Munajat I, Lee N, Nik Z. Developmental dysplasia of hip screening using Ortolani and Barlow testing on breech delivered neonates. Malaysian Orthop J. 2012; 5: 13-16.
34. Jari S, Paton RW, Srinivasan MS. Unilateral limitation of abduction of the hip. A valuable clinical sign for DDH? J Bone Joint Surg Br. 2002; 84: 104-107.
35. Şenaran H, Özdemir HM, Ögün TC, Kapicioglu MIS. Value of limited hip abduction in developmental dysplasia of the hip. Pediatr Int. 2004; 46: 456-458.
36. Stein-Zamir C, Volovik I, Rishpon S, Sabi R. Developmental dysplasia of the hip: risk markers, clinical screening and outcome. Pediatr Int. 2008; 50: 341-345.
37. Choudry Q, Goyal R, Paton RW. Is limitation of hip abduction a useful clinical sign in the diagnosis of developmental dysplasia of the hip? Arch Dis Child. 2013; 98: 862-866.
38. Paton RW. Screening in developmental dysplasia of the hip (DDH). Surgeon. 2017; 15: 290-296.
39. Čustović S, Šadić S, Vujadinović A, et al. The predictive value of the clinical sign of limited hip abduction for developmental dysplasia of the hip (DDH). Med Glas. 2018; 15: 174-178.
40. Roposch A, Liu LQ, Protopapa E. Variations in the use of diagnostic criteria for developmental dysplasia of the hip. Clin Orthop Relat Res. 2013; 471: 1946-1954.
41. Jiménez C, Delgado-Rodríguez M, López-Moratalla M, Sillero M, Gálvez-Vargas R. Validity and diagnostic bias in the clinical screening for congenital dysplasia of the hip. Acta Orthop Belg. 1994; 60: 315-321.
42. Padilla-Raygoza N, Medina-Alvarez D, Ruiz-Paloalto ML, Cordova-Fraga T, Sosa-Aquino MA, Perez-Olivas AH. Diagnosis of developmental dysplasia of the hip using sound transmission in neonates. Health (Irvine Calif). 2014; 6: 2510-2516.
43. Duni A, Ruci V. Reliability of clinical tests in developmental dysplasia of the hip. Bull Intl Sci Surg Assoc. 2009; 4: 2-3.
44. Lee MC, Eberson CP. Growth and development of the child's hip. Orthop Clin North Am. 2006; 37: 119-132.
45. Victoria State Government. Maternal & Child Health Services Annual Report 2016-2017. Victoria; 2018.
46. Centre for Epidemiology and Evidence. 2009-2010 Summary Report from the New South Wales Child Health Survey. NSW Ministry of Health; 2012.
47. Woodacre T, Dhadwal A, Ball T, Edwards C, Cox PJA. The costs of late detection of developmental dysplasia of the hip. J Child Orthop. 2014; 8: 325-332.
48. Gulati V, Eseonu K, Sayani J, et al. Developmental dysplasia of the hip in the newborn: a systematic review. World J Orthop. 2013; 4: 32-41.
49. Terjesen T, Horn J. Have changes in treatment of late-detected developmental dysplasia of the hip during the last decades led to better radiographic outcome? Clin Orthop Relat Res. 2016; 474: 1189-1198.
50. Pollet V, Van Dijk L, Reijman M, Castelein RMC, Sakkers RJB. Long-term outcomes following the medial approach for open reduction of the hip in children with developmental dysplasia. Bone Joint J. 2018; 100B: 822-827.
51. Morbi AHM, Carsi B, Gorianinov V, Clarke NMP. Adverse outcomes in infantile bilateral developmental dysplasia of the hip. J Pediatr Orthop. 2015; 35: 490-495.
52. Schneuer FJ, Bentley JP, Davidson AJ, et al. The impact of general anesthesia on child development and school performance: a population-based study. Paediatr Anaesth. 2018; 28: 528-536.
53. Australian College of Chiropractic Paediatrics. Policy on infant hip screening. https://accp.asn.au/policy-on-infant-hip-screening. Accessed January 20, 2020.

Appendix 1.

Figure 3.
Supine straight leg length (image used with guardian permission). Leg length is assessed with the infant supine and with both hips and knees extended. In the presence of a dislocated hip, there will be an apparent shortening of the affected leg observable at the line formed when comparing medial malleolus position.

Figure 4.
Allis test (image used with guardian permission). The Allis test is performed supine with infant's feet placed together on the examining table with the hips and knees flexed. In the presence of a dislocated hip, there will be relative and apparent shortening of the affected femur, producing the Galeazzi sign.

Figure 5.
Thomas test (image used with guardian permission). The Thomas test involves full flexion of one hip to rest on the infant's chest, with the other leg straightened as much as comfortably possible. Due to in utero contractures, a degree of residual flexion would be observed in infants under 6 weeks of age; however, this flexion contracture should not be present after 6 weeks of age. In the presence of hip pathology, expected flexion contractures would be absent in infants younger than six weeks of age, and a flexion contracture will develop in infants older than six weeks of age.

Figure 6.
Barlow manoeuvre (image used with guardian permission). As the Barlow manoeuvre has no proven predictive value for future hip dislocation, and could create instability if performed incorrectly, it is not recommended to be performed as a part of routine screening assessment. The AAP recommends that if the Barlow test is performed that it be done by gently adducting the hip while palpating for the positive indication of pathology with the femoral head shifting out the back of the acetabulum. It is important that no posteriorly directed force be applied.

Figure 7. *Ortolani test (image used with guardian permission). The Ortolani test is a manoeuvre to reduce a recently dislocated hip. In performing this test, the thigh is flexed and abducted, and the femoral head is lifted anteriorly into the acetabulum. In the presence of a dislocated hip, relocation will be felt as a "clunk," not an audible "click".*

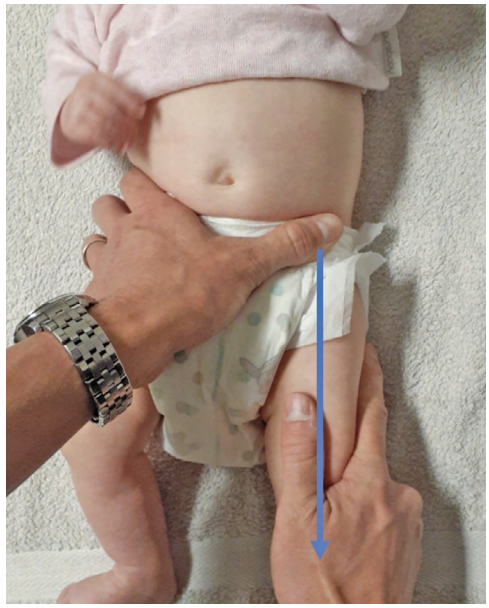

Figure 8. *Telescoping test (image used with guardian permission). The Telescoping test involves applying a traction force on the supine infant's leg, contacting above the knee joint. In the presence of hip instability or dislocation, there would be increased passive motion detected on the affected side.*

Figure 9A.
Hip abduction test, initial position (image used with guardian permission).

Figure 9B.
Hip abduction test; full abduction on left hip (image used with guardian permission).

The hip Abduction test is performed with the infant supine, with hip and knee flexed to 90° (Figure 9A). In the presence of hip pathology, unilateral limitation of hip abduction is defined as a hip that shows less than 60° abduction when at 90° flexion or an asymmetry in abduction of greater than 20°.

Appendix 2.

Figure 10.
Pavlik harnessing with Denis Browne Bar.

Fracture of an os peroneum

Michelle E. Fabbro, BSc, DC[1]
Andrew R. Bigness, BSc(Hon), DC[2]
John A. Taylor, DC, DACBR[3]

Os peroneum is an accessory ossicle located within the peroneus longus tendon, present in 26% of the population. Fractures of the os peroneum present as pain localized on the lateral aspect of the foot resulting from direct trauma, muscle contraction, inversion injuries or chronic overuse injuries. We document a case of a fractured os peroneum that resulted in the insidious onset of ongoing pain that was managed conservatively.

(JCCA. 2020;64(2):155-157)

KEY WORDS: chiropractic, os peroneum, fracture

L'os péronier est un os sésamoïde du tendon du muscle long péronier latéral observé chez 26% de la population. La fracture de l'os péronier se manifeste par une douleur localisée à la face latérale du pied à la suite d'un traumatisme direct, d'une contraction musculaire, d'une blessure d'inversion ou d'une blessure de surutilisation. Nous documentons un cas de fracture de l'os péronier ayant causé l'apparition insidieuse d'une douleur continue soignée par un traitement conservateur.

(JCCA. 2020;64(2):155-157)

MOTS CLÉS : chiropratique, os péronier, fracture

Case Presentation

A 59-year-old female factory worker presented with insidious onset of left lateral foot pain, swelling and tenderness of four months duration. The pain was aggravated by weight bearing, walking and tight footwear and was relieved significantly by rest. Her occupation typically involved standing on her feet all day for an eight-hour shift. She was also taking bio-identical hormone replacement therapy (progesterone and estradiol) and reported no bone mineral density issues. Previous foot trauma resulted in a fracture of the distal 5th metatarsal many years ago.

Visual inspection revealed significant swelling involving the left lateral foot between the cuboid and lateral malleolus. On examination, swelling and point tenderness

[1] Private practice, Sault Ste. Marie, ON
[2] Private practice, Windsor, ON, Rapid Access Clinic for Low Back Pain, St. Michael's Hospital, Toronto
[3] Chiropractic department, D'Youville College, Buffalo, NY

Corresponding author:
John A. Taylor
4354 Kathaleen Street, Hamburg, NY, USA 14075
E-mail: jtaylordacbr@icloud.com
Tel: (716) 548-6343

The authors have no disclaimers, competing interests, or sources of support or funding to report in the preparation of this manuscript.
The involved patient provided consent for case publication.

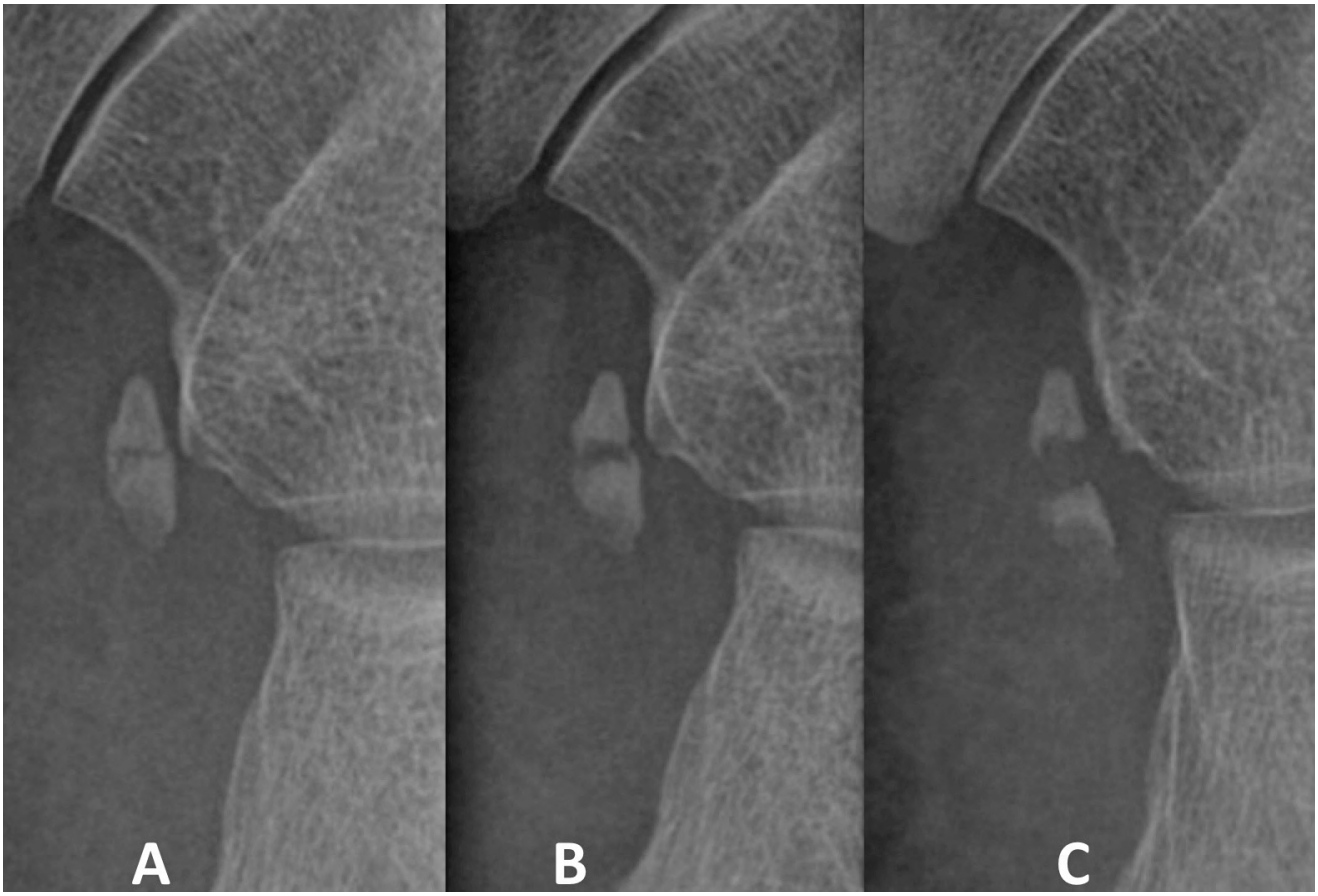

Figure 1.
The initial medial oblique radiograph (A) shows a transverse fracture through the os peroneum. A second radiograph (B) obtained three months later shows sclerosis of the fragments and resorption at the fracture site. A third radiograph (C) obtained at five months, demonstrates retraction of the fracture fragments that raises the suspicion of avulsion or partial or complete rupture of the peroneus longus tendon.

were elicited near the base of the 4th and 5th metatarsals, cuboid, anterior talofibular ligament and peroneus tendons. Palpation of these structures provoked severe, local pain, and a tuning fork applied to the site of the os peroneum elicited a "jump sign".

Routine radiographs of the foot ordered by the chiropractor revealed an irregular transverse fracture in an os peroneum with no displacement (Figure 1A). Follow-up radiographs obtained three months later revealed sclerosis of both bone fragments and minimal resorption at the fracture site (Figure 1B).

The patient was referred by the chiropractor to an orthopedic surgeon who placed her on short-term disability for five weeks and immobilized the foot in a soft sleeve-style brace for one week. The patient experienced relief with rest and application of ice for a five-week duration. Upon return to work her symptoms worsened again and she was prescribed a walking boot by the orthopaedic surgeon, which was discontinued after four days as the air splint exacerbated the pain. Five months after initial onset, the orthopaedic surgeon prescribed a soft compression sleeve for her foot and recommended a return to work with modification to limit weight bearing. After a further two months of work modification, her symptoms worsened. Another set of radiographs (Figure 1C) ordered by the orthopaedic surgeon revealed further distraction of

the fracture fragments, a finding suggestive of rupture of the peroneus longus tendon as well as non-union of the fracture. Magnetic resonance (MR) imaging was performed but the images were inconclusive regarding rupture of the peroneus longus tendon.

Finally, after 12 months the pain subsided, and the patient resumed normal everyday activities. However, since then, she has experienced ongoing, recurrent, intermittent pain at the same site which she self-manages by modifying activity and footwear.

Discussion

The normal variant, os peroneum is a painless accessory ossicle located within the peroneus longus tendon, present in 26% of the population, 40% of which are unilateral and 30% of which are bipartite.[1] Fractures of the os peroneum present as pain localized on the lateral aspect of the foot overlying the cuboid region.[2] Palpation of the ossicle may increase the pain.[1] Direct trauma, strong muscle contraction, inversion injuries[3,4] or chronic overuse injuries[5] are the typical mechanisms of injury. Such fractures may be associated with tearing of the peroneus longus tendon.[2]

The os peroneum is usually detected on routine radiographs and the internal oblique projection of the foot shows the os peroneum to best advantage.[2] Other diagnostic imaging techniques (Table 1) including computed tomography (CT), ultrasonography (US) and magnetic resonance (MR) imaging are also useful in the evaluation of normal os peronea as well as bipartite and fractured os peronea.[1]

In this patient, the initial os peroneum fracture may have resulted from chronic repetitive trauma. The course of recovery may have been delayed because of partial rupture of the peroneus longus tendons, uncertain owing to the inconclusive MR images.

Table 1.
Imaging modalities used in the evaluation of os peroneum fracture and key imaging features.[1]

Imaging modality	Key Imaging Findings
Radiography	Presence of the accessory ossicle adjacent to the cuboid bone just proximal to the fifth metatarsal styloid seen best on internal oblique foot images. Major differential diagnoses are bipartite os peroneum and fractures of the cuboid or fifth metatarsal bone
Computed tomography	Used to examine the os peroneum for irregular margins and cortical discontinuity suggestive of fracture and displacement.
Ultrasonography	Used to evaluate soft tissues and tendinopathy as well as to compare the anatomy bilaterally.
MR imaging	Used to perform soft tissue evaluation including edema, and tendon rupture.

Key Messages

- Os peroneum is present in 26% of the population
- May be unilateral (40%) or bilateral
- May be bipartite (30%)
- Fracture may be associated with rupture of the peroneus longus tendon
- Fracture is underdiagnosed

References

1. Chagas-Neto, FA, Souza, BN, Nogueira-Barbosa, MH. Painful os peroneum syndrome: underdiagnosed condition in the lateral midfoot pain. Case Reports Radiol. 2016; 1-4.
2. Bianchi, S, Bortolotto, C, Draghi, F. Os peroneum imaging: normal appearance and pathological findings. Insights Imaging. 2017; 8(1): 59-68.
3. Smith, JT, Johnson, AH, Heckman, JD. Nonoperative treatment of an os peroneum fracture in a high-level athlete: case report. Clin Orthopaed Rel Res. 2011; 469(5): 1498-1501.
4. Lee A, Taylor JA, Sherwood WH. Acute fracture and diastasis of the bipartite os peroneum: a case report. Topics Diagnost Imaging. 2007: 4-7.
5. Favinger, JL, Richardson, ML, Chew, FS. Progressive retraction of a fractured os peroneum suggesting repetitive injury to the peroneus longus tendon. Radiol Case Reports. 2018; 13(1): 216-219.