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CLINICAL EVIDENCE

Chiropractic Treatment of a Post-Concussion Syndrome Secondary to Volleyball Injury in a 14-Year-Old Female: A case report

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Objective/Clinical Features: A 14-year-old female was struck in the frontal bone (glabella) by a volleyball with significant impact on March 2012 from an inferior to superior direction, while she was twisting her body towards the left. She was seen by both a pediatrician and neuro-pediatrician and was told to take Tylenol, and rest (watch and wait). She presented to this office on July 2012, approximately 4-months post-trauma, with no memory of the volleyball game, decreased visual fields, dizziness, nausea, extreme fatigue, and headaches since impact along with focal in occipital and glabella regions. Due to her symptomatology she had been unable to attend school since the March 2012 accident.

Intervention/Outcomes: The patient was treated with chiropractic sacro occipital technique (SOT) category two supine block (two wedges) placement for pelvic torsion and associated sacroiliac joint hypermobility syndrome, cervical stairstep adjustments (non high velocity low amplitude) without only slow gentle small arc twisting or rotation, and parietal sagittal suture cranial release techniques. The day following the first treatment she was able to return to school for the first time since the injury and she reported that the pain in her occipital region had subsided. She was seen for three more visits with the focus on cranial adjusting of the craniofacial region and by August 2012, one month later, she was symptom free. Until she was treated at this office her symptoms had remained stable without any improvement. Following the first treatment there was consistent improvement noted which continued after each subsequent office visit

Discussion: The temporal nature of her symptoms, from the time of the trauma, are consistent with her having suffered a post-concussion syndrome with associated brain trauma. Of significance is that her symptoms had not changed for four months until receiving her first chiropractic treatment, which suggests a possible correlation between the care rendered and the patient's presentation post-treatment. While regression to the mean, placebo or ideomotor effects, or coincidence might be a consideration, her lasting effects since the injury and immediate response to treatment is compelling. With any single subject case report it is always difficult to generalize the findings to the population at large, however there may be a subset of patients that are unresponsive to medication and watching and waiting that might find conservative SOT chiropractic care a viable option.

Conclusion: Based on the finding of this case report SOT and cranial treatment for the care of post-concussion syndromes in athletes warrants further study. Ideally interdisciplinary conservative care facilities would be optimal to treat patients with these methods, particularly when they are unresponsive to medication and more aggressive options are not a reasonable option.

Indexing Terms: Chiropractic, TMJ, dental, sacro-occipital technique.

… Concussion remains a significant issue for chiropractors to identify and manage. This case presents a 14 yo female who responded well to conservative SOT management'

Introduction

An epidemiological study exploring high school sport injuries sustained in practice and competition found that, of the injuries that occurred during competition, a greater percentage were more likely to be concussion related. (1) A study by Frommer et al, (2) investigating gender differences regarding concussion symptoms in high school athletes, found that some authors (3, 4, 5, 6) noted differences between sexes do exist in sport-related concussion. The Frommer study determined that, regarding symptom resolution time and return to play time, little difference was evident in the severity or outcome of concussions sustained between sexes in high school athletes. However, male and female high school athletes appeared to present with different types of symptoms after a sport-related concussion. Males reported more cognitive symptoms, whereas females reported more symptoms in the neurobehavioral and somatic categories. (2)

There are a limited number of studies investigating high school volleyball related injuries in the literature, particularly those focusing specifically on concussion and post-concussion syndrome in this patient population. Of the injuries associated with high school volleyball, concussion represented the third-most frequent injury (4.8%) in the High School Reporting Injuries Online (HS RIO) population. Just over half of the competition-related concussions in high school (60.9%) occurred while digging/making a defensive play, and middle blockers and setters sustained more than half of the concussion related injuries (52.6%). (7)

Of interest is that the volleyball injury rate was higher in high schools with less than 1,000 students, as compared to high schools with more than 1,000 students. Similar to the Resser et al study7, Kerr et al also found that the injury rate was higher during competitions than during practices for high school, and that middle blockers had a relative high incidence of concussion.8

As high school competition is growing, it is possible that trends in the collegial setting might be translatable to the high school athletic arena. Of importance is one study, which assessed '*328 male and female athletes from 19 teams competing in one of seven sports (soccer, lacrosse, basketball, softball, baseball, volleyball, field hockey) at four colleges in the northeast region of the United States.*' (9) Results found that more than one-quarter of the sample had experienced pressure from at least one source (e.g., coaches, teammates, fans, and parents) to continue playing after a head impact during the previous year. (9) '*Results of a latent profile mixture model indicated that collegiate athletes who experienced pressure from coaches, teammates, fans, and parents were significantly more likely to intend to continue playing in the future than were athletes who had not experienced pressure from all sources, or only pressure from coaches and teammates.*' (9)

Case History

A 14-year-old female presented for chiropractic care at this office with headache and nausea persisting for four months after being struck in the head by a volleyball, March 2012. The injury occurred at a volleyball tournament about 400 miles from her home. She was struck in the frontal bone (*glabella*) with significant impact from an inferior to superior direction, while she was twisting her body towards the left. She immediately lost vision, was nauseated and dizzy, and felt pain at the point of impact. She had memory of her coach standing in front of her after the injury.

Her mother reported a positive Romberg test. (10) The following was reported by her mother, as told to her by the trainer, the coach, and other team players, as the patient had no memory following the injury: *The patient served the volleyball one more time, then sat out the rest of the game. She left the court, drank water, and used a cold compress over her eyes. The bright lights and noise in the gym were bothersome and caused her headache to worsen. She went out for pizza that night with the team. She took children's liquid Tylenol (acetaminophen) and slept 9 hours. She*

attempted play the next morning but was again overcome by nausea and dizziness, as well as a worsening headache, when she returned to the gym. She was driven home later that day and slept in the backseat for the 7-hour drive. The nausea, dizziness and headache persisted for the entire ride home.

The patient was seen by her pediatrician the following day after unsuccessfully attempting to go to school. She was unable to sit through even one class and needed to go home. She was diagnosed with a concussion and told to take acetaminophen and sleep. She was told not to go to school or engage in any physical activity. The nausea, dizziness and headache persisted.

The following week she returned to her pediatrician, who referred her to a neuro-pediatrician. She saw the neuro-pediatrician twenty days post-trauma, and was told to continue to take acetaminophen and rest (watch and wait). She attempted returning to school the following week on 3 occasions but was unsuccessful, even with taking 3-hour naps in the nurse's office. She visited a neurologist 2 months post-trauma and was again told to take acetaminophen and rest. She presented to this office in July 2012, approximately 4 months post-trauma, with no memory of the volleyball game, decreased visual fields, and persisting dizziness, nausea, extreme fatigue, and headaches. She reported focal headaches in occipital and glabella regions. Headaches after the injury were a 10/10, but would reduce to a 7-8/10 if she would lie in bed in a dark room. Acetaminophen had no effect on her headaches. Due to her symptomatology, she had been unable to attend school consistently since the March 2012 accident.

Treatment

The patient was treated with chiropractic sacro occipital technique (SOT), category two supine block (two wedges) placement (11, 12, 13) for pelvic torsion, and associated sacroiliac joint hypermobility (14) syndrome. Cervical stairstep adjustments (15) (non-high velocity low amplitude) with only slow gentle small arc rotation, and (parietal) sagittal suture cranial release techniques were then performed. (16, 17, 18) Lastly, a release was done on the right occiput and the right malar bone. The day following the first treatment, she was able to return to school for the first time since the injury. She reported that the pain in her occipital region had subsided. The next visit she was still displaying a slight positive Romberg test, but with less dizziness. Her headache had reduced to a 3/10 and nausea had abated. The second treatment consisted of additional cranial release techniques – right frontal bone, right vomer, sagittal suture, and intra-oral (hard palate) releases. Following that treatment, she reported her headache to be a 1/10. She was seen at this office for treatment five times between July and August 2012.

Results

This patient tolerated the cranial treatments very well and following each office visit, improvement was noted by the treating physician, the patient, and her mother. This helped relieve both the patient's and her mother's anxiety about her ability to recover. The patient reported she was able to return to school and got 90% on her midterm examinations after her second treatment at this office.

She was seen for three more visits, with the focus on cranial adjusting of the craniofacial region. By August 2012, 5-months post-trauma, she was symptom free. Until she was treated at this office, she had shown no improvement in her general overall state and her symptoms had remained consistent and unchanging. After the first treatment there was great improvement noted and this continued following each subsequent office visit. In September, approximately 6-months post-trauma, she returned to playing volleyball. There had been no return of symptoms and a 9-year follow-up revealed there has not been a return of her post-concussion symptoms.

Discussion

While there has been quite a bit of emerging research discussing chiropractic and its care of post-concussion and brain trauma syndromes (19, 20, 21, 22, 23, 24, 25) a search of Pub Med, Mantis, and Chiroindex found only a single case study discussing concussion syndrome and a pediatric volleyball athlete. (26)

Hughes (26) reported a 12-year-old female patient was referred by her oral surgeon to a chiropractor for a volleyball related trauma. Following the sports-related trauma, the patient presented with severe temporomandibular joint (TMJ) dysfunction (TMD). While not complaining of neck pain, she did present with features of upper cross syndrome and limited cervical ranges of motion. Chiropractic treatment included high velocity low amplitude spinal adjustments, along with transcutaneous electrical nerve stimulation (TENS) and low-level laser. The chiropractic care moderately helped, and ultimately she was successfully treated by the oral surgeon with TMJ arthrocentesis and manipulation of the mandible under anesthesia. (26)

Some research has suggested that certain high school athletes might benefit from use of head protection. (27) This is particularly true for volleyball players in positions while digging/making a defensive play, and/or middle blockers and setters. One study found that facial re-injury of a volleyball player might be prevented by using a custom-made protective facial shield. (28) Pollard et al, (29) reviewing pediatric volleyball-related injuries treated in the United States emergency departments from 1990-2009, determined that the number of volleyball-related concussions/closed head injuries had increased significantly. They suggested that contact with the net/pole was associated with concussions/closed head injury. Their findings indicated there were opportunities for making volleyball an even safer sport for children. '*Protective padding, complying with US volleyball standards, should cover all volleyball poles and protruding hardware to prevent impact-related injuries*'. (29)

Biese et al (30) unexpectedly found that adolescent female athletes who have had sport related concussions might be susceptible for lower extremity injuries. In fact, they found that '*female adolescent athletes who reported a sports-related concussion within the past 12 months were more likely to sustain an acute-noncontact lower extremity injury during their high school sports season when compared with female athletes without a previous sport-related concussion*.' (30) Of importance is that head trauma alone, without a reported concussion, may be a subclinical event worthy of concern in our youth sport athletes. This is due to the fact that repetitive head trauma may put athletes at risk for lowered neuropsychological functioning, even without a reported concussive event. (31)

Multiple studies have investigated the appropriateness for chiropractors to assess and treat post-concussion syndromes and have yielded interesting results. A Canadian comparative survey study found that '*concussion knowledge among Canadian fourth year chiropractic interns and specialty college residents compares favorably with the knowledge of fourth year medical students and residents in diagnosing and managing concussions.*' (32)

A study by Taylor and Wynd (33) determined that there was an overconfidence of the chiropractic practitioner in recognition of mild traumatic brain injury, which was incongruent with what appeared to be low knowledge scores. They determined '*knowledge*' based upon a practitioner's familiarity with the Balance Error Scoring system and utilization of the Standardized Concussion Assessment Tool (SCAT). Instead, the majority of the chiropractic clinicians in this study relied upon their history and clinical examination for diagnosis, and referred their patients for neurological consolations with only a small minority of surveyed chiropractors providing treatment. (33)

In a study by Kazemi et al, they found that though there might be a need for more standardized guidelines and learning gaps for chiropractic treatment of concussions: '*North American*

chiropractors demonstrated the ability to recognize and treat concussions.' (34) Moreau et al (35) found that '*a high percentage of the sports-certified chiropractors who responded assess and manage sport concussion in their practice, and many of them endorse the use of the Sideline Concussion Assessment Tool–3 as a sideline assessment tool.*' (35) When Johnson et al (36) performed a narrative review of the literature in 2013, they found that '*doctors of chiropractic encounter concussed athletes at events and in clinical practice*.' (36) They advised 'i*t is essential for doctors of chiropractic to understand the importance of using standardized concussion assessment tools and current concussion guidelines.*' (36)

One important assessment tool that is necessary for chiropractors working in the sport-related fields where subjects might sustain concussions is the SCAT. (37, 38) The SCAT is an assessment tool that has been found to be reliable and valid.39 The most current version of sport concussion assessment tool (SCAT) - 5th edition was developed by the '*Concussion in Sport Group*' and can be downloaded for free. (40)

The various validated assessment tools for post-concussion syndrome are crucial for creating a history of a patient's injury, and for monitoring their ability to safely return to play. They can also be utilized for determining various gradations of injury, and to monitor clinical presentation, recovery and response to care. While all the various assessment tools are also important for interdisciplinary communication, in this case the patient's ability to return to school, and ultimately back to volleyball play, was guided not by assessment forms, but by the treating physician, patient, and parents close monitoring of symptoms. Of concern Yard et al (41) cautioned that '*too many adolescent athletes are failing to comply with recommended return-to-play guidelines. Sports medicine professionals, parents, coaches and sports administrators must work together to ensure athletes follow recommended guidelines*.' (41)

With the 14-year-old female patient in this case, the temporal nature of her symptoms from the time of the trauma is consistent with her having suffered a post-concussion syndrome with associated brain trauma. Of significance was that her symptoms had not changed for four months, until receiving her first chiropractic treatment. This suggests a possible correlation between the care rendered and the patient's presentation post-treatment. While regression to the mean, placebo, ideomotor effects, or coincidence might be a consideration, her lasting effects since the injury and immediate response to treatment is compelling.

Conclusion

Based on the finding of this case report, SOT and cranial treatment for the care of post-concussion syndromes in athletes warrants further study. Ideally, interdisciplinary conservative care facilities would be optimal to treat patients with these methods.

This is particularly the case when patients are unresponsive to medication, and more aggressive options are not a reasonable option.

With any single subject case report it is always difficult to generalize the findings to the population at large. However there may be a subset of patients who are unresponsive to medication and watching and waiting, and who might find conservative SOT chiropractic care to be a viable option.

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Informed consent to chiropractic care is held by the practitioner.

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