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Effects of CranioSacral therapy upon symptoms of post-acute concussion and Post-Concussion Syndrome: A pilot study

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ABSTRACT

Objective: The purpose of this study was to investigate the utilization of CranioSacral Therapy (CST) in patients with Post-Concussion Syndrome (PCS) and capture patient-reported perceptions of clinical outcomes of lived treatment experiences.
Design: Two-part, longitudinal study conducted through a chart review of target group, followed by a Patient-reported Treatment Outcome Survey (PTOS).
Participants: A convenience sample of 212 patients with a historical incidence of head trauma not requiring hospitalization was obtained through medical records department dating back ten years. Inclusion criteria for further chart review (n = 67) was determined by identifying patients with a confirmed concussion directly correlated with presenting symptoms and for which CST was specifically sought as a treatment option. Demographics and patient-determined treatment duration data were analyzed by comparison groups extensively suggested in existing literature: Recovery time since injury as either Post-acute concussion (<6 months) or Post-Concussion Syndrome (PCS) (≥6 months); Athletes (A) or Non-athletes (NA); and traditional gender. Final PTOS group criteria was determined by eliminating confounding issues reporting (n = 47): (A, n = 24 and NA, n = 23).
Results: Quantitative data was analyzed via Numerical Analysis, and qualitative data was analyzed via Inductive Content Analysis. Symptoms reported in all charts as well as in the PTOS were consistent with identified PCS subtypes. Utilization of CST revealed that most patients determined the treatment effect upon concussion symptoms within 1–3 sessions. Nearly twice as many sessions were attended in the PCS than post-acute groups. Referral sources, studied for a perspective on local concussion after-care discharge planning, ranged from professional to personal recommendation or self-discovery. A majority of patients met goals of reducing post-acute or PCS as reasons cited by self-determined change-in-status or discharge from service. Patients were asked to indicate on the PTOS which pre- and post-treatment symptoms were helped or not helped by this particular intervention.
Conclusions: Patient-reported changes of PCS symptoms is critical when evaluating treatment options. CST is an experiential treatment that addresses subjective levels of dysfunction, thus it is the patient deciding the value of an intervention. A sizable portion of patients in all groups reported a positive effect upon their symptoms by CST. Patients indicated personal meaning to CST through their utilization of multiple sessions. A high percentage indicated the likelihood of referring others with PCS for CST. Of the 212 patient charts first studied, the 145 not meeting inclusion criteria suggest some chronic conditions may present as long-term effects of older head injuries. CST is a low-risk, conservative treatment option for PCS sub-types worthy of further clinical study.

1. Introduction

Awareness of concussion effects has prompted rigorous clinical management endeavors and established policies for patients sustaining mild head injuries (Harmon et al., 2019; McCrory et al., 2017; Ellis et al., 2016b). From dramatic injuries of soldiers and

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professional athletes, to mundane events like car accidents and incidental head blows, patients seeking medical treatment for various levels of head trauma causing a concussion has a conservative estimated incidence of 1.6–3.8 million annually in the United States (Theeler et al., 2012; Gaw and Zonfrillo 2016; Laker 2011; Daneshvar et al., 2011). Most patients are assumed to recover from concussions in one to three months through the normal process of rest (Williams et al., 2015). Persistent symptoms beyond somewhat ambiguous healing allowance (ranging from days to months) are referred to as Post-Concussion Syndrome (PCS) (Phillips and Reddy 2016; Kamins and Giza 2016). Several studies of PCS demonstrated symptoms becoming chronic and lasting months or even years in a percentage of people (Hiploylee et al., 2017; Dikmen et al., 2017; Kenzie et al., 2017; Tator et al., 2016; Ahman et al., 2013; Laker 2011).

Subtypes of PCS have been identified primarily by patient-response to various treatment management endeavors, and include: physiological, migraine-headaches, vestibular-ocular, cervicogenic and/or psychiatric-psychological components (Maruta et al., 2018; Scheiman et al., 2017; Iverson et al., 2015; Kristjansson and Treleaven 2009). Physiological subtype is often mediated by cerebrovascular and heart rate alterations and biomarkers related to autonomic nervous system imbalances (Ellis et al., 2016a; Mutch et al., 2016; Meier et al. 2015a; Bartnik-Olson et al. 2014; Maugans et al., 2012; King et al., 1997). Clinically, physiological PCS contributes to chronic headaches, dizziness, fatigue, or heightened sensitivity exacerbated by physical activity (Kenzie et al., 2017; Ellis et al., 2016a; Harmon et al., 2019; Bartnik-Olson et al. 2014). Headache is the most common concussion symptom in acute, post-acute, and PCS stages (Eisenberg et al., 2014; Seifert 2013).

Cervicogenic subtype of PCS is akin to whiplash presentation where soft tissue inflammation and spine communicating to vestibular and oculomotor systems are altered (Garcia et al., 2016; Marshall et al., 2015; Stecco et al., 2013; Alvarez et al., 2012; Alsalaheen et al., 2010; Passatore and Roatta 2006). Neuropsychological subtype has aspects of mood instability, cognitive cognition, sleep disruption, and/or symptoms of Post-traumatic Stress Disorder (Dikmen et al., 2017; Lundblad 2017; Kontos et al., 2016; Chrisman and Richardson, 2014; Covassin et al., 2014; Grubenhoff et al., 2014; McCrea et al., 2013; Seifert 2013).

1.1. Measurement of PCS

Patient-reported symptom scales are vital in the management of PCS and have demonstrated sensitivity in capturing acute and long-term effects (Maruta et al., 2018; McCrory et al., 2017; McLeod and Leach 2012; Randolph et al., 2009; Alla et al., 2009). Several derivative core scales exist that share a broad range of symptom items. (Table 1). Though they lack in scientific scrutiny, these checklists help contribute to both concussion detection and return to play/work decisions, as well as patient-reported symptom tracking (Alla et al., 2009). The Post-Concussion Symptom Checklist (PCSC) is one example of a symptom tracking tool that tracks 20 key features (Lovell et al., 2006; Sawchyn et al., 2000).

Adequate literature suggests that differences exist in the reporting of severity of symptoms between genders, that athletes and soldiers may report differently than the average mild head injury patient, and younger patients may be more unreliable in differentiating between symptoms (Williams et al., 2015; Iverson et al., 2015; Berz et al., 2013; Theeler et al., 2012; Laker 2011). For example, the concussed athlete may require unique symptom tracking in cases where motivation in under-reporting pain level exists and where a tendency to minimize the full scope of concussion impact has been documented (Harmon et al., 2019; Meier et al., 2015b; Kerr et al., 2014).

1.2. Treatment for PCS

The focus for treatment following a concussion is to find ways to effectively manage the patient's unique symptom constellation. Rest until symptoms abate remains the primary treatment for concussion, regardless of etiology (Gagnon and Ptito 2017; Leddy et al., 2016; Thomas et al., 2015). However, studies conducted to investigate concussion recovery have found rest alone may not be as beneficial as once thought. (Willer et al., 2019; DiFazio et al., 2016; Silverberg and Iverson 2013). Research on adult recovery from concussion indicates sex-specific symptoms and recovery rates (Berz et al., 2013). In one study, female athletes with concussions reported experiencing an increase of symptoms with prolonged rest (Willer et al., 2019). Both physical and behavioral medicine have proposed conceptual models of treating subtypes of PCS (Lundblad, 2017; Makdissi et al., 2017; Garcia et al., 2016; Kreber & Griesbach, 2016; Jull et al., 2002; Leddy et al., 2016; Marshall et al., 2015; Schneider et al., 2014). There is an absence of definitive outcomes-based data on all treatments for PCS, requiring the reliance on integrating evidence with clinical experience and patient values (Harmon et al., 2019).

In clinical application, CranioSacral Therapy (CST), a specific whole-body method of treating connective tissues with osseous attachments to enhance exchange of fluids has been shown to have effect upon a number of chronic conditions similar or identical to the PCS subtypes (Breman and Kratz, 2020; Chaitow, 2005; Davis, 2009; Upledger and Vredevoogd, 1983). The body of data is limited to observational designs and low to moderate quality of randomized controlled methods (Teale 2013; Jäkel and Von Hauenschild 2012; Ernst 2012). Nonetheless, CST is emerging as an alternate treatment option for traumatic brain injuries and PCS (Wedel and Murrey, 2017; Leskowitz 2016).

In a recent single-blinded case series, eleven retired professional football players received combined CranioSacral Therapy mixed with other manual therapies resulting in statistically positive effects upon pain intensity, range of motion, memory, cognition, and sleep (Wetzler et al., 2017). Another pilot study investigated the clinical effects of CST on ten active duty military participants with traumatic head injury and post-traumatic stress disorder.

Table 1
Variety of symptoms included in various self-reporting checklists of PCS.

Common symptom characteristics of Post-Concussion Symptom Tracking Scales			
Physiologic	Cognitive	Psycho-emotional	Neurologic
Headaches	Clarity of thought	Atypical emotionality	Vision alternations
Nausea/vomiting	Decreased response time	Sadness	Hypersensitive to light
Sleep disturbances	Concentration	Irritability; nervous	Hypersensitive to noise
Fatigue	Memory	Helplessness; hopelessness	Balance problems
Pain other than head			Vertigo; dizziness

Participants reported significant reduction in headache intensity, anxiety, and pain interference with daily life. (Davis et al., 2016). A case study concluded that the implementation of CST in the inpatient treatment of postoperative meningioma and brain injury had positive effects upon head pain and vertigo (Haller et al., 2015).

Anxiety and stress can exacerbate symptoms of PCS and vice versa (Kontos et al., 2016; Covassin et al., 2014). CST was demonstrated to have a favorable effect on autonomic nervous system activity, a standard hallmark of anxiety and stress (Girsberger et al., 2014). A retrospective outcome study at a health center in the UK suggested that positive effects were experienced for patients with headaches and migraine, neck and back pain, anxiety and depression (Harrison and Page 2011). Other studies and reported cases have shown CST to have positive effect in the treatment of cervicogenic headaches, migraines, and trigeminal neuralgia (Seffinger and Tang 2017; Rao and Khatri 2017; Kratz 2016; Facó et al., 2016). A sham study design was demonstrated as a control for non-specific treatment effects in future CST clinical trials (Haller et al., 2014).

1.3. Purpose

The purpose of this two-part pilot study was to investigate the effects of CranioSacral Therapy (CST) upon symptoms of Post-Concussion Syndrome (PCS) through routine documentation as well as through self-reporting of perceived benefits in the lived experiences of patients.

2. Method

This chart review gathered a convenience sample from an outpatient clinic population of reported head injuries from ten years of medical records (Vassar and Matthew 2013). The initial chart retrieval identified 212 patients who sought CST for various pains or quality of life issues where a history of concussion was reported, either purposefully or incidentally. Inclusion criteria for the first study group were patients with formally-diagnosed concussion for which the patient had specifically sought CST to treat known symptoms ($n = 67$) of PCS. The chart review explored trends in patient demographics, etiologic activities related to the head injury, documentation of presenting symptoms, rest allowance since injury, and utilization of CST.

Comparison groups were created to explore for inherent differences in motivation and perception in reporting symptoms the final chart group ($n = 67$). The first two were separated by activity cause of concussion: Athletic Group ($n = 33$) and Non-athletic Group ($n = 34$). Both groups were further divided by traditional gender to explore differences such as perception of persistence of symptoms. Age was a factor in the PTOS inclusion group where only subjects over the age of 14 were considered reliable in their symptom reporting. Controlling the variable of natural healing through rest, a further subdivision of each group was determined by the time since injury: (Post-acute stages < 6 months and PCS stage ≥ 6 months). (See Tables 2 and 3).

Referral sources were studied to gain perspective on trends in local concussion after-care discharge planning (Zasler et al., 2013). (See Table 4).

Following completion of the chart review, patients were recruited to complete an anonymous [post-treatment] Patient-reported Treatment Outcome Survey (PTOS). Exclusion criteria were determined by those with confounding or co-occurring issues (See Table 5). The final PTOS group of patients ($n = 47$) were invited to complete an electronic survey. The A Group ($n = 24$) and NA Group ($n = 23$) was maintained for the survey to compare symptom reporting differences. Personal contact offering an invitation to participate in a research survey was made by a relatively neutral party (clinic manager) through texts or email. The survey confirmed complete anonymity and provided informed consent explaining that the purpose of the survey was to study the effects of CST on symptoms of concussions. Patients were notified that participation was voluntary and termination could happen at any time.

The Post-Concussion Symptom Checklist (PCSC) was chosen for the survey as it allows individuals a rating scale of frequency, intensity, and duration of 20 key features associated with PCS (Lovell et al., 2006; Sawchyn et al., 2000). The PCSC was utilized as reference in forming survey questions for respondents to recall what symptoms (presented as a checklist) were present prior to treatment and what, if any, were helped or not helped by CST. (See Table 7). The number of CST sessions attended and the number of treatments needed to discern an effect by the patient were sought, as well as the value participants placed on CST by a willingness to recommend CST to other people with PCS. Patient anonymity, as well as group assignment to only Groups A and NA, was maintained from data collection from through final analysis. PTOS recruitment happened monthly attempting to reach a response rate of 50%+. The study was to conclude when response target was met or after three months elapsed.

2.1. Treatment provided

CranioSacral Therapy (Upledger-CST) was the recommended treatment for all the study group patients, and was the preferred treatment sought by the patients arriving in the clinic. 95% of sessions were 60 min in length with shorter session length for young clients and a small percentage where the patient requested 90 min sessions. The average frequency of scheduling was weekly appointments. Therapists providing CST included two occupational therapists and one physical therapist. Clinical backgrounds combined seventy years of rehabilitation experience and each provided CST within competency levels (ranging 12–18 years practicing CST). All achieved certification in CST techniques, and one earned a CST Diplomat level. These monitored standards were obtained through clinical trainings from Upledger Institute International (Upledger Institute International, 2015). Therapist assignment was not factored in the final analysis.

2.2. Measurements and analysis of data

Quantitative data from chart review was captured, stored, and analyzed through the use of excel spreadsheets. Information included: cause of head injury, age and gender, date since injury, utilization of services by the number of CST sessions billed, and symptom tracking. Quantitative data from answers to PTOS questions, as well as symptom checklist recordings, were transferred from the online survey source. Quantitative data was analyzed via Numerical Analysis, and qualitative data from the PTOS was analyzed via Inductive Content Analysis. The data was analyzed manually and independently by both authors.

3. Results

3.1. Retrospective chart review data analysis

Final chart group members ($n = 67$) had confirmation of a medically diagnosed concussion(s) prior to seeking CST treatment. None had required hospitalization, and only two patients indicated a temporary loss-of-consciousness following their concussive head injury. All patients presented in clinic with either post-acute or persistent PCS symptoms directly correlating to the diagnosed concussion, and most had been able to return to a semblance of their pre-injury activities.

Table 2
Patients from medical records: Sustaining concussions in athletic activity (A) (n = 33).

Sports related to Athlete Group participants' Concussions					
Volleyball/Basketball	13	Football	4	Watersports	2
Soccer/Rugby	8	Hockey	2	Multiple sports	4
Athlete: Gender & Age		**Average Time Post-Injury** $\overline{\overline{X}}$		**Utilization – session average** Participation range 1–10+ sessions	
Female Age range: 3–31 yrs $\overline{\overline{X}}$ = 20.5 yrs					
A - Females	n = 9	<6 months $\overline{\overline{X}}$ = 1.69 months		$\overline{\overline{X}}$ = 2.9 CST sessions	
A - Females	n = 9	≥6 months *range 6 mth-30 yrs		$\overline{\overline{X}}$ = 4.2 CST sessions	
Male Age range: 14–30 yrs $\overline{\overline{X}}$ = 17.9 yrs					
A - Males	n = 4	<6 months $\overline{\overline{X}}$ = 1.83 months		$\overline{\overline{X}}$ = 2.8 CST sessions	
A - Males	n = 11	≥6 months *range 6 mth-12 yrs		$\overline{\overline{X}}$ = 5.8 CST sessions	

Table 2: Age when injury occurred, Sports the Athletes sustained concussion; Recovery time allowance, and Utilization of CST treatment (average number of sessions). *Wide range of post injury time span, average not calculated.

Table 3
Patients from medical records: Sustaining concussions in non-athletic activity (NA) (n = 34).

Activities related to concussions in Non-athlete participants					
Fell/struck head		13		Motor Vehicle Accident	10
Head struck object		10		Chose not to disclose	1
Athlete: Gender		**Average Time Post-Injury**		**Utilization – session average**	
Female Age range: 3–31 yrs $\overline{\overline{X}}$ = 36.5 yrs		**< or ≥ than 6 months**		Participation range 1–10+ sessions	
NA - Females	n = 10	<6 months $\overline{\overline{X}}$ = 1.5 months		$\overline{\overline{X}}$ = 5.00 CST sessions	
NA - Females	n = 19	≥6 months $\overline{\overline{X}}$ = 19.1 months		$\overline{\overline{X}}$ = 5.89 CST sessions	
Male Age range: 14–30 yrs $\overline{\overline{X}}$ = 35 yrs					
NA - Males	n = 3	<6 months $\overline{\overline{X}}$ = 1.83 months		$\overline{\overline{X}}$ = 3.0 CST sessions	
NA - Males	n = 2	≥6 months $\overline{\overline{X}}$ = 12.0 months		$\overline{\overline{X}}$ = 6.0 CST sessions	

Table 3: Age and activities the Non-athletes sustained concussion; Recovery time allowance, and Utilization of CST treatment (average number of sessions attended).

Table 4
Referral sources reflecting concussion after-care plans/actions.

Referral sources guiding patients to CranioSacral Therapy		
Athletic group (n = 33)	Referral sources	Non-athletic group (n-34)
11	Family member	8
7	Family friend	9
7	Sports teammate	0
3	Psychologist/Physician	3
2	Therapist from different clinic	3
3	Self (knowledge or researched)	12

Table 4: Variety of referral sources to this specific clinic for CST services for the patient population of having a known concussion.

Table 5
Exclusion criteria for Patient-reported Treatment Outcome Survey (20 charts excluded).

Exclusion Criteria: Patient-reported Treatment Outcome Survey (PTOS)
• 5 - removed 2° to youth and historian unreliability (≤14 years @ concussion)
• 3 - opted out of treatment without explanation
• 6 - removed due to diagnosed complications of confounding injuries or symptoms: (subarachnoid hemorrhage, subdural hematoma, Chiari formation, alcoholism, active Lyme disease)
• 2 - transfer of care to specialized chiropractic 2° to atlas malalignment
• 4 - removed due to litigation (for motor vehicle accidents).

The A Group represented fairly equal by gender (18 females to 15 males). Age range for A- Males was 14–30 years ($\overline{X}$ = 17.9 years) and A-Females was 3–31 years ($\overline{X}$ = 20.5 years). Four in A Group (n = 33) were collegiate athletes and the remaining were students in state sanctioned, club, or recreational sports. Thirteen reported sustaining multiple concussions. The NA Group (n = 34), sustained

Table 6
Reasons for discharge or change in status.

A (n = 33)	Reasons for Discharge/Change in Status	NA (n = 34)
15	Goals Achieved – patient-reported positive outcomes	9
0	Positive response but schedule/travel conflicts	4
10	Goals Achieved - Moved to health maintenance status or Follow-up as needed	12
2	Referred to other professional; kept maintenance status	2
3	Referred to other professional – discharge	4
3	No reason given from patient – self discharge	3

Table 6: Trends in discharge and change-in-status from CST treatments for PCS.

concussions in motor vehicle accidents, being struck by a blunt object, or falling. Two participants were athletes injured in a non-athletic injury who may have aligned with athletic perspective, but this was not controlled for. Gender ratio of the NA group was less equitable (29 females to 5 males). Age range for the NA-Males was 17–53 years ($\overline{X}$ = 35.0 years) and NA- Females was 6–63 years ($\overline{X}$ = 36.5 years). (See Tables 2 and 3).

Average natural recovery times in the post-acute (<6 months) athletic group revealed half the A-Females and a quarter of the A-Males were less than 2 months from injury ($\overline{\overline{X}}$ = 1.69 months for Females and $\overline{\overline{X}}$ = 1.83 months for Males). Post-acute non-athletes had similar recovery time allowance ($\overline{\overline{X}}$ = 1.5 months for NA-Females and $\overline{\overline{X}}$ = 1.82 months for NA-Males). (See Tables 2 and 3).

Natural recovery times in the PCS groups (≥6 months) revealed a far greater range of months to years of persistent symptoms. In the Athletic group, A-Females ranged 6 months–30 years, and A-Males ranged 6 months to 12 years from injury onset, thus an average was meaningless. The PCS recovery time allowance for the NA-group was able to be averaged (NA-Females $\overline{\overline{X}}$ = 19.1 months and NA-Males $\overline{\overline{X}}$ = 12.0 months). (See Tables 2 and 3).

Chart-documented symptoms were consistent with subtypes of post-concussion. Headache was the most frequently reported, seconded by sensory hypersensitivities and cognitive alterations. Women tended to report more symptoms than men in all groups. Treating therapists tracked symptoms through the usual patient reflection on which symptom(s) existed or persisted, though formalized symptom tracking tools were not consistently used between all charts. The use of descriptive or numeric pain-intensity scale and quality of life summation was found routinely in documentation. In addition, there was no consistency of documenting if any other therapies were trialed before or during their CST experiences. The data of symptoms tracking were not useable due to lack of uniformity or standardization. No valuable data was available for comparable treatments, other than for the usual recommendation of time allowance for healing through prolonged rest. Instead, trends were studied for patient-directed utilization of

Table 7
Patient-reported Symptoms and perceptions of treatment effect by CST reflected on PTOS.

Symptom identification based on Post-Concussion Symptom Checklist and Patient-reported Outcomes to Treatment						
A-Group n = 24 (17 responses)				NA-Group n = 23 (12 responses)		
Prior to Tx	Helped	Not helped	Persistent Concussion Symptom	Prior to Tx	Helped	Not helped
.94	.94	.00	Headache	.82	.90	.00
.68	.44	.22	Nausea	.45	.50	14
.00	.00	.00	Vomiting	.09	.20	.00
.63	.63	.00	Balance problems	.55	.40	.14
.69	.56	.00	Dizziness	.45	.40	.00
.19	.06	.00	Blurry or double vision	.18	.10	.14
.63	.63	.00	Sensitivity to light	.45	.30	.14
.50	.38	.00	Sensitivity to noise	.45	.30	.14
.25	.19	.00	Pain other than headache	.45	.50	.00
.44	.25	.00	Feeling 'in a fog'	.64	.70	.00
.44	.25	.11	Feeling slowed down	.45	.40	.00
.75	.50	.22	Difficulty concentrating	.64	.30	.14
.63	.19	.44	Difficulty remembering	.45	.20	.14
.19	.13	.11	Difficulty falling/ staying asleep	.55	.30	.43
.44	.19	.11	Fatigue or low energy	.64	.70	.00
.32	.25	.00	Drowsiness	.27	.30	.00
.19	.13	.00	Feeling atypically emotional	.64	.60	.00
.37	.31	.00	Irritable	.64	.60	.00
.37	.13	.22	Sad	.36	.30	.00
.19	.6	.22	Nervousness	.36	.20	.14
.13	.6	.00	Helpless or hopeless	.18	.10	.00
.19	.13	.22	Other	.27	.00	.57

Table 7: Patient-reporting individualized PCS symptoms and outcomes of CST. (Tx = treatment).

treatment and the reasons for discharge or change-in-status to reflect the patient-perspectives of CST. (See Table 6).

Utilization of patients' self-determined length of treatment was reflected as a personal investment and was quantified by number of sessions attended. Treatment duration was patient-determined when treatment response was ascertained, abatement of symptoms, or other interpretations. Treatment series ranged from 1 to 10+ sessions for all groups. The average number of sessions for A-Males was just over 4 for <6 months post injury group and over 5 sessions for ≥6 months post-injury group. The average number of sessions for A-Females was less than 3 treatment sessions in both time span groups.

NA-Females utilized 5 treatment sessions on average in the <6 months post injury group and just under 6 sessions in the ≥6 months post-injury group. NA-Males utilized 3 sessions on average in the <6 months post injury group and 6 sessions on average in the ≥6 months post-injury group. (See Tables 2 and 3). Group sizes were too small for statistically meaningful data.

Referral sources were tabulated. (See Table 4). The majority within the A Group was referred by family, friends, or teammates. The majority within the NA Group was also by family or self-referral, with half reporting that personal research guided their decision to seek treatment.

Reason for change-of-status or discharge data was collected. The exceptions were patients who revealed symptoms that warranted outside referral (Example: clinical symptoms of Chiari formation or atlas mal-alignment). The majority of A and NA Groups indicated positive responses from treatment upon their symptoms through evidence of self-determined attendance as well as returning for follow-up or health maintenance visits. Six of the 67 patients from all groups, self-discharged without disclosing a reason or feedback about response to treatment (See Table 6).

3.2. Analysis of patient-reported Treatment Outcome Survey

PTOS inclusion participants totaled 47, (A; n = 24 with equal 12 male:12 female ratio) and (NA, n = 23 with 2 males:21 females). A 62% response rate was complete at the three-month target date yielding a total of 29 patient surveys to be analyzed (A, n = 17) and (NA, n = 12). Participant identity was concealed throughout the course of collecting and analyzing survey results, therefore gender, age, and recovery time had no bearing in the final PTOS analysis (other than the A or NA group identity). After affirming that CST for a concussion and/or PCS was received, participants were directed to survey questions that included symptoms from the PCSC checklist. There, they would identify what symptoms they had experienced following their head injury and which they believed were helped or not helped by CST. (See Table 7). The survey concluded with utilization questions and their opinion on the value of treatment they experienced. (See Table 8).

Only one A, and two NA participants, chose to skip the question addressing the specific symptoms checklist present prior to treatment. The remaining 26 participants completed the entire survey, and all provided some form of feedback or opinion about their lived experience with CST and the effect they perceived upon their symptoms.

From the symptoms reported in the PTOS, persistent headache and migraines were the most commonly reported in both groups followed by vestibular/sensory and cognitive/memory/concentration. This was consistent with symptoms recorded from the chart review. Pain, other than headaches, was also present half of the time in both groups. Due to small sample size, no statistical analysis was possible on change of symptoms reporting.

Number of sessions attended and how long to determine effect of treatment was recorded. A majority reported determining the effects within 1–3 sessions. The survey respondents confirmed their lived experience of CST had a positive change or effect upon their unique neurological, emotional, and physical symptoms. The vast majority of 29 participants from both groups provided open-ended comments about their experiences. They answered the question of whether they would be very likely or likely to recommend CST to others with PCS, reflecting a value that these respondents hold for this treatment (See Table 8). Only three participants provided a comment to the question seeking any negative effects of treatment, and all reported mild, transient discomforts that cleared between sessions.

4. Discussion

The findings reflect a decade of clinical use of CST for PCS by three therapists in one Midwestern outpatient clinic. The literature data support various interventions for PCS subtypes which include psychological, cervical and vestibular rehabilitation interventions (McCrory et al., 2017). The differential method of CST as a distinct manual therapy has yet to be fully explored as an option for PCS, though emerging studies support for its use with functional similarities of PCS subtypes. Of the 212 patient charts included in the clinic's history of patients reporting a mild head injury, only 67 clearly correlated their reason in seeking CST treatment was due to symptoms of a resultant concussion. The other 145 patients reporting similar symptoms of PCS but not correlating their issues to their historical head injury (and thus not included in this study) suggest that further study of chronic effects of head injuries presenting in clinical settings is needed. Men, both athletes and non-athletes, reported less variety of symptoms than women, and headaches/migraines were the prevailing complaint for both gender groups.

The practice of CST has a learning curve of competency, and skill levels were controlled for reliability of CST application through Upledger Institute International certification and/or diplomat status. Existing studies of CST addressing [isolated] symptoms that are also included with PCS has demonstrated positive outcomes. There remains sparse empirical evidence, however, of CST's validity. Clinical precautions for CST include ruling out atlas malalignment, intracranial pressure alterations, or limited techniques in the presence of Chiari formations.

Self-reporting tools for tracking PCS have been a consistent component of concussion management and have repeatedly been demonstrated sensitive to the effects (Randolph et al., 2009). There could be a risk of leading participants in naming symptoms, or on the other hand, the PCSC could assist patients, especially athletes, into recalling the full realm of symptoms and even highlight PCS subtypes. Despite the lack of use of a structured symptom list in the charts, patients reliably reported symptoms consistent with concussion checklists. Data from all patient-reported symptoms may have had an untold impact by the relative age difference between A Group and NA Group (regardless of gender).

The majority of patients had allowed for various lengths of recovery time before seeking treatment. Waiting for natural recovery time did not preclude some post-acute patients seeking treatment. Nearly twice as many sessions were attended in the PCS groups than the post-acute groups. Several patients reported that CST assisted the healing process and a majority of PTOS respondents reported finding personal value in a reduction of symptoms, regardless what stage of recovery. Data from the utilization of CST matched the patient-reported data that treatment effects upon symptoms were determined in a relatively short period of time (between 1 and 3 sessions), despite not having controls over any co-occurring treatments.

Despite the 62% PTOS response rate, the sample size of both A

Table 8
Patient-reported lived experiences of receiving CST.

Quantitative data from PTOS of Patients' lived experiences receiving CST for PCS		
I could determine an effect in:	A-Group (n = 17)	NA-Group (n = 12)
One session	.88	.42
2 to 3 sessions	.06	.42
4 or more sessions	.06	.08
I felt no effect on symptoms	.00	.08
How many sessions of CST did you participate in?		
1 to 3 sessions	.31	.36
4 to 8 sessions	.38	.18
9 or more sessions	.31	.37
Likelihood of recommending CST to others with concussions?		
Very likely	.88	1.00
Likely	.06	.00
Neither likely or unlikely	.00	.00
Unlikely	.00	.00
Very unlikely	.06	.00

Table 8: Patient-reporting utilization & perception of CST for PCS reflected by session participation and likelihood of offering a referral.

and NA Group were ultimately too small for meaningful statistical analysis. Nonetheless, the majority of responders assigned a positive effect of CST upon their individualized symptoms.

Differences between A and NA group data from the PTOS and utilization of CST from the chart review may reflect the athletic mindset culture of under-reporting, minimizing, ignoring, or toughing out symptoms for various reasons. At the time of the PTOS, none of the athletes were active in their sports, so their reporting was probably no longer influenced by political cultures of coach perceptions or school athletic department values in supporting concussion recovery. There was a stark contrast of medium ages between the A Group and NA Group (A, Females: $\overline{\overline{X}} = 20.5$ yrs and Males: $\overline{\overline{X}} = 20.5$ yrs) and (NA, Females: $\overline{\overline{X}} = 36.5$ yrs and Males: $\overline{\overline{X}} = 35.0$ yrs), but the impact and significance of this remains unknown.

Most patients were referred by others privy to the outcome of treatment and may reflect a trend in increased awareness of the local regional care for sports- and non-sports related concussions and available treatments. This may have contributed to some patients not 'waiting' for their symptoms to clear with rest alone. As an additional observation, many reported the referral sources had also received CST in the past leading to the conclusion that the 'experiential nature' of participation in CST holds some value. The after-care post-discharge planning for the patients in this study reflected both professional and individualized directives and initiatives to locate a treatment option beyond rest.

The survey response of those participants reported being 'very likely' or 'likely' to recommend CST for post-acute and PCS suggests a personal investment on these patients' part with their recovery and experiences with CST. In management of neurological and/or psychological issues such as chronic pain, sensory disturbances, mood/cognition, and quality of life, it is ultimately the patient who decides the value of an intervention.

4.1. Study limitations

The study authors acknowledge multiple limitations: relatively small sample size of comparison groups, limited quantitative data analysis of post-acute and PCS symptoms, inherent bias of investigators and patients, and lack of any control groups or comparable treatments. Parallel treatments were not an exclusion criterion because of lack of consistency in documentation with intakes. However, with the number of patients reporting having a discernment of treatment effects within 1–3 sessions may have minimized interference.

Authors acknowledge that the study requested patients to recall symptoms anywhere from 12 months to 10 years post-treatment. The aim was not to prove symptoms existed, but merely to explore patients' perspective of treatment upon the symptoms they personally recalled. Real-time symptom tracking would have greater strength in reliability and validity of measuring treatment effects.

5. Conclusion

The retrospective chart review concluded that a sizable portion of this patient population with post-acute concussion symptoms (<6 months) as well as persistent PCS (≥6 months) attributed the achievement of therapy goals of concussion symptom abatement through CST. With twenty-nine participants reporting in the PTOS, positive outcomes upon their individualized symptoms were noted. Patients reported determining treatment effects in a relatively short period of time for most patients in all groups with little to no negative or harmful effects. Patients assigned personal value to CST through the likelihood of referring others with PCS for CST as well as through utilization usage. This pilot study concludes that CST is an existing and low-risk treatment for symptoms of post-acute concussion and PCS sub-types and is worthy of further clinical study.

6. Clinical relevance

- There is an immediate need to investigate all possible treatment options for PCS subtypes.
- Patient-reported outcomes rank as compelling means to assign value to treatment invention related to subjective neurological and psychological symptoms of PCS.
- CranioSacral Therapy (Upledger) is a clearly defined method beginning with a basic protocol that raises the degree of reliability of technique application through a rigorous certification process.
- Sham control(s) has been developed to advance the strength of the clinical study of CST.
- Clinicians should consider there may be differences in symptom reporting between gender, ages, and athletes.

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Susan Vaughan Kratz: Conceptualization, Methodology, Investigation, Software, Validation, Formal analysis, Project administration, Writing – original draft, Collaborative revisions. **Daniel J. Kratz:** Conceptualization, Methodology, Formal analysis, and Interpretation, Supervision, Collaborative revisions.

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