

Table 1 Study Objectives

- To investigate the appropriateness of the eligibility criteria, and determine the participant recruitment rate
- To investigate the acceptability and feasibility of this physical rehabilitation programme by determining attendance at face to face sessions, adherence to the home exercise programme, and participant opinion of the effectiveness of individual therapy components
- To assess the suitability of outcome measures proposed for use in a future randomised controlled trial
- To obtain baseline estimates of scores (and standard deviations) on the proposed outcome measures
- To provide preliminary data on the clinical effectiveness of the rehabilitation programme
- To estimate the sample size required for a powered clinical trial to evaluate the effectiveness of this approach

Table 2 – Summary of treatment approaches

Treatment approach	Aim	Description and Equipment	When and how much
Sensory re-education ⁴⁻⁸	Retraining and improving sensory discrimination	Exercises focus on palpating and visualising the weight, size and texture of an object, matching paired dominoes or learning to read braille. <i>Equipment:</i> Common household objects (e.g. a nut, bolt, coin or paper clip), dominoes and learn to read braille books	Patient advised to complete 10 minutes of focused exercise twice a day
Sensory motor retuning (SMR - orthotic) ⁹⁻¹³	Increasing hand representation in the sensory motor cortex	Movement patterns are altered by use of an orthosis that aims to rebalance the hand by blocking the compensating movement and facilitating use and 'retraining' of the dystonic part. <i>Equipment:</i> A bespoke thermoplastic orthosis that blocks the compensating movement (e.g. finger MCPJ hyperextension or wrist flexion)	Orthosis to be worn for at least 30 minutes per day either on its own or in combination with mirror therapy or slow down exercise treatment
Mirror therapy ¹⁴	Re-establishing motor control to assist in retraining movement patterns	Instant visual feedback of an unimpaired movement mirrored on the impaired hand/limb can facilitate re-establishment of motor control by retraining basic movement patterns in a slow and precise manner. The patient visualises the feeling and image of the dystonic side carrying out the specific task of writing or playing a musical instrument. <i>Equipment:</i> A mirror, musical or writing instrument	Patient advised to complete 10 minutes twice a day
Slow down exercise treatment (SDET) ¹⁵	Retraining movement patterns	The task causing the dystonia is repeated at a speed where dystonic movements are not elicited with the hope that the dystonic movement pattern can eventually be "overwritten." The MD subjects play a piece very slowly and record the speed (using a metronome) in beats per minute. After two weeks, the speed is increased by 10% and if there are no increases in dystonic symptoms then	30 minutes per day

		<p>incremental speed increases occur every fortnight. The focus is on precision and accuracy of movement patterns, not on playing speed.</p> <p>For the WD subjects the subjects undertook slow writing retraining, using a loose relaxed tripod grip, large free movements coming from the shoulder and elbow and a variety of writing implements and surfaces. Slow writing in an exercise book or large sheets of paper that are on a high, low or sloped work surface are used to write letters such as Aa, Bb, Cc and shapes such as circles, loops and ellipse.</p> <p><i>Equipment:</i> MD: musical instrument and metronome; WD: variety of writing implements (e.g. pencil, pen, marker, paint brush) and writing surfaces (e.g. paper, white board, sloped writing board).</p>	
Soft tissue massage (STM)	To decrease myofascial pain (tender, taut bands and trigger points). ¹⁶	Patients affected by TSD may have myofascial pain due to the severity of or trying to compensate for the involuntary movements. STM administered by hand therapist in treatment sessions.	Ten minutes of STM administered per treatment session
Ultrasound therapy (UST)	To decrease levels of myofascial pain and trigger points.	Ultrasound therapy used in combination with soft tissue massage has been shown to have an immediate effect when treating latent myofascial trigger points. ^{17,18} Administered by hand therapist in treatment sessions.	Ten minutes of UST administered per treatment session.
Forearm muscles stretches	To decrease myofascial tension and pain	Forearm flexor and extensor muscle stretches ¹⁶ one repetition of each stretch five times a day with a ten second hold in each position at the end of range (but not going into hypermobile range). Exercises were taught within the therapy sessions and incorporated into the HEP	One forearm flexor and one forearm extensor muscle stretch five times a day with a thirty second hold at the end of range

			(taking care not to go into hypermobile ranges.)
Shoulder exercises	Increase freedom of movement in the shoulder girdle	Tension in the shoulder girdle is often a secondary symptom of TSD. Compensating movement patterns can be employed in an attempt to stabilise the affected body part. Scapulo-humeral rhythm exercises ¹⁹ require the subject to lean over and in a relaxed manner, using inertia, to carry the arm forward and backwards, side to side and in a circular motion. These exercises were taught within the therapy sessions and incorporated into the HEP	Five minutes twice a day of the paired shoulder exercises positions (forward and backwards, side-to-side and circular motions.)
Hand strengthening exercises (putty)	To increase proprioceptive awareness and strength of intrinsic hand muscles	Whilst TSD is not due to muscular weakness the affected hand can show signs of weakness or altered proprioception due to the involuntary motions, altered functional hand movements and decreased ability to perform specific tasks. The functional value of strengthening exercises in muscles that are affected by a myopathic process has been supported. ²⁰ These exercises were taught within the therapy sessions and incorporated into the HEP	5 minutes twice a day.

Table 3 - Clinical characteristics for recruited participants (n = 12)

	Musicians Dystonia (n = 7)	Writers Dystonia (n=5)
Gender	4 male / 3 female	0 male / 5 female
Age: mean years (sd)	45 (13.9)	57.2 (3.5)
Age of dystonia onset: mean years (sd)	41.6 (11.9)	43.4 (8.0)
Time from symptom onset to diagnosis: mean years (sd)	2.9 (1.9)	5.0 (0.6)
Past use of botulinum toxin: n (%)	0 (0%)	5 (100%)
Instrument played:		
Piano	4 (58%)	N/A
Guitar	2 (28%)	
Flute	1 (14%)	
Style of music played:		
Classical	6 (76%)	N/A
Rock	1 (14%)	
Affected body part: n (%)		
Small finger	1 (14%)	2 (40%)
Middle finger	1 (14%)	1 (20%)
Small and ring fingers	4 (58%)	1 (20%)
Wrist and middle finger	1 (14%)	1 (20%)

Data pertains to all participants who completed the study; N/A not applicable

Table 4 - Changes in clinical outcomes at baseline, three and six months (n=12).

Scale (Available scale range)	N	Baseline Mean (sd) Median (IQR)	3 Months Mean (sd) Median (IQR)	Effect Size (Baseline – 3 months)	6 Months Mean (sd) Median (IQR)	Effect Size (Baseline – 6 months)
Arm Dystonia Disability Scale (0-100%, higher score = less disability)	12	66.07 (13.85) 72.86 (52.50, 77.14)	70.0 (12.57) 77.14 (62.14, 77.14)	0.28	69.25 (11.65) 73.0 (57.0 , 80.0)	0.23
Tubiana-Chamagne Scale* (0-5, higher score = less disability)	7	2.86 (1.07) 3.0 (2.0, 4.0)	3.0 (1.15) 3.0 (2.0,4.0)	0.13	3.43 (0.98) 3.0 (3.0, 4.0)	0.53
Brief Illness Perception Questionnaire (0-80, higher score = more threatening view of the illness)	12	50.67 (8.97) 49.50 (41.75, 55.75)	47.25 (10.23) 45.0 (39.25, 55.50)	0.38	44.33 (10.39) 46.50 (38.50, 51.25)	0.71
Health State (EQ-5D 5L) (0-1, 1 = complete health)	12	0.79 (0.15) 0.79 (0.70, 0.90)	0.84 (0.13) 0.86 (0.85, 0.92)	0.34	0.88 (0.9) 0.91 (0.84, 0.94)	0.59
Video score (1-4, higher score = greater impairment)	12	2.5 (0.78) 2.75 (2.75, 3.19)	NA	NA	1.98 (0.81) 1.88 (1.06, 2.75)	0.78
Clinical Global Improvement Scale (0-7, where 0 = very much improved and 7 = very much worse)	12	NA	3.08 (0.51) 3.0 (3.0, 3.0)	NA	2.58 (0.99) 2.5 (2.0, 3.0)	0.97

* Scale only completed by musicians; NA = Not assessed Table 5 - Overview of qualitative results

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Themes	Sub themes	Indicative quotes
The impact of dystonia	Work life	<p><i>"I cannot perform any more or demonstrate in lessons. Playing is hard work, it knocks me out, and I do not loosen up as the time progresses – it becomes painful."</i> (012, male, MD)</p> <p><i>"My second and ring fingers can claw into my palm and my brain freezes for two minutes or so and I cannot write and I have to consciously think through how to write and this feels very bizarre."</i> (003, female, WD)</p>
	Emotional wellbeing	<i>"I feel I have a hole inside me. I am completely gutted that I can't play the piano like I used to."</i> (001, male, MD)
Individuals respond differently to specific treatment techniques	Slow down exercise therapy (writing retraining)	<i>"Using white board markers and chunky pens really helps when writing as does the Coban tape on my thumb, index finger and middle finger; all together it helps a lot."</i> (008, female, WD)
	Mirror therapy	<i>"When using the mirror, I realise how small the movements with the affected finger need to be and so I am practicing contrary motion looking at the unaffected hand and visualising the movements in the affected side."</i> (001, male, MD)
	Sensory re-education	<i>"Sensory re-education is boring and mirror therapy/or playing with my guitar strung up the other way is frustrating as it highlights the problems that the left hand has as the right hand can move so freely and easily."</i> (012, male, MD)
Changes require persistence and take time	Small changes	<i>"No big improvements but I am doing exercises every day and I think there is a slight improvement overall."</i> (011, female, MD)
	Larger changes	<i>"I've made big improvements. I have already been able to play certain passages that I have not played for 4-5 years with more ease ... I played freely and felt almost entirely normal."</i> (003, male, MD)