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Case Report

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Effect of soft hand splint (lycra) for stereotypic hand behaviour in children with dystonia: case report

Abstract

Introduction: Dystonia in children's causes involuntary movement, cramps or tremor in the hand or arm muscles usually when making highly practiced hand movements such as writing or playing a musical instrument. It is a movement disorder in which involuntary sustained or intermittent muscle contractions cause twisting and repetitive abnormal postures or both. Hand splints can maintain optimum biomechanical alignment of hand to keep it in functional position and enable children to overcome activity limitation and participation restriction by focusing training on unrestricted parts of their bodies over which they have better control. Here a dynamic lycra splint based on neurofacilitation of developmental reactions technique with an aim to stabilize the wrist into greater midline and enabling improved alignment of the finger flexors and extensor muscles was designed.

Place of study: Occupational Therapy Department, NIOH, Bonhooghly, Kolkata-90.

Duration of study: 3months.

Study design: Pre-test- post-test experimental study design.

Study tools: Modified Ashworth Scale (MAS), Modified Jebsen's Taylor Hand Function Test (M-JTHFT).

Study technique: A written informed consent was taken from both the subject who agreed to participate. The therapy sessions frequency was 45minutes/day, 5days/weeks for 03-months. The lycra splint (either with or without zipper) were used only while performing functional task in the department of occupational therapy.

Results: The post-test shows that the abnormal maximal tone significantly reduced MAS and improves the score of M-JTHFT.

Conclusion: The Lycra Splint designed was considered to have a significant effect in the treatment of Dystonic Hand and also has a significant effect in reducing spasticity, controlling stereotypic hand behaviour and improving hand function. The children's with disabilities due to dystonia and in school can improve their hand-writing skills and other hand function if wear lycra splint that fabricated by qualified occupational therapist.

Keywords: soft splint, lycra, hand behavior,dystonia

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Abbreviations: MAS, modified ashworth scale; M-JTHFT, modified jebsen's taylor hand function test; CP:, cerebral palsy

Introduction

Dystonia is defined as a movement disorder in which involuntary sustained or intermittent muscle contractions cause twisting and repetitive abnormal postures or both.[1] It usually occurs during voluntary movement or with voluntary maintenance of a posture of the limbs or body. A dystonic may or may not have increased resistance to movements so that it may be either stiff or floppy or change with time.[2] Dystonia may occur as a primary condition (idiopathic dystonia) that is familial or occurs in the absence of a family history. It may result from certain environmental factors or "insults" that affect the brain (secondary or symptomatic dystonia). Dystonia may be associated with certain non-degenerative, neurochemical disorders (known as "dystonia-plus syndromes") that are characterized by neurologic features, such as Parkinsonism or myoclonus. Dystonia is also a primary feature of certain, usually hereditary, neurodegenerative disorders (so-called "heredodegenerative dystonias").[3]

Dystonia may affect one area of the body, and is known as "Focal Dystonia", if more than one part of the body is involved it is known as "Generalized Dystonia"[2]. In Focal hand dystonia, abnormal movement are initiated by an attempt to carry out a specific motor skill within particular context which is not explained by diminished practice effort and it cannot be circumvented by any masking strategy [4]. Dystonia may occur in an attempt to move the part, which produces the wrong pattern of muscle activity and results in a movement different from the intended one. For e.g. attempted flexion of the fingers to hold a pen may lead to flexion of additional fingers, extension of the wrist or movement of the hand or the neck. 'Spooning' during which the fingers of the hand are bent backward with the wrist flexed, elbow and wrist flexion with the hand held near the body are some of the characteristic postures in dystonia. A dystonic movement of one limb may be triggered by an attempted movement of a different limb. For example, a dystonic movement of the right hand may occur while the left hand is performing a rapid movement. Dystonic movement must be observed at rest, with action of the parts of the body affected by dystonia.[2] Dystonia can lead to sustained, abnormal fixed postures or positions of affected body regions, potentially causing permanent contractures.[3]

Lycra is a brand name (made by Invista) of Spandex or Elastane which is a synthetic fibre known for its exceptional elasticity. It is

strong but less durable than natural. The name "Spandex" is an anagram of the word "expands". It is the preferred name in North America; in many European countries it is referred to as" Elastane", and is known in Britain mainly as "Lycra". It is a polyurethane-polyurea copolymer that was developed in 1959 by Chemists CL Sanquist and Joseph Shivers at DuPont's Bengers Laboratory in Waynesboro, Virginia. Spandex fibres are produced in four different ways: melt extrusion, reaction spinning, solution dry spinning, and solution wet spinning. All of these methods include the initial step of reacting monomers to produce a prepolymer. Once the prepolymer is formed, it is reacted further in various ways and drawn out to make the fibres. The solution dry spinning method is used to produce over 94.5% of the world's spandex fibres.[5]

No specific study on the effectiveness of lycra splint on dystonic hand has been done. But the effectiveness of lycra splint/garments on several cases of children with Cerebral palsy has been made. Lycra material has been effectively used to improve proximal stability and function in children with cerebral palsy and also for normalization of tone in related cases. Blair E, et al.,[6] did a study to describe a study on the UP suit, a proximal stability splint fabricated from Lycra, in the management of children with cerebral palsy. It resulted in an improvement in posture and reduction of involuntary movement immediately. The amount of functional improvement depended on the type and severity of impairments, the subject's attitude, their capacity for purposeful intent and compliance.[6]

Elliott C, et al.,[7] did a study to determine changes in upper limb movement substructures that denote fluency of movement in children with cerebral palsy (CP) following lycra splint wear. A significant difference was observed between baseline and three months of lycra splint wear in the movement substructures; movement time, percentage of time and distance in primary movement, jerk index, normalised jerk and percentage of jerk in primary and secondary movements. The results indicate that lycra arm splinting induced significant changes in movement substructures and motor performance in children with cerebral palsy.[7]

Hand splints can maintain optimum biomechanical alignment of hand to keep it in functional position and enable children to overcome activity limitation and participation restriction by focusing training on unrestricted parts of their bodies over which they have better control. So the need to incorporate strategies such as appropriate splinting is a must. Although there are many custom made hand splints available, but they are of little help. They either lack the provisions to overcome the effect of tonal influences on hand posture with change in position, or are very expensive with poor acceptance rate. So a dynamic lycra splint based on neurofacilitation of developmental reactions technique with an aim to stabilize the wrist into greater midline and enabling improved alignment of the finger flexors and extensor muscles was designed.

Case presentation

Place of study

Occupational Therapy Department, NIOH, Bonhooghly, Kolkata-90.

Duration of study

3months (case study 02 no's)

Study design

Pre-test- post-test experimental study design.

Parameters to be studied

MAS: Modified Ashworth Scale for tone, M-JTHFT: Modified Jebsen's Taylor Hand Function Test for completion of some task (30 parts maximum).

Study techniques

The aim of the study and procedure was explained to parents of the dystonic child and a written informed consent was taken from both the subject who agreed to participate. The maximal tone of long flexor of hand was measured by using Modified Ashworth scale (MAS) and hand function ability by using Modified- Jebsen's Taylor Hand Function Test (M-JTHFT) that evaluates the ability to grasp, hold, move, and place large objects and tests the coordination by reaching and holding placing of small objects such as coin etc.

Therapy session

Therapy duration-45minute, Therapy sessions frequency will be 5days/weeks for 03-months. Child having dystonia was sited comfortably on the chair and hand supported on a table. The lycra splint (either with or without zipper) were used only while performing functional task in the department of occupational therapy.

Sample- 1

Material used: Lycra splint with zipper.

Objective: To keep the hand either in a functional position (i.e. 20-30degree of wrist extension, MCP in 90degrees of flexion and the thumb in abduction) or in a slight wrist extension and thumb in abduction (Figure 1-3).

Figure 1 Starting position.

Figure 2 Mid position.

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Figure 3 Final position.

Advantages:

i. The attachment of zipper makes donning and doffing easier.

ii. This can also reduce spasticity in Spastic hand as well as stabilization of the joints and help in controlled movement of the fingers.

iii. With the hand in functional position, it helps grasping objects and other hand functions easier to perform.

iv. It can stretch thumb web space and prevent from contracture.

v. It can also reduce spasticity of hand by keeping the thumb in extension.

Disadvantages:

i. Stitching of the desired pattern is difficult.

ii. Perspiration is one of the complaints as perforated lycra not available.

iii. Loose fitting design and ineffective pull of zipper can reduce optimum effectiveness of the splint.

Sample- 2

Material used: Lycra splint without a zipper.

Objective: To stabilize the joints and produce controlled movements of the hand (Figure 4 & 5).

Advantages:

i. This produces proximal stability of the joints in dystonic hand.

ii. This type of splint allows individual finger movements.

iii. With hands in stable position, this splint allows better hand function.

iv. Cosmetically acceptable.

Disadvantages:

i. Donning and doffing is difficult as no zipper is attached.

ii. Comfortability is less due to tight fitting.

iii. Perspiration is one of the complain as perforated lycra is not available.

iv. Stitching of the desired pattern is difficult.

Figure 4 Wrist in functional position.

Figure 5 Independent finger movement and doffing.

Result and discussion

The post-test shows that the abnormal maximal tone significantly reduced MAS, and improves the score of M-JTHFT as shown in the Table 1. In sample 1 donning-doffing was easy due to the attachment of zipper. But ineffective pull of zipper hampered optimum functioning. Hand function was easy with the hand in functional position but loose fitting design hampered appropriate prehension. In sample 2 independent finger movement was possible with significant control of stereotypic hand movements. But absence of zipper made it difficult to put on. In both design perspiration was a common problem and stitching of the desired pattern was difficult. Both the samples were tried during functional movements like holding and placing of wooden pegs, turning objects and/or blocks, writing practice on papers etc. to observe the effectiveness of the splint.

Table 1 Showing Pre-test, Post test data of MAS and M-JTHFT in sample-1 and sample-2

Variable	Child Age	MAS		M-JTHFT	
	(In Years)	MAS (0)	MAS (3)	M-JTHFT (0)	M-JTHFT (3)
Sample 1	8	3	1+	30-Mar	17/30
Sample 2	10	2	1	30-May	22/30

MAS (0): Modified Ashworth Scale score at pre-test

MAS (3): Modified Ashworth Scale score at post-test after 03 months

M-JTHFT (0): Modified Jebsen's Taylor Hand Function Test score at pre-test

M-JTHFT (3): Modified Jebsen's Taylor Hand Function Test score at post-test

Conclusion

The Lycra Splint designed was considered to have a significant effect in the treatment of Dystonic Hand and also has a significant

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effect in reducing spasticity, controlling stereotypic hand behaviour and improving hand function. The children's with disabilities due to dystonia and in school can improve their hand-writing skills and other hand function if wear lycra splint that fabricated by qualified occupational therapist.

Limitation

i. Only two soft splints (Lycra splint) were tried.

ii. A better design and stitching would have been more beneficial.

iii. The splints were used only while performing functional task.

Recommendation

i. Larger number of sample will give a better conclusion.

ii. Perforated material to reduce perspiration would be more comfortable.

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Conflicts of interest

Author declares there are no conflicts of interest.

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