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FASCIA SCIENCE AND CLINICAL APPLICATIONS: Pilot Study

A pilot study of fascia Bowen therapy for 8-11 year-old boys with developmental coordination disorder

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A R T I C L E I N F O

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A B S T R A C T

Background: Developmental coordination disorder (DCD), also known as dyspraxia, is a disorder emerging in childhood characterised by motor skill impairments. The motor difficulties often produce negative effects in other areas of life, such as poor self-esteem and reduced social interactions. One treatment used for DCD is fascia Bowen therapy, which involves stimulating the fascia tissues of the body using finger and thumb rolling movements over the skin to improve overall muscle movement. However, no studies to date have been reported testing the effectiveness of fascia Bowen in DCD.
Methods: The present pilot study tested the effectiveness of 6 weeks of fascia Bowen in 10 boys aged 8–11 years with DCD. None of the boys had ever received treatment in any form before this study. Motor skills were assessed using the Movement Assessment Battery for Children-2 (MABC-2) and the DCD questionnaire, and psycho-social functioning was measured using the Self-Perception Profile, Spence Social Skills Questionnaire, and Strengths and Difficulties Questionnaire. All measures of interest were assessed before and after the therapy.
Results: Results showed significant improvement in motor function post-intervention, with 60% of the children no longer clinically being classified as having a movement difficulty on the MABC-2. However, no significant improvements were seen in psycho-social measures, at least within the short time-frame of the therapy in the current study.
Conclusions: The current pilot study revealed improvements in motor functioning after fascia Bowen therapy, across both performance and questionnaire measures, but that these improvements did not extend to wider areas of life. Further research in DCD is needed to test the effectiveness of fascia Bowen in larger studies with expanded ages and both genders over longer periods, including the generalisation of results of these longer interventions to different areas of life beyond motor ability.

1. Introduction

Developmental coordination disorder (DCD), also known as dyspraxia, involves a substantial impairment of motor skills compared to what would be expected for a child's age and intelligence level (American Psychiatric Association, 2013). DCD is a relatively common disorder of childhood, with prevalence rate estimates of approximately 5%–6% for children aged 5–11 (American Psychiatric Association, 2013; Leonard, 2018). Those with DCD are evident by their general clumsiness and poor posture, and they are slower than normal in their behaviours. Handwriting is usually poor and there are problems in reaching certain developmental milestones during childhood, which often alerts people about potential motor problems.

DCD also impacts other areas of life beyond motor dysfunction, including academic performance, self-esteem, social functioning, family relationships and general wellbeing (Dewey et al., 2002; Leonard, 2018; Lingam et al., 2012). Children with DCD are at risk of developing a variety of psychological and social difficulties, which includes educational under-achievement (Dewey et al., 2002; Missiuna et al., 2014; Watson and Knott, 2006). These difficulties often emerge because they are slower in completing tasks than their peers and have problems interacting with others across

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various school settings (Missiuna et al., 2006; Zwicker et al., 2017).

There are various theories of DCD to explain the underlying mechanisms and these theories have helped inform different approaches to treatment (Blank, 2012). The major treatments available for DCD can generally be placed into either bottom-up or top-down theoretical categories, with bottom-up referring to lower-level sensory-motor processing in the body and top-down referring to the higher-level cognitive processes in the brain (World Health Organisation, 2001). Bottom-up approaches focus on the sensory-motor deficits in DCD, with atypical sensory-motor processing travelling up to the brain where it exerts effects on the functioning of cortical motor areas. Examples of treatments integrating bottom-up approaches are sensory integration therapy (SIT), process-orientated treatment and perceptual motor training (Mandich et al., 2001; Smits-Engelsman et al., 2013).

In contrast, top-down approaches emphasise the cognitive and problem-solving processes used to successfully perform tasks (Sugden and Chambers, 1998; Mandich et al., 2001; Miller et al., 2001; Barnhart et al., 2003). Therefore, the focus of these approaches are the cognitive processes within the brain, which then exert their effects on the neural information travelling down to the muscles to perform motor movements. The European Academy of Childhood Disability (EACD) currently recommends the use of top-down approaches for DCD and these guidelines are followed in the UK. This recommendation has been based upon results from meta-analysis studies about treatment effects using motor interventions for children with DCD, which report that task-specific top-down approaches are more effective than bottom-up interventions (e.g. Smits-Engelsman et al., 2013). However, available evidence for bottom-up approaches has been weak in terms of the quantity and quality of the research done to date and thus is problematic to interpret (Smits-Engelsman et al., 2013). Additionally, there is a genuine lack of transparency in treatment protocols in the field, meaning its often hard to know and interpet the methodologies. The lack of clarity in the literature makes it difficult to determine what approaches are effective or ineffective (Hillier, 2007), which creates uncertainty about the quality of evidence investigating bottom-up treatments to date. Therefore, further research testing the efficacy of bottom-up therapies in DCD is needed.

One potential bottom-up intervention for improving DCD is fascia Bowen therapy, which is a derivation of The Bowen procedure that utilises non-invasive light touch movements of a practitioner's fingers and thumbs along different tissue systems of the body including muscles, tendons, ligaments, joints, nerves etc., with the aim of trying to re-align the soft tissue structure of the body (Baker, 2014; Chaitow, 2014b; Wilks and Knight, 2015). Since fascia surrounds all those types of tissues targeted by Bowen techniques, it is inevitable that fascia is affected by the treatment movements, and in different ways to other types of tissues such as muscles (Chaitow, 2014a; Wilks and Knight, 2015). Fascia is connected with all tissue types of the body and represents an important network of the body's structure, and dysfunction of this tissue adversely affects many other body systems and abilities (Chaitow, 2014a,b; Schleip, 2014; Wilks and Knight, 2015). Activity of fascia is a key aspect of body perception, which is an area of function that is compromised in those with DCD (Schoemaker et al., 2001).

Fascia Bowen philosophy believes that the continuity and continuum of the fascia connective tissue in the humans is significant towards optimal functioning (Schleip et al., 2012). Fascia Bowen therapy is administered even more lightly than the Bowen movements, by touching the skin so lightly that it does not move the muscles and ligaments as Bowen treatment does. Fascia Bowen is administered in a hoop-like format (following the invisible dermatomal lines of the body) and is designed to more specifically target the fascia soft tissue systems of the body (Chaitow, 2014b). Fascia's role begins just below the skin's surface, so its communicative network can be easily manipulated from outside the body, stimulating it to slide hydraulically in an attempt to relax it (Schleip et al., 2012). This ability to reduce tension by external stimulation using manual touch is an important feature in a fascia Bowen intervention because anecdotal reports by practitioners note unilateral tightness in children with DCD compared to typically developing peers. Fascia Bowen treatment is desirable because it can be administered directly through clothing, making it is quick and easy for qualified Bowen practitioners to carry out the intervention.

There is evidence that Bowen techniques are effective at improving muscular problems, as well as overall well-being. A systematic review by Hansen and Taylor-Piliae (2011) reported that over half the Bowen technique-based studies included in the review were successful in improving a range of different chronic to acute conditions and that some evidence demonstrated reduced symptoms of pain. Dicker (2001) reported about a study of a 6-week Bowen technique treatment in community-dwelling healthcare workers over the age of 41. Results showed an 89% improvement in the original symptoms suffered by the participants and that they experienced a 78% improvement in their ability to work after receiving the Bowen intervention. Results further showed a reduction in stress levels, an improvement in wellbeing and quality of life, including a better ability to sleep and increased energy levels. Other studies of Bowen therapy have shown similar improvements in muscle flexibility and movement, as well as additional areas such as quality of life (Carter, 2001, 2002; Dicker, 2005; Marr et al., 2008).

While a handful of studies have looked at the effectiveness of The Bowen technique related to the symptoms of specific conditions, no research to date has specifically evaluated the efficacy of fascia Bowen therapy for improving general muscular functioning, as well as psychological and social well-being. The present research aims to fill this gap in the literature by running a preliminary proof of concept pilot-study to test the effectiveness of fascia Bowen therapy for improving motor, psychological, social functioning in a sample of boys with DCD. It was expected that improvements in motor functioning would be seen after therapy compared to before, because the fascia Bowen intervention specifically aims to improve muscular functioning. Given the short time-frame of the 6-week therapy period, it was not known whether psychological, social and behavioural functioning would be higher after therapy compared to before.

2. Methods

2.1. Participants

The present sample consisted of 10 males aged between 8 and 11 years (mean age = 9.7; SD = 1.2) recruited from mainstream primary schools across the counties of Berkshire, Oxfordshire and Wiltshire. Information about the study was posted on Facebook sites, shared with dyspraxia groups, and was disseminated through independent occupational therapists (OT's) working in the field. None of the boys had ever had any treatment of any kind for DCD.

All participants had a diagnosis of DCD according to international criteria (APA, 2013), and had scores at or below the 15th centile on the Movement Assessment Battery for Children-2 (MABC-2) as assessed by a registered OT. The 15th centile of the MABC-2 was selected because it is the threshold within the 'Traffic Light' system of the MABC-2 which determines whether a child has a movement difficulty or not. In this system red denotes a significant movement difficulty, amber suggests the child is 'at risk' of having a movement difficulty, and green reflects no detected movement difficulty (see further explanation below). The mean MABC percentile score of participants in the present study was 4.6 (SD = 3.53), which is in the red area of motor difficulty.

Exclusion criteria for participation in the study included the presence of co-morbid conditions including hemiplegia and cerebral palsy, or if participants were non-ambulant (i.e. unable to walk or move under their own volition). Girls were excluded due to differing developmental milestones between males and females and while differences pre-puberty are moderate, they are more likely to reflect environmental influences such as those socially induced by parents, peers, teachers and coaches (Thomas and French, 1985). A further exclusion criterion was that all participants were without intellectual disability, as indicated by a statement of special educational need (or absence thereof). Additionally, none of the participants were receiving any other form of intervention before or during the intervention period.

2.2. Materials

2.2.1. Motor functioning: movement assessment battery for children 2 (MABC-2)

The MABC-2 (Henderson et al., 2007) is designed to be carried out by a qualified professional for the identification and description of impairments in motor performance of children aged 3–16 years of age. The MABC-2 includes 8 tasks in total, which produce scores for the three subscales of manual dexterity, ball skills, static and dynamic balance. Scores from all these tasks are converted into centile scores which are incorporated into a 'Traffic light system', which explain a child's total test score in terms of categories of difficulty. Red signifies performance at or below 5th percentile (a significant movement difficulty), amber signifies between the 6th and 15th percentile (the child is 'at risk' of a movement difficulty), and green signifies performance above the 15th percentile (no detected movement difficulty). The MABC-2 shows good reliability and validity (Henderson et al., 2007).

2.2.2. The developmental coordination disorder questionnaire - parent version (DCDQ-P)

The DCDQ-P (Wilson et al., 2009) is completed by the parents about their children's motor performance in everyday activities. It uses a 5-point Likert scale across 15 items, to produce a total score out of 75. It includes 3 subscales; the subscale 'control during movement' includes 6 items for a score out of 30, 'fine motor and handwriting' includes 4 items for a score out of 20, and 'general coordination' has 5 items for a score out of 25. Higher scores indicate better motor performance for the child. It is reported to have strong reliability and validity (Wilson et al., 2009).

2.3. Psychological functioning

2.3.1. Self-perception profile for children (SPP–C)

The SPP-C (Harter, 1985) is a 30-item self-report questionnaire for children to measure self-esteem. It includes five subscales measuring scholastic competence, social acceptance, athletic competence, physical appearance, behavioural conduct and general self-worth. There are 6 items within each of the 5 subscales. The SPP-C uses a 'structured alterative format' whereby each item contains two associated statements, each statement having a choice of two responses each, thereby providing a four-point scale for each item. Scores can fall between 1 and 4 and a mean is calculated, giving a mean score out of a possible 4 for each of the 5 subscales. The SPP-C is reported to have good reliability and validity (Muris et al., 2003).

2.3.2. The self perception profile for children-parents (SPP–P)

The SPP-P (Harter, 1985) is a parental report measure of self-esteem which has five subscales covering scholastic competence, social acceptance, athletic competence, physical appearance and behavioural conduct, and one scale assesses overall self-worth. The parent measure is a parallel version to the child version, which was also run in the present research. There are 15 items, with three in each domain. The SPP-P uses a structured alterative format whereby each item contains two associated statements, each statement having a choice of two responses each, thereby providing a four-point scale for each item. Scores can fall between 1 and 4 and a mean is calculated, giving a mean score out of a possible 4 for each of the 5 subscales. Its reliability and validity are reported as acceptable (Boyle et al., 2008).

2.3.3. Spence Social Skills Questionnaire-pupil (SSQ-Pu)

The SSQ-Pu (Spence, 1995) is a 30 item self-report questionnaire measuring social skills using a 3-point Likert-scale. There are 3 subscales measuring conflict resolution/avoidance, warmth and empathy, and social involvement. Participants can score up to 20 in each subscale, with a higher score indicating a higher level of social competence. The three subscale scores can be combined to produce a total score. The SSQ-Pu has been shown to have good reliability and internal validity (Spence, 1995).

2.3.4. Spence Social Skills Questionnaire-parent (SSQ-P)

The SSQ-P (Spence, 1995) is a 30-item questionnaire using a 3-point Likert-type rating scale. The item has 3 subscales covering conflict resolution/avoidance, warmth and empathy and social involvement. A score of up to 20 can be achieved for each subscale, with a higher score indicating a higher level of social competence. The three subscale scores can be combined to produce a total score. Its reliability and internal consistency was found to be good with a Guttman split-reliability of 0.90 (Spence, 1995).

2.3.5. Spence Social Skills Questionnaire - teacher (SSQ–T)

Social interaction was also measured using the SSQ-T (Spence, 1995), which is completed by the primary teacher and is a parallel version to the child version of the SSQ. The format is the same as in the child version described above. The internal consistency and validity are good, with a Guttman split-half reliability of 0.93 (Spence, 1995).

2.3.6. Strengths and Difficulties Questionnaire-parent (SDQ-P)

Behaviour was measured by parents using the 25-item SDQ (Goodman, 1997), which includes 5 subscales covering emotional symptoms, conduct problems, hyperactivity/inattention, peer relationship problems and pro-social behaviour. Each item has a 3-point Likert scale and each subscale produces a score out of 10. Higher scores indicate a higher level of difficulty, except in the case of the pro-social subscale where a higher score indicates a better level of social functioning. Its reliability and validity are considered to be satisfactory (Hawes and Dadds, 2004).

2.3.7. Strengths and difficulties questionnaire - teacher (SDQ-T)

The SDQ-T (Hawes and Dadds, 2004) is a teacher-report measure with 25 items in the format of a 3-point Likert-scale. It includes 5 subscales covering emotional symptoms, conduct problems, hyperactivity/inattention, peer relationship problems and pro-social behaviour. Each subscale produces a score out of 10, with the higher score indicating a higher level of difficulty apart from pro-social, where a higher score indicates a better level of social functioning. The reliability and validity are found to be satisfactory (Hawes and Dadds, 2004).

2.4. Autism co-morbidity

2.4.1. The social communication questionnaire (SCQ)

The SCQ (Rutter et al., 2003) is a 40-item parent-report measure of Autism Spectrum Disorder (ASD) symptoms and was included here because of high co-morbidity between DCD and ASD. The items are administered in a yes/no response format completed by the parent, to produce a score out of 40. If a child scores 15 or above, then this is highly indicative of ASD. The SCQ has shown excellent sensitivity and specificity for screening of ASD symptomology (Chandler et al., 2007).

2.5. Procedure

The research involved three different phases, a pre-therapy testing session, a 6-week fascia Bowen therapy period and a post-therapy testing session. The study lasted approximately 8 weeks in length for each participant, though one child received his 6 therapy sessions over an 8-week period due to illness and absence from school during that time. The pre- and post-therapy assessments were both carried out by a professionally-qualified OT, as administration of the MABC-2 requires qualification as a medical professional i.e. a doctor, nurse, or OT. The OT in this study regularly used the MACB-2 as part of their standard practice, and was already very familiar with using it. The OT was aware that all the boys were receiving the fascia Bowen treatment because of the lack of a control group. However, the OT had no knowledge about fascia Bowen treatment or any experience with it. The research was carried out in compliance with the Helsinki Declaration and the study received ethical approval from the University of Bath Psychology Research Ethics Committee. One parent/guardian for each of the children provided written informed consent to take part in the research, and all children provided assent.

2.5.1. Pre-therapy assessments

The pre-therapy motor assessments took place in schools for 9 of the participants and a 10th participant was assessed at home at the request of his parents. For this an OT completed the MABC-2 with each of the children to assess initial motor functioning. The children also completed the SPP-C and SSQ-P, and an appropriate member of staff at each child's school completed the SSQ-T and the SDQ-T. The SSQ-P, DCDQ-P, SPP-P Children, SDQ-P, and the SCQ were completed with a parent of each child via telephone.

2.6. Fascia Bowen therapy

The fascia Bowen therapy took place during weeks 2–7 of the study for all of the children, apart from one who completed it during weeks 2–9 due to illness during that period affecting two of the weeks. Each individual therapy session took approximately 45 min and each participant received one session per week for a total of 6 weeks. Sessions took place in a private room in the child's school (7 participants) or in a non-NHS clinic (3 participants), depending on which option was most convenient for the participant and their family. Each child was brought into the treatment room by a teacher or a parent and the child was asked politely to lie prone and fully clothed on the treatment couch. The child was then asked if they were comfortable and told to let the practitioner know if they felt uncomfortable at any point during the session. Once they were comfortable and ready, the treatment was begun.

The fascia Bowen therapy was carried out to target movement of the fascia only, and involved taking the ‘skin slack’ and moving it back and then forward again to release the skin. This was done without specifically making the rolling moves over the muscles and ligaments that are characteristic of Bowen therapy. Instead, each fascia Bowen move is done at the level of the superficial fascia with the aim of targeting the relationship between the fascia and the nerves, tendons or muscles in each area being focused upon. These were carried out using short sequences at key structural points of the body by applying the movements in a hoop-like direction to follow the invisible dermatomal lines of the body. Each sequence of moves focused on a key area of the body, and then was followed by a short break lasting approximately a couple of minutes. The breaks are included to allow the body to rest for a few minutes in order to initiate the processes of repair. Using these types of movements, a standardised treatment protocol regime was followed that was originally devised by Howard Plummer, which involves moving from one area to another across the body following the dermatomal lines. Further information about the specifics steps of the therapy are available in a standardised teaching manual; however, this manual is not currently available in the public domain. The steps used in the present research involved those generally followed by professional practitioners who have been trained to administer fascia Bowen therapy.

The whole treatment protocol was administered over a period of 45 min, with the children receiving treatment lying in both prone and supine positions during the session according to the fascia Bowen protocol instruction sheet. The practitioner did not engage in general conversation with the child during the treatment process. At the end of the treatment protocol the child was asked to come down from the treatment couch and he was then escorted to the door where he was met by his teacher or a parent, depending upon where the treatment had taken place.

2.6.1. Post-therapy assessments

In week 8 of the research the same measures were carried out as in the pre-therapy with the children, teachers and parents. For one of the children this occurred during week 10.

3. Results

The mean SCQ score for the current sample was 13.6 (SD = 4.79), which is below the cut-off score of 15 which suggests possible ASD (Rutter et al., 2003). In addition, 7 out of the 10 children had individual SCQ scores below the cut-off score of 15. The outcome data of the 3 children who met the screening threshold was compared to the data for the other 7 children, and little or no difference was seen in the scores between them on any measure. This included the MABC-2 data, as the 3 participants who scored above 15 were not the ones who showed the least or the most change in motor functioning following the therapy.

3.1. Motor functioning

3.1.1. MABC-2 results

A MANOVA was conducted with the 3 MABC-2 subscales (manual dexterity, aiming and catching, balance) as the DV's and time (pre-therapy and post-therapy) as the IV. Results of the MANOVA revealed that time had a significant effect on the MABC-2 scores, $F\,(3,7) = 7.44$, $p = .014$, $\eta^2 = 0.76$ (see Fig. 1). Follow up univariate analyses within the three subscales were therefore conducted. The times for manual dexterity score were significantly different between time 1 and 2, $F\,(1,9) = 6.1$, $p = .04$, $\eta^2 = 0.4$), with scores being higher post-intervention (M = 15, SE = 4.75) compared to pre-intervention (M = 4.15, SE = 1.02). The times for aiming and catching were also significantly different between the times, $F\,(1,9) = 8.3$, $p = .01$, $\eta^2 = 0.48$, with scores being higher post-intervention (M = 26.85, SE = 7.01) compared to pre-intervention (M = 11.4, SE = 3.78). The times for balance scores were once again significantly different from pre-to post-therapy, $F\,(1,9) = 14.6$,

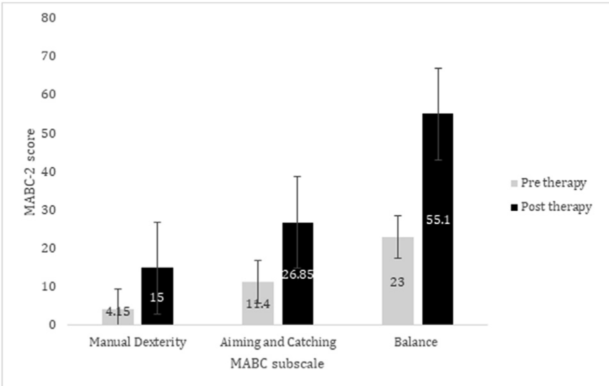

Fig. 1. Graph showing mean scores for the Movement Assessment Battery for Children version 2 (MABC-2) subscales across the pre- and post-intervention times, with higher scores reflecting better motor functioning. Note the error bars represent standard error of the means.

$p = .0004$, $\eta^2 = 0.62$, with scores being higher post-intervention ($M = 55.1$, $SE = 10.07$) compared to pre-intervention ($M = 23$, $SE = 6.79$).

The mean total percentile score showed that the pre-intervention total was in the red zone (Mean $= 4.6 \leq$ 5th percentile; see Table 1). The mean post total percentile score showed that the post-intervention total was in the green zone (Mean $= 23.5 \geq$ 15th percentile). Looking individually at the total percentile score for each child, Table 1 demonstrates how many children moved between categories on their movement difficulties. It was found that 3 children remained in the red category, 1 child moved up one category from red to amber, 4 children moved up 2 categories from red to green and 1 child moved up one category from amber to green. This means that 6 children, post-intervention, were now in the category classed as no longer having a movement difficulty.

3.1.2. CDQ-P results

A MANOVA was conducted with the mean scores for the 3 subscales of the DCDQ-P (control movement, handwriting, co-ordination) as the DV's and time (pre-therapy and post-therapy) as the IV. Results using Pillai's trace showed there was a trend towards a significant effect of time on the subscales of the DCDQ-P, $F(3,7) = 3.33$, $p = .08$, $\eta^2 = 0.59$ (see Fig. 2). Follow-up tests of univariate effects showed there was a significant effect of control movement, $F(1, 9) = 10.8$, $p = .01$, $\eta^2 = 0.54$, with scores at post-therapy ($M = 19.5$, $SE = 1.19$) higher than those at pre-therapy ($M = 15.5$, SE 0.872). There was no significant effect of time for the coordination scores, $F(1,9) = 1.33$, $p = .28$, $\eta2 = 0.13$, nor was there a significant effect of time for handwriting scores, $F(1,9) = 0.19$, $p = .67$, $\eta^2 = 0.02$.

3.1.3. Psychological functioning results

A mixed MANOVA was conducted with time (pre-therapy versus post-therapy) and respondent (parent versus pupil) as the IV's and all 5 subscales of the Self-Perception Profile (SPP) (scholastic competence, social acceptance, athletic competence, physical appearance, behavioural conduct) as the DV's. The results of the MANOVA showed there was no significant effect of time on the mean SPP scores, $F(5,5) = 2.45$, $p = .17$, $\eta^2 = 0.71$). The MANOVA further showed, using Pillai's trace, that there was a significant main effect of respondent on the SPP scores, $F(5,5) = 6.92$, $p = .027$,

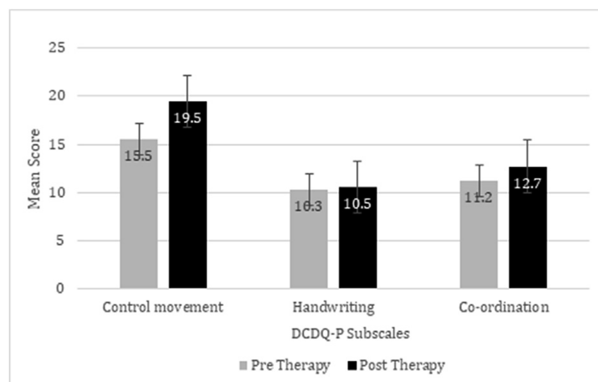

Fig. 2. Graph showing the mean scores pre- and post-intervention for the Developmental Coordination Disorder Questionnaire - parent version, with higher scores indicating better motor performance. Note the error bars represent standard error of the means.

Table 1
Pre- and post-intervention centile category for each participant in the Movement Assessment Battery for Children 2, with higher scores reflecting better motor ability. Red denotes motor performance at or below the 5th percentile (significant movement difficulty), amber signifies motor performance between the 6th and 15th percentile (at risk of a movement difficulty), and green denotes motor performance above the 15th percentile (no detected movement difficulties).

Participant	Pre-Intervention centile	Post-Intervention centile
1	1	5
2	9	63
3	0.5	5
4	5	16
5	2	9
6	0.5	1
7	9	37
8	5	37
9	9	25
10	5	37

$\eta^2 = 0.8$. Follow-up tests of univariate effects showed there was a significant effect of respondent on the athletic competence subscale, F (1,9) = 24.3, p = .001, with pupils rating higher (M = 2.4, SE = 0.19) than parents (M = 1.66, SE = 0.22) on athletic competence also parents rating higher (M = 3.87, SE = 0.06) than pupils (M = 3.03, SE = 1.4) on physical appearance. There were no significant differences in the remaining scales (scholastic competence, social acceptance, behavioural conduct). There was no significant multivariate interaction between time and respondent F (5,5) = 2.64, p = .15, $\eta^2 = 0.73$.

3.1.4. Social functioning results

A 2-by-3 mixed ANOVA was conducted on the total SSQ scores with time (pre-therapy versus post-therapy) and respondent (parent versus pupil versus teacher) as the IV's. The ANOVA showed there was no main effect of time, F (1,9) = 2.82, p = .127, $\eta^2 = 0.24$ (pre therapy score = 42.6, SD = 2.6; post therapy score = 39.8, SD = 3.2). The results further showed a trend towards a significant main effect of respondent, F (2,18) = 3.07, p = .07, $\eta^2 = 0.25$), with teacher scores (44.6, SD = 3.8) lower than both the parents' (42.5, SD = 3.1) and children's scores (44.6, SD = 1.8). The ANOVA also showed that there was no significant interaction between respondent and time, F (2,18) = 0.31, p = .74, $\eta^2 = 0.03$.

3.1.5. Behavioural functioning

A mixed ANOVA on the total scores of the difficulty scales of the SDQ was conducted with Time (pre-therapy versus post-therapy) and respondent (teacher versus parent) as the IV's. Results showed there was no significant main effect of respondent, F (1,9) = 2.085, p = .709, $\eta^2 = 0.016$ (parent report = 17.1, SD = 1.47; teacher report = 14.6, SD = 1.6), nor a significant main effect of time, F (1,9) = 0.48, p = .57, $\eta^2 = 0.05$ (pre therapy score = 16.3, SD = 1.7; post therapy score = 15.3, SD = 1.45). The ANOVA also showed there was no significant interaction between time and respondent, F (1,9) = 0.148, p = .709, $\eta^2 = 0.05$.

A separate mixed ANOVA was conducted on the SDQ pro-social subscale scores with respondents (teacher versus parent) and time (pre-therapy versus post-therapy) as the IV's. This was done because as the SDQ manual states that the scores for this subscale should not be combined with the other SDQ scales. The results from the mixed ANOVA showed that the difference between respondents was non-significant, F (1,9) = 1.29, p = .285, and the effect size ($\eta^2 = 0.126$) was small (see Fig. 3). Similarly, there was no significant effect of time, F (1,9) = 3.15, p = .109, $\eta^2 = 0.260$. ANOVA showed that there was a significant interaction between respondent and time on pro-social SDQ score, F (1,9) = 5.19, p = .049, $\eta^2 = 0.366$. A post-hoc paired-samples T-test was conducted to examine the difference between the Teacher scores only which showed they were higher pre-intervention (M = 6.5, SD = 2.84) compared to post-intervention (M = 2.75, SE = 0.22), t (9) = 2.75, p = .022.

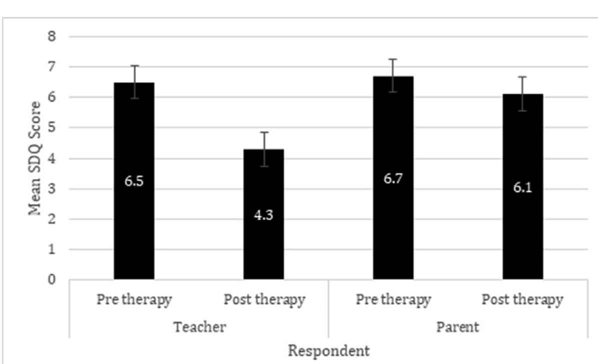

Fig. 3. Graph showing mean scores at pre- and post-intervention for the prosocial scale of the Strengths and Difficulties Questionnaire (teacher and parent versions), with higher scores indicating higher levels of prosocial behaviour. Note the error bars represent standard error of the means.

4. Discussion

The aim of this pilot study was to investigate if a 6-week fascia Bowen therapy improved motor functioning, as well as psychological, social and behavioural functioning, in a sample of boys aged 8–11 diagnosed with DCD. The results showed that motor functioning was improved in the sample of boys with DCD after the fascia Bowen therapy compared with before, such that most of the boys no longer met the motor impairment criteria for DCD after receiving the therapy. However, no improvements were seen in psychological, social or behavioural functioning after the therapy compared to before. Therefore, while the current findings showed that a 6-week fascia Bowen therapy improved muscular functioning in a small group of boys with DCD, these improvements did not extend to further areas of life.

Significant improvement on the MABC-2 scores of the children with DCD was demonstrated from before to after the fascia Bowen therapy sessions. The improvements were seen across all the subscales of the MABC-2, including manual dexterity, aiming, and catching and balance scores. After the study, six of the 10 participating children no longer fell into the category of having a movement difficulty according to their MABC-2 "traffic light" system, and another child showed improvement that resulted in being labelled only in the "at risk" category of movement difficulty after the therapy. The motor improvements generally involved medium to large effect sizes, which was surprising and promising given that previous literature has often not reported strong effect sizes for bottom-up interventions (Novak, 2013; Smits-Engelsman et al., 2013). Together, the present research provides initial evidence for the efficacy of fascia Bowen therapy for improving movement difficulties in children with DCD, although further research in this area including control groups is needed.

The improvement in the children's muscular functioning after the fascia Bowen intervention involved improved manual dexterity, aiming and catching and balance. The present results are consistent with previous studies showing that Bowen therapy improves motor functioning in other specific conditions and groups (Hansen and Taylor-Piliae, 2011), and extends the findings to include DCD. The muscular improvements may translate to better performance in everyday activities for children with DCD, such as reduced clumsiness in the form of falling over and colliding with obstacles, less dropping of objects, and greater chance to participate in games with other children involving ball skills. However, the current results of improved muscular functioning from fascia Bowen therapy did not also translate to improvements in psychological, social and behavioural domains, or in scholastic functioning. The lack of increases in self-esteem, social interaction and behavioural strengths after the therapy may show that fascia Bowen only targets muscular issues in DCD, though in itself this means the therapy is effective in improving the key muscular problems characteristic of DCD. Another explanation for the lack of generalisation of improvements to other areas could also be due to the relatively short 6-week time period of the therapy in the present research for evaluating improvements in psycho-social and scholastic functioning, which may need to be evaluated over many months. Further research is needed to evaluate if improved muscular functioning from fascia Bowen therapy translates into improvements in social, psychological and behavioural areas of life over longer time periods of testing.

4.1. Limitations

A limitation of the present research was that it only included 10 boys with DCD, with no control group included in the study for comparison purposes. Therefore, the results need to be replicated with the inclusion of a matched control group for comparisons, which either does not receive treatment or receives an alternative treatment. The small sample was due to the general difficulties in recruiting sufficient numbers of participants with DCD for therapy purposes, and due to time-limitations as the research was used towards the doctoral thesis of one of the authors (Morgan-Jones, 2015). The study only included males because there is a higher prevalence rate of males than females in DCD. Therefore, replications of the study should also include larger samples of participants with DCD, which should include both boys and girls. Since only one experienced OT assessed all the participants in the present study, there may have been biases in the results due to the familiarity of the participants with the OT and because the OT was aware of the nature of the study. Future research should include larger studies with expanded ages and both genders, as well as procedures to make the OT blind to diagnosis or group. Despite these limitations, the present study has helped provide proof of concept about fascia Bowen therapy in DCD as effective in improving the muscular ability of children with DCD.

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Conflicts of interest

None.

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