The Effect of Lumbosacral Manipulation on Growing Pains

<Information removed for anonymity>

Abstract

Background: Growing pains are a frequent clinical presentation that continues to puzzle practitioners, with very little conclusive evidence in any medical field, including Chiropractic.

Objective: The aim of this study was to determine whether lumbosacral manipulations have an effect on growing pain symptoms.

Methods: Thirty participants with growing pains between the ages of 4 and 12 years were recruited. The participants were placed into two groups of fifteen participants each. Group one received lumbosacral manipulations to restricted joints as determined by motion palpation, while Group two never received any professional intervention. Often parent(s)/guardian(s) of children who suffer from growing pains will rub the child's legs and offer verbal reassurance in an attempt to console their children. Parent(s)/guardian(s) of both groups were encouraged to continue to do this throughout the duration of the trial. Instructions were given to the parents so that the same rubbing technique and rubbing cream (aqueous cream) was used. Subjective changes were tracked using a pain diary that the parent(s)/guardian(s) needed to complete, a six week post study follow up question regarding children's GP's and Oucher self-report pain scale. Objective measures consisted of pressure algometer readings of the tibialis anterior muscle belly.

Results: The statistical data was analyzed using the Friedman test, Mann-Whitney test and the Wilcoxon Signed-Rank test. The results demonstrated that both groups responded favorably to their specific treatment over time. However, the group that received lumbosacral manipulations proved to show a quicker response to treatment; and the post-study follow up of this same group had markedly more positive feedback than the other group. These results highlighted the positive effects of Chiropractic manipulation on growing pain symptoms.

Conclusion: The results from this study, specifically the feedback from parent(s)/guardians(s) and pain diaries, indicated that spinal manipulation has benefit in the treatment of growing pains. The results also demonstrated that other avenues of treating growing pains, such as simple leg rubs, could also bring relief.

Key words: Manipulation, growing pain, Chiropractic

Die Effek van Lumbosakrale Manipulasie op Groeipyne

Abstrak

Agtergrond: Groeipyne is 'n algemene kliniese simptoom wat praktisyne steeds verwonderd laat, met baie min onweerlegbare bewyse op enige mediese gebiede, insluitende Chiroprakties.

Objektief: Die doelwit van hierdie studie is om vas te stel of lumbosakrale manipulasies 'n effek het op groeipyn simptome.

Metodes: Dertig deelnemers wat groeipyne beleef tussen die ouderdomme van 4 en 12 jaar is gewerf. Die deelnemers is in twee groepe van vyftien deelnemers elk verdeel. Groep een het lumbosakrale manipulasies op die betrokke stywe gewrigte soos deur beweging palpasie bepaal is, ontvang. Die behandeling is gekombineer met die gebruiklike massering van bene en gerusstelling wat ouer(s)/voog(de) in hierdie gevalle voorsien. Dit was vergelyk met 'n groep wat net die gebruiklike massering van bene en gerusstelling van ouer(s)/voog(de) ontvang het. Instruksies is aan die ouers gegee sodat dieselfde masseringstegniek en masseringsroom (aqueous room) gebruik is. Albei groepe het 'n pyn dagboek ontvang wat die ouer(s)/voog(de) moes voltooi, 'n ses-week na-studie opvolg vraag aangaande die kinders se groeipyne en Oucher eie selfverslag pynskaal voltooi. Objektiewe lesings het bestaan uit druk algometer lesings van die tibialis anterior spier.

Resultate: Die statistiese data is geanaliseer deur die Friedman toets, Mann-Whitney toets en die Wilcoxon Signed-Rank toets te gebruik. Die resultate het aangedui dat albei groepe gunstig gereageer het op hul behandeling met tyd. Die groep wat die lumbosakrale manipulasies ontvang het, het egter 'n vinniger reaksie op die behandeling getoon en die na studie opvolg toets van dieselfde groep het merkbaar meer positiewe terugvoering as die ander groep getoon. Hierdie resultate het die positiewe effekte wat chiropraktiese manipulasie op groeipyn simptome het, beklemtoon .

Konklusie: Die resultate van hierdie studie, spesifiek die terugvoering van die ouer(s)/voog(de) en pyn dagboeke, het aangedui dat lumbosakrale manipulasie voordelig is in die behandeling van groeipyne. Die resultate het ook aangedui dat ander opsies/kanale waarmee groeipyne behandel word, soos eenvoudige beenmassering, ook verligting kan bring.

Sleutelwoorde: Manipulasie, groeipyn, chiroprakties

INTRODUCTION

Background

French physician, Marcel Duchamp, first described growing pains (GP) in 1823 (Evans, 2008). Evans, Scutter, Lang and Dansie (2006) stated that Peterson provided the best definition in 1986 (Peterson, 1986). He defined GP by inclusion and exclusion criteria. The inclusion criteria were: intermittent pains in both legs (non-articular in location) that are generally present late in the day or at night time, often waking the individual. The exclusions were: physical signs (swelling, redness, trauma, reduced joint range, limping) and objective findings (blood tests, imaging).

Prevalence

GP is said to mainly affect children between the ages of 3 to 12 years (Uziel and Hashkes, 2007), although Lowe and Hashkes (2008) stated that GP tend to occur in children aged 4 to 14 years. Uziel and Hashkes (2007), estimated that GP, diagnosed by typical clinical symptoms, is the most common form of episodic childhood musculoskeletal pain occurring between the ages of 3 and 12 years. Evans and Scutter (2004b) found that the prevalence of GP has been reported in nine separate studies since 1928. They best estimated the global prevalence of GP, as defined by Peterson, in children 4 to 6 years of age as 36.9%.

Aetiology

Multiple authors agree that there is no conclusive aetiology for GP, (Al-Khattat and Campbell, 2000; Evans and Scutter, 2004a; Evans *et al*. 2006; Evans and Scutter, 2007; Uziel and Hashkes, 2007; Evans, 2008; Lowe and Hashkes, 2008). Furthermore the term "growing pain" is thought to be a contradiction as there is no evidence that the process of growth is painful, the peak incidence of pain does not conincide with peak growth periods and pain does not occur at sites where growth is thought to take place (Lowe and Hashkes, 2008)

Despite the uncertainty of the aetiology, three main theories dominate the literature. They include the anatomical, fatigability and psychological models (Evans, 2008). The anatomical theory centered on the premise that the cause of the leg pain was a postural or an orthopaedic defect that could induce bad posture or stance and that treatment of the defects were clinically observed to give relief (Evans and Scutter, 2007). The fatigue theory has been periodically reiterated; focusing on a surmised accumulation of metabolic waste products within the leg muscles, but remains untested. This theory was developed since parents often associated episodes of GP with periods of increased physical activity (Evans *et al*. 2006). With regards to the psychological theory, increased vulnerability to pain has been suspected, as has a familial predisposition. There is dissent regarding gender bias, where girls have historically been regarded as more susceptible to GP (Evans, 2008).

Chiropractors typically consider the anatomical (biomechanical) and pain referral aetiology, whereby pain from distant origins such as the lower back refer into the legs, as points where they could have an influence. Alcantara and Davis (2011) mentioned that a Chiropractic approach lends itself to supporting an anatomical aetiology of growing pains, albeit from a Chiropractic perspective. It is thought that the solution lies in an understanding and appreciation of the biomechanical relationship between the spine, the pelvis and the lower extremities, as this biomechanical relationship is bi-directional in nature.

Management

Evans *et al*. (2006) did a prevalence study in South Australia and found that approximately one-third (35.9%) of parents sought professional advice concerning their child's GP condition. Of those who did, the majority consulted a doctor (26.8%). Other health professional consulted included: chiropractors (4.9%), podiatrists (3.8%), and medical specialists (3.1%). Only 5% of cases of the children taken to consult a health professional were investigated or treated.

There is no typical treatment prescribed in any of the presenting studies. However, different treatment options were sought and tried. Non-pharmacological approaches included were comforting and local massage therapy (Uziel and Hashkes, 2007), muscle stretching (Evans, 2008), warmth modalities (Lowe and Hashkes, 2008) or simply no management with general improvement over time (Uziel, Chapnick, Jaber, Nemet and Hashkes, 2010). Pharmacological

approaches typically include analgesics, such as paracetamol, chronic medication and various types of over-the-counter medication (Evans et al., 2006; Evans, 2008; Lowe and Hashkes, 2008; Uziel and Hashkes, 2007).

Joint manipulation has pain inhibitory effects, that could relieve GP regardless of the cause. Although this effect would be considered more management than curative of the problem. Mechanisms such as gate control whereby the stimulation of large diameter nerve fibers from normal tactile stimulation inhibit the pain felt from the smaller diameter nerve fibers that conduct pain could play a role in pain relief (Mendell, 2014). Although this mechanism would also be activated with other physical therapies such as massage (Kessler, Marchant and Johnson, 2006). Manipulation also activates the descending pain inhibitory system from the dorsal periaqueductal (dPAG) gray (Sluka, Skyba, Radhakrishnan, Leeper and Wright, 2006; Skyba, Radhakrishnan, Rohlwing, Wright and Sluka, 2003). Wright (1995) demonstrated the effect of manipulation on this system by noting the specific responses of dPAG activation, most markedly beingrapid analgesia. An increase in substance P, which has an potent analgesic effect, has also been shown to occur with joint manipulation (Molina-ortega, Lomas-Vega, Hita-Contreras, Plaza Manzano, Achalandabaso, Ramos-Morcilla and Martinez-Amat, 2014).

Despite the possible effects joint manipulation could have on GP, there is limited evidence on the efficacy of Chiropractic manipulation as a treatment intervention. A few case studies have been published (Fysh, 1992; Alcantara and Davis, 2011) which have reported favorable responses.

Aim of the study

This study aimed to assess the effect of Chiropractic manipulation of lumbosacral joints found to be restricted during motion palpation on GP, combined with standard leg rubs and reassurance from the parent(s)/guardians(s). This was done by comparing it to a control group that received only standard leg rubs and reassurance from the parent(s)/guardian(s).

Contribution to field

This study demonstrates the possible biomechanical link to GP and thereby offers more support to one of the many possible aetiologies associated with growing pains. The role played by

Chiropractic in pain inhibition can also be supported. Importantly this study renders a proven treatment protocol for GP in the Chiropractic profession and offers an option to parents with children suffering from GP.

RESEARCH METHOD AND DESIGN

Design

This was a quantitative quasi experimental study utilizing 30 children diagnosed with GP. Treatment took place at the children's prospective schools over a three week treatment protocol consisting of two treatments per week. The hypothesis was that Chiropractic manipulation would have a beneficial effect on the children's GP by its possible effect on biomechanics and pain inhibition.

Materials

The only materials used in this study was a portable chiropractic table that was used to perform the lumbosacral manipulation.

Recruitment procedure

Children from primary and pre-schools in the Alberton and Bedfordview areas were informed of this study via an A5 advertisement insert in the different schools' newsletters sent to the parent(s)/guardian(s). The researcher's contact details were on the letters so that interested participants could contact the researcher directly. The newsletters were sent to approximately 1000 learners within 2 primary schools and 3 pre-schools from which the first thirty participants that volunteered and qualified were recruited for the study. Only thirty participants were used as this study served to only demonstrate if there was a change to motivate for more extensive studies in on the topic. Potential participants who heard of this study via word of mouth could also participate.

Inclusion and exclusion criteria

Due to the lack of conclusive evidence regarding the aetiology of GP, the definition for this study was: intermittent, bilateral leg pain that is non-articular in location and presents in the late afternoon without any physical abnormalities such as signs of trauma, skin lesions,

congential abnormalities, atypical bony alignment etc . The participants were selected based on the inclusion exclusion criteria described by Evans (2008). Which is bilateral, intermittent pain, localized to the musculature of the anterior thigh, calf and posterior knee, presenting in the late afternoon or early evening with normal findings on physical examination. Participants were excluded if they presented with any other description of pain or physical findings.

Data collection method

Thirty participants were divided into two groups of fifteen according to their entrance into the trial. The first 15 participants who volunteered to participate were allocated to Group one, the remaining 15 children were allocated to Group two. Group one received spinal manipulative therapy to the lumbosacral spine as well as leg rubs and consoling from the parent(s)/guardian(s) as per usual, when needed. Group two received only leg rubs and consoling from the parent(s)/guardian(s) as per usual, when needed.

Treatments and measurements took place in a private venue on the school grounds. The researcher performed all manipulations using diversified technique to manipulate restrictions found in the lumbosacral spine. A basic leg rub technique was explained and demonstrated to the parent(s)/guardian(s) so that the same technique was used for both groups at home. It consisted of gentle rubbing in a circular pattern over the thighs and lower legs. The parent(s)/guardian(s) were requested to only use aqueous cream should they feel they needed a cream base for the leg rubs.

Group one received six spinal manipulative therapy treatments over a period of three weeks. The only objective measurements performed were the algometer measurements which were taken by the researcher on the first, third and fifth visits prior to treatment, and on the seventh visit. The algometry measurements were performed on the tibialis anterior muscle belly as children with GP have demonstrated a decreased pain threshold in this area (Lowe and Hashkes, 2008)Subjective measurements consisted of the Oucher self-report pain scale (OSRPS), the pain diary and the 6 week post trial follow up question. The participants were required to complete the OSRPS on the first, third and fifth visits prior to treatment, and on the seventh visit. The OSRPS is a linkert item, whereby images of children with facial expressions of happy to sad are represented on a scale (Fig 1). The children were requested to choose a section on the

scale that best represented the GP they were experiencing. No treatment occurred at the seventh visit. The parent(s)/guardian(s) were required to hand in their pain diaries on the last visit.

Group two received no treatment from the researcher over the period of three weeks but had to come in for the same measurements as Group one four times at roughly five day intervals. The parent(s)/guardians(s) were requested to be present for at least the first and the last visits.

Data analysis

All statistical analysis was performed by STATKON (the statistical department at UJ). STATKON made use of the OSRPS results and the pressure pain threshold readings done with a pressure algometer. STATKON performed an Exploratory Data Analysis (EDA) on the study results, looking at the normality and equal variances. EDA also assists in detection of mistakes, checking of assumptions, preliminary selection of appropriate models, determining relationships among the explanatory variables, and assessing the direction and rough size of relationships between explanatory and outcome variables. If the assumptions of normality and equal variances held true, parametric testing was used, and if not, non-parametric testing was used.

Parametric testing consisted of Intergroup Analysis making use of the Independent Samples T-Test and Intragroup Analysis making use of Repeated Measures ANOVA. Independent Samples T-Test compared means for two groups and Repeated Measures ANOVA tested the equality of means. Non-parametric testing consisted of Intergroup Analysis and made use of the Mann-Whitney U-Test and Intragroup Analysis made use of the Friedman Test. If statistically significant findings were demonstrated the Wilcoxon Signed-Rank Test was performed.

Context of study

All children were recruited from the Alberton and Bedfordview areas which has similar socio-economic status and culture. The demographic distribution of the participants was a reflection of the demographics of the area.

Ethical Considerations

The study was approved by the University of Johannesburg's Faculty of Health Sciences Higher Degrees Committee (HDC18-01-2013) and Academic Ethics Committee (AEC18-01-2013). There were no major anticipated risks to the study other than the possibility of slight post manipulative pain and discomfort. As minors were involved in the study consent as well as assent was obtained from the parent(s)/guardian(s)once the study was explained to the parent(s)/guardian(s) as well as the child. A child friendly information form was given to the children making use of diagrams to assist in explaining the study. Privacy was ensured as all consultations took place in a private room provided by the school. Anonymity was maintained as no personal information was revealed on any of the data. Confidentiality was ensured by storing all data in a secured room with no unauthorized access. Participants were informed that participation was on a voluntary basis and that they could withdraw from the study at any stage.

The participants underwent an initial examination which determined the participants' suitability for the study. If any health concern was discovered during the examination the participant would have been referred to the relevant health care professional. After examination algometry measurements of the tibialis anterior as well as completion of the OSRPS occurred. Participants were then treated according to their allocated groups. The participants in Group two were offered treatment post study free of charge.

RESULTS

Pain diary

Table 1 represents the values for the pain diaries completed and handed back at the end of the study. It can be seen that there was unfortunately poor compliance on the initial pain diary and therefore no statistical analysis could be performed. The responses for the post study email was more favorable, although more so for Group one.

Insert table 1 from separate attachment

Post study email

A post study follow up was done 6 weeks after the study via email. The question posted to the parent(s)/guardian(s) of both groups was: "Have you noticed any changes or improvement in your child's growing pains or activities during the six weeks after the study?"

Group one had an overwhelmingly positive response with twelve parent (s)/guardian (s) giving positive responses, one giving what can be considered a neutral response and two not responding at all. As compared to Group two which had one negative response saying the growing pains got worse, four positive responses and ten not responding. See table 2 for detailed feedback from the post study follow up question.

OSRPS

Intragroup analysis

The Friedman test was used to demonstrate any statistically significant improvement in the OSRPS readings between visit 1 and visit 7. Group one showed a p-value of 0.002 and the p-value for Group two was 0.006. Both groups showed p-values of < 0.05, which indicates a statistically significant improvement in the perception of pain. The Wilcoxon Signed-Rank Test was then performed to determine where this change occurred, refer to table 3.

Insert Table 3 from attachment

The Wilcoxon Signed-Rank test was used to demonstrate at which point any statistically significant improvement occurred (p-value < 0.05). Table 2 represents the statistical p-value results of the OSRPS scores using the Wilcoxon Signed-Rank test. Group one showed significant change of OSRPS rating right from the start with a p-value of 0.007 from reading 1 – reading 2. Group two only started showing significant change from reading 1 – reading 3.

Intergroup analysis

Table 4 represents the statistical p-value results of the mean OSRPS scores using the Mann-Whitney test. The p-value for the first reading was 0.666. As the p-value of the first reading is not <0.05, it shows no statistical significance and indicates that the two groups started off comparable. No statistical significance was noted between the two groups over the four readings.

Insert table 4 from attachment

Pressure algometer

Algometer readings of the anterior tibialis were taken as this has been shown to correlate to GP (Lowe and Hashkes, 2008) .

Intragroup analysis

The Friedman test was used to demonstrate any statistically significant improvement between visit 1 and visit 7. Table 5 represents the statistical p-value results of the pressure algometer readings using the Friedman test. Only Group two showed p-values < 0.05, proving statistically significant change. The Wilcoxon Signed-Rank test was then performed with the Group two pressure algometer readings to determine where this change occurred. The Wilcoxon Signed-Rank test was used to demonstrate at which point any statistically significant improvement occurred.

Insert table 5 from attachment

Intergroup analysis

Table 6 represents the statistical p-value results of the pressure algometer readings using the Mann-Whitney test. No statistical significance was noted between the two groups over the four readings in the right leg or the left leg.

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Discussion

Outline of the results

Although the aetiology of GP is unknown, the aetiological theories considered in this study, from a Chiropractic perspective, were the anatomical (biomechanical) aetiology, pain referral aetiology, the activation of pain inhibitory systems and psychological impact or effects. Because the participants in Group one have improved in subjective and objective measurements and the parent(s)/guardian(s) of the participants have responded very positively to the post study follow up, one could consider that the anatomical theory proposed by Evans and Scutter (2007) whereby the cause of the leg pain was a postural or an orthopaedic defect. It is possible that by treating the restrictions in the lumbar spine, nociceptor activation was decreased by relieving the mechanical stress induced by the joint restriction. These results can also be supported by the

pain referral theory by Cookson (2003). The activation of pain inhibitory systems might all also contribute to the aetiologies for GP and can also explain Group one's favorable response. Manipulation is thought to activate pain inhibitory systems via a few mechanisms, being gate control, activation of the dorsal periaqueductal gray descending inhibitory systems and release of substance P. This multi system effect could explain the superior response to treatment in Group one. However, it should be noted that all of these pain inhibitory mechanisms are thought to provide relatively short term pain relief. Lastly, and likely most importantly, the psychological impact also needs to be considered.

Although Group one had the best and fastest improvement, both groups did improve despite Group two functioning more as a "control" group. It was expected that Group two would have had no improvement as no treatment beyond what the parents most likely were already doing was performed. However, it was assumed that parents were already performing leg rubs and reassuring their children as this is the standard treatment for GP. It is possible that because GP have no know aetiology parents may have considered rubbing their children's legs and providing reassurance as reinforcing pain behavior. The data indicates the opposite. By acknowledging the child's pain and providing a form of treatment, albeit very limited, the children in fact seemed to demonstrate a beneficial response. This could be explained by psychological reasoning, as well as scientific reasoning whereby the rubbing activated the pain inhibitory systems such as gate control, or likely both.

Limitations

Due to the small sample size and lack of response on the pain diary and post study follow up statistical analysis could not be performed on this data. Assumptions and trends had to be used to interpret the data.

Although all measures used in this study have been tested scientifically for content and construct validity (Beyer, Denyes and Villarruel, 1992; Kinser, Sands, and Stone, 2009), the researcher has some concerns regarding this during the study. Some of the participants (particularly those under 7) to did not seem to understand what GP's were or what was expected from them regarding the OSRPS. Some participants tended to interpret any scratches or bruises on the legs as pain in the legs and would then complete the OSRPS accordingly. From the age 7 years and above the researcher found good correlation between GP in the legs and the

OSRPS readings. There was also some concerns with regards to the pressure algomter. It seemed the participants did not grasp the difference between pain threshold and pain tolerance. Many of the participants, again especially the younger participants, saw the pressure algometer as a game and the participants tried to see how much pain they could tolerate. The results from the above objective measures are still included as there is still some valid data that can be interpreted, however the above concerns needs to be raised and one needs to consider the whole picture when interpreting the data.

The randomization technique used did not allow for true random group allocation, it is possible that the more eager parent(s)/guardian(s) or more severe cases volunteered first and were therefore placed in Group one.

Recommendations

The results obtained through this study may be improved and validated by using a larger sample group whereby the population may be more accurately presented and allow for more contingency with regards to parent(s)/guardian(s) compliance where their feedback is needed. It would also be beneficial to do the study over a longer duration, or to do further follow up post treatment as this would provide insights as to whether the anatomical or pain inhibitory theories are causing the positive effect. Chiropractic treatment beyond the lumbar spine would also provide further insights.

Conclusion

The results of the data collected from this study, the pressure algometer and OSRPS readings, showed that spinal manipulation had some benefit. However, the pain diaries and feedback from the parent(s)/guardian(s), which are probably more reliable for GP, indicates that spinal manipulation provided significant improvement to the children's perception of GP. The general trend noted lower intensity and lower frequency of pain. There is a strong indication, despite the limitations of this study, that GP can be managed effectively with Chiropractic treatment. However, the results also indicate that some relief may have occurred by simply reassuring the child and rubbing their legs. In conclusion, it appears that GP's can be managed with relatively little intervention and need not be left for the child to "grow out of".

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