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Original article

Assessment of Biomechanical Measures using Beighton Scale in Down syndrome

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ABSTRACT

Background: Down syndrome is a set of physical and mental traits caused by a gene problem that happens before birth. Down syndrome is caused by a problem with a baby's chromosomes. Children with Down syndrome demonstrate many musculoskeletal differences. The most common abnormality is joint hypermobility. This joint hypermobility in Down syndrome children is measured using Beighton scale. The Beighton Hypermobility scale (BHS) requires the performance of 5 maneuvers (4 bilateral and 1 body flexion, for a total of 9). Our aim was to measure joint hypermobility in Down syndrome children. Our objectives were to assessment of biomechanical measures in children with Down syndrome

Result: The study included 15 participants out of which 4 maneuvers in the Beighton scale were not significant. Placing hands on the floor without bending the knee one of the maneuver of the Beighton scale is extremely significant.

Conclusion: From this study it concluded that Biomechanical Measures were not significantly affected in Down syndrome.

Keywords: Down syndrome, joint hypermobility and Beighton Scale.

Introduction:

My Extra Chromosomes Makes me Extra Cute!

Down syndrome is a set of physical and mental traits caused by a gene problem that happens before birth. Down syndrome is caused by a problem with a baby's chromosomes.[1]Down syndrome is a chromosomal disorder resulting in 47 chromosomes instead of 46. Commonly called trisomy 21, Down syndrome results from faulty cell division affecting the 21st pair of chromosomes.[6] Children with Down syndrome demonstrate many musculoskeletal differences. The most common abnormality is joint hypermobility.

Joint hypermobility (JH) or 'ligamentous laxity' is felt to be an underlying risk factor for many types of musculoskeletal presentation in pediatrics, joint hypermobility syndrome (JHS) describes such disorders where symptoms become chronic, often more generalized and associated with functional impairment.[3]

The frequency of musculoskeletal disorders (MSDs) arising from such hypermobility in childhood is quite variable, both across population and within individuals.[4]

This joint hypermobility in Down syndrome children is measured using Beighton scale. The 9-point Beighton hypermobility score (BHS) is the most widely used system for the diagnosis of joint hypermobility in children. The standard methodological evaluation using the BeightonHyermobility scale (BHS) requires the performance of 5 maneuvers (4 bilateral and 1 body flexion, for a total of 9).

The administration of the BHS uses a standardized procedure and employs a systemic promoting strategy. The examiner demonstrates the maneuver to the examinee and the examinee performs the maneuver.[5]

Methodology:

The participants were recruited from Abilashaschool and V.B. Indian Society for Mentally retarded, Mumbai.

A total of 15 boys and girls, diagnosed with Down syndrome between the age of 7 to 12 years who can follow simple instructions.

Beighton Scale:

The Beighton scale includes 5 maneuvers:

- Passive dorsiflexion of the 5th MCP> 90^0
- Passive dorsiflexion of the thumb to the flexor aspect of the ipsilateral forearm
- Hyperextend the elbow>10^0
- Hyperextend the knee>10^0
- Place the hands flat on the floor without bending the knees

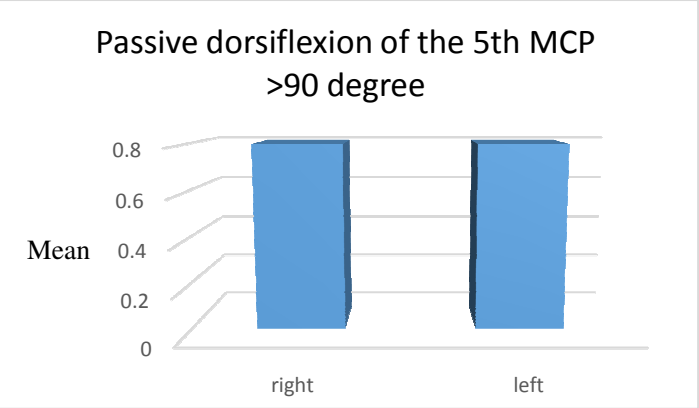
Beighton scale is 9 point scoring scale in which first 4 maneuvers - Passive dorsiflexion of the 5th MCP> 90^0, Passive dorsiflexion of the thumb to the flexor aspect of the ipsilateral forearm, Hyperextend the elbow>10^0, Hyperextend the knee>10^0 are performed bilaterally; and the last maneuver - Place the hands flat on the floor without bending the knees is a whole body flexion.

If the participant was able to perform they were scored 1 and if the participants were not able to perform they were scored 0.

Results:

Table no.1: Passive dorsiflexion of the 5th MCP >90 degree

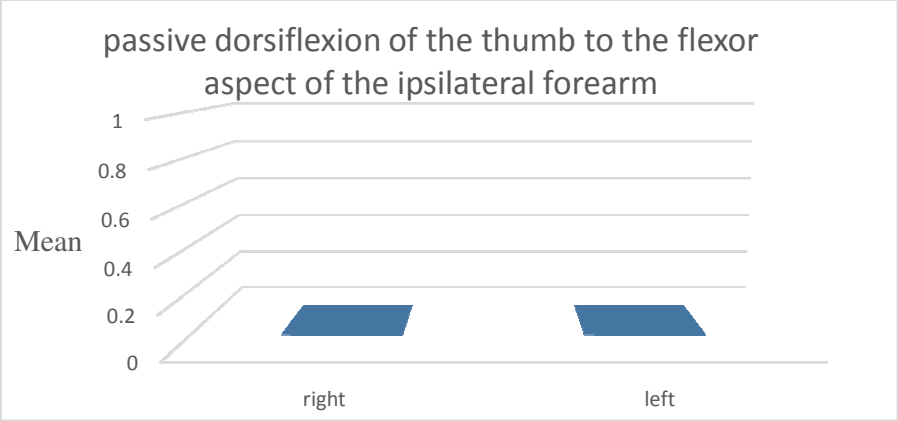
Passive dorsiflexion of the 5th MCP >90 degree	Mean	p value	t value	Result
Right	0.8	>0.9999	0.0000 with 28^0 of freedom	not significant
Left	0.8			



Graph 1: represents that on comparison between right and left passive dorsiflexion of the 5th MCP >90^0 using unpaired t test in which p value >0.9999 and t value is 0.0000 with 28^0 of freedom, considered not significant.

Table no.2: Passive Dorsiflexion of the thumb to the flexor aspect of the ipsilateral forearm

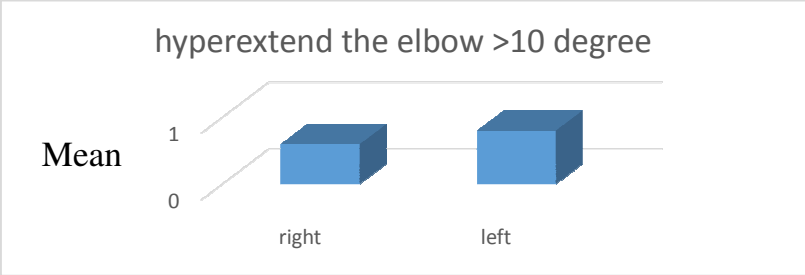
Passive dorsiflexion of the thumb to the flexor aspect of the ipsilateral forearm	Mean	Result
Right	0	Not significant
Left	0	



Graph 2: represents that on comparison between right and left passive dorsiflexion of the thumb to the flexor aspect of the ipsilateral forearm is not significant as one column of SD is zero.

Table no.3: Hyperextend the elbow>10^0

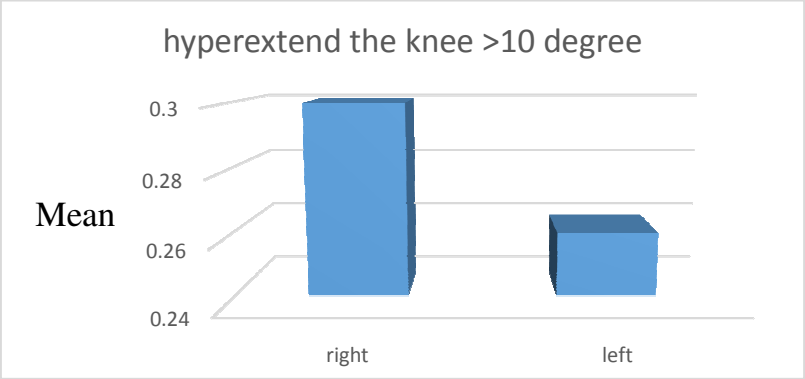
Hyperextend the elbow>10^0	Mean	p value	t value	Result
right	0.6	0.4265	0.8069 with 28 degrees of freedom	not significant
left	0.8			



Graph 3: represents that on comparison between right and left hyperextension of the elbow >10^0 using unpaired t test in which p value is 0.4265 and t value is 0.8069 with 28 degrees of freedom, considered not significant.

Table no.4 Hyperextend the knee >10 degree

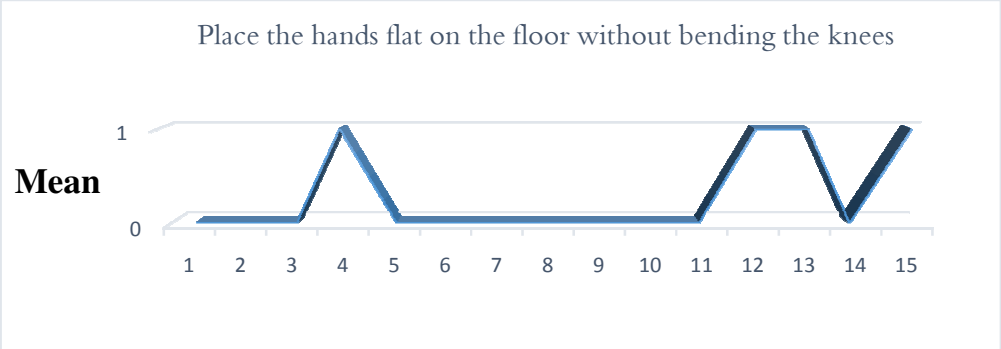
hyperextend the knee >10 degree	Mean	p value	t value	Result
Right	0.3	0.7025	0.3859 with 28 degree of freedom	not significant
Left	0.26			



Graph 4: represents that on comparison between right and left hyperextension of the knee > 10^0 using unpaired t test in which p value is 0.7025 and t value is 0.3859 with 28 degree of freedom, considered not significant

Table no. 5: Place the hands flat on the floor without bending the knees

Place the hands flat on the floor without bending the knees		p value	t value	Result
1	0	<0.0001	6.662	Extremely Significant
2	0			
3	0			
4	1			
5	0			
6	0			
7	0			
8	0			
9	0			
10	0			
11	0			
12	1			
13	1			
14	0			
15	1			



Graph no. 5: Shows that only four participants were able to place the hands flat on the floor without bending the knees, which is extremely significant with p value <0.0001 and t value 6.662

DISSCUSSION:

A sample consisting of 15 participants were assessed using Beighton Scale for joint hypermobility syndrome. They were assessed on all 5 components of Beighton Scale.

Passive dorsiflexion of the 5th MCP >90^0 was not significant because ROM of the little finger is generally lesser than the other digits.

Passive dorsiflexion of the thumb to the flexor aspect of the ipsilateral forearm came not significant because interpalangeal joints of the thumb are more stable and the ligaments around it also helps to prevent the hypermobility .Hyperextension of the elbow >10^0 came not significant because three ligaments medial collateral ligament, lateral collateral ligament and annular ligament that surrounds the elbow joint prevent the hyperextension of the elbow.

Hyperextension of the knee >10^0 was not significant because stability of the knee joint is due to its ligaments. This ligaments around the knee joint must be taut, which is the main reason that prevent the hyperextension of the knee. The fifth maneuver 'placing the hands flat on the floor without bending the knees' came extremely significant, reason could be that joint hypermobility is due to abnormal collagen found in Down syndrome. Collagen is the major protein that makes up ligaments, tendons, cartilage, bone and the support structure of the skin. One of the types of collagen (type VI) is encoded by a gene found on the 21st chromosome. The resulting effect in people with Down syndrome is increased laxity, or looseness of the ligaments that attach bone to bone and muscle to bone.

A study conducted by Ken Pitetti et al on "Measuring joint hypermobility using Beighton scale in Intectually disable children" had mentioned that a significant difference was seen between the participants with and without Downs Syndrome, with a greater score on Beighton scale for participants with downs syndrome.

CONCLUSION:

From this study it concluded that Biomechanical Measures were not significantly affected in Down syndrome.

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