Original Article International Journal of Paediatric Orthopaedics 2018 July-Dec;3(2):9-11

Reliability of Beighton's Score in a Pediatric Population

Nimesh G Patel[1], Peter Riddlestone[1], Roshan Gunalan[1], Anthony Gough[1], James Metcalfe[1], Ben Holroyd[1]

Abstract

Introduction: Beighton's score (BS) is a valid screening tool in an adult population, but its use in pediatrics to assess generalized joint mobility is not fully validated. The correlation of hypermobility and joint pain in children is also not fully understood. We, therefore, aim to investigate the reliability of BS in the pediatric population.

Materials and Methods: Over a 3-month period, children presenting to our pediatric orthopedic unit had their BS measured by a trained orthopedic surgeon. Non-ambulatory children were excluded, as were those with known hypermobility syndrome or neuromuscular disorders.We also screened them for joint pain and measured their lower limb rotational profile.

Results: A total of 200 patients (92 males and 108 females) were assessed, aged between 3 and 15 years (mean 10.1). Mean standard deviation (SD) BS was 2.06 (2.2), and the range was 0–8. Comparing males versus females, mean BS SD was 1.71 (2.25) versus 2.36 (2.14); p=0.0378, age was 9.75 versus 10.13, and BS range was 0–7 versus 0–8.64 children (32%) complained of pain in at least one joint, though the mean SD BS in these patients was 1.71 (1.86).

Discussion: We found that the average BS was just over 2 in all of our children, though significantly lower in males.In adults, a score of 4 or higher has been attributed to generalized hypermobility, though a true diagnostic cutoff has not been defined in children.Since there is already an innate tendency to have an increased BS in normal children, it makes interpretation of the score in a pediatric population difficult and less meaningful.Of note, there was no correlation between arthralgia and a high BS or abnormal lower limb rotational profile.We therefore do not recommend routine measurement of BS to diagnose hypermobility in a pediatric population.

Keywords: Beighton's score, hypermobility, joint laxity, pediatric population

Introduction

The Beighton score (BS) was originally described as an assessment tool modified from the technique described by Carter and Wilkinson in 1964 in patients suffering from Ehlers-Danlos syndrome, to screen for hypermobility[1]. It mostly described adult patients, and therefore, its use in a pediatric population has not been truly validated. Considerable variation in therange of movement is possible within joints of normalchildren, varying between gender (females more mobile) and ethnicity, though joint laxity is thought to decrease with age[2]. Up to 15% of "normal" children have hypermobile joints; those that have symptoms, where no other cause is found, are defined as having benign joint hypermobility syndrome[3]. Although common, it is generally under-recognizedin the primary care setting and therefore poorly managed. For the majority of children, this may bear no consequence, though polyarticular hypermobility may still persist into adulthood in up to 30% of cases[2]. It is well documented that children with joint hypermobility predominantly complain of cramp-like pain, especially in leg muscles during or after activity. The level of this is thought to relate to the level of hypermobility and tends to resolve in adult life[1]. Children may also present with "clicking or cracking" joints andswellings around a joint and fatigue[4]. They, therefore, have lower health-related quality of life scores[5]. Treatment is, hence, warranted and usually encompasses a multidisciplinary approach including physical therapy, activity modification, and analgesia[5]. The dilemma is therefore diagnostic. An objective assessment is useful, taking into account their level of pain or fatigue, muscle length, and strength, as well as assessing function. Of coursejoint range of movement needs to be assessed and the British Society for Pediatric and Adolescent Rheumatology state that the BS may be useful in this[6]. How applicable this is in a pediatric population is still not fully understood. We, therefore, aim to investigate the reliability of BS in the "normal" pediatric population and assess for any correlation with joint pain as a secondary outcome.

[1]Department of Paediatric Orthopaedics Derriford Hospital, Plymouth, UK

Address of Correspondence
Dr. Nimesh Patel,
Department of Paediatric Orthopaedics Derriford Hospital Plymouth, UK
E-mial: dr.nimeshpatel1@gmail.com

Materials and Methods

Over a 3-month period, all children presenting to our

Table 1: BS system		
Test	Right	Left
Passive dorsiflexion of 5th metacarpophalangeal joint to >90°	1	1
Opposition of the thumb to the volar aspect of the ipsilateral forearm	1	1
Hyperextension of the elbow to >10°	1	1
Hyperextension of the knee to >10°	1	1
Place hands flat onto floor without bending knees	1	
Total	9	
BS: Beighton's score		

regional pediatric orthopedic unit had their BS measured prospectively by a trained orthopedic surgeon (one of 2 consultants or residents) as part of theroutine clinical examination. The outline of the score is demonstrated in Table 1. According to the original criteria, a score of 4 or more out of 9 is diagnostic of joint hypermobility[7]. The methodology of theexamination was discussed between the team and standardizedto improve consistency. Passive movements were used, and the techniques were as described in Beighton's original paper[1]. The children were tested following a visual demonstration by the examiner so that the child knew what to expect. With consent, these scores were collaborated on our database along with age, gender, and other diagnoses. Non-ambulatory children were excluded, as were those with known hypermobility syndrome, neuromuscular disorders, scoliosis, and congenital hip dysplasia or dislocation.

We also screened them for joint pain as a secondary outcome to assess whether there was any correlation between pain and BS. Analysis was performed using a Microsoft Excel spreadsheet (Microsoft Corporation, Redmond, Washington), and statistical analysis was performed using an unpaired t-test with GraphPad InStat software (GraphPad, La Jolla, California) and 95% confidence interval. A $p<0.05$ was considered statistically significant.

Results

A total of 200 patients were assessed. They aged between 3 and 15 years (mean 10.1). There were 92 males and 108 females, and their details along with the results are outlined in Table 2. The mean standard deviation (SD) BS was 2.06 (2.2), and the range was 0–9. Comparing males to females, the mean BS SD was significantly lower in males, at 1.71 (2.25) in males, and 2.36 (2.14) in females p=0.0378. The mean age of males was 9.75 and that of females was 10.13.The range of BS in males was 0–7 compared to 0–9 in females. 64 children (32%) complained of pain in at least one joint, though no patients complained of pain during the time of review. Except for 7 patients complaining of pain in both knees, the remainder only suffered from pain in a single joint. The mean SD BS in the patients suffering from occasional joint pain was 1.71 (1.86).

Table 2: Results summary		
Patients	Male - 92	Female - 108
Mean age (years)	9.75	10.13
Age range (years)	Mar-15	
Mean BS (SD)	2.06 (2.2)	
	1.71 (2.25)*	2.36 (2.14)
Range	0-7	0-9
BS: Beighton's score		

Discussion

We found that the average BS was just over 2 in all of our children, though significantly lower in males [4]. In adults, a score of 4 or higher has been attributed to hypermobility, though a true diagnostic cutoff has not been defined in children. Since there is already an innate tendency to have an increased BS in children, it makes interpretation of the score in a pediatric population difficult, less reliable, and less meaningful. We have demonstrated that even a "normal" or asymptomatic child can be labelled "hypermobile" based on their BS. This can be explained by the connective tissue structures in children being generally looser and therefore causing hypermobile joints, especially compared to adults. The soft tissue around a hypermobile joint can also be placed under more stretch, and therefore, be attributable for pain experienced by some hypermobile children[4]. Of note, we noticed no correlation between joint pain and a high BS. In fact, we found that the mean BS in those children describing pain was lower than the rest of the cohort. This puts into question whether there is a true link of joint pain in children attributed to hypermobility, or whether there could be another cause. These include idiopathic, growth related, inflammatory conditions, or syndromic[4]. Of course, it would be left to the physician to investigate this if pain was the predominant symptom. The criticism of the original Beighton paper is that it did not include detailed explanations of the tests and it does not define criteria for diagnosing hypermobility syndrome, thussimply, it is a descriptive rather than diagnostic test. This means that it can be inconsistent and difficult to interpret. However, a large population-based study of 1300 children utilizingdiffering methods of Beighton testing between examiners demonstrated a good intertester reproducibility when following the standardizedprotocol[8]. The tests also utilizevisual judgement on the amount of joint mobility (or hyperextension) rather than theformal measurement with a goniometer (to assess 10° of hyperextension). However, there is evidence that there is concurrent validity between goniometer measurements in degrees and visual judgement when assessed over a single joint, and therefore, would not be a confounding factor[9]. Two of the limitations of this study include having multiple examiners/testers, as well as only using clinical judgement to

assess joint range of movement. The points mentioned above address the little impact that these have on our results. Another limitation is the fact that we assessed and examined children who presented to our clinic for another issue, rather than asymptomatic children in the community. The total number of children examined was also small, taking into account the age range and gender division. There would be smaller numbers if divided into age subgroups. An interesting observation and scope of a further study would beinvestigated if BS and age were inversely proportional, but much higher numbers would be required to make this conclusion. In Carter and Wilkinson's original study, they found a 7% prevalence of joint laxity in 285normal (control) children aged 6–11 years using their criteria for generalizedjoint laxity. They also found neitherdifference between sexes nor a change in prevalence with age[10]. Ruth Wynne-Davies carried out her study using the Carter and Wilkinson criteria on just over 3000 children (controls) ranging from 1 weekto18years. She reported that children were most lax jointed at 2 years. By the age of 6, only 5% of normal children had laxity, and by the age of 12, <1% were affected[11]. There is scope for a larger population using BS based on these findings to truly investigate the correlation with hypermobility since it is well known and more widely used and quoted. Since children have an innate tendency to have more mobile joints than adults, it may thereforebe more reliable to change the criteria and use a higher BS fordiagnosing hypermobility as suggested in the study by Junge et al., where a cutoff of more than 5/9 was used[8]. Moreover, the more comprehensive "Brighton" score incorporates the potential multisystemic nature of hypermobility syndrome[12]. The "Brighton" score, when combined withBS using the higher diagnostic score of 5/9, could be the more reliable scoring system.

Clinical relevance

We would not recommend routine measurement of BS to diagnose and assess hypermobility in children. It has a role as part of the overall assessment of children when evaluating joint hypermobility syndrome, alongside a systemic assessment. This opens the scope for a larger population-based study.

References

1. Beighton P, Horan F. Orthopaedic aspects of the Ehlers-Danlos syndrome. J Bone Joint Surg Br 1969;51:444-53.

2. Hakim AJ, Sahota A. Joint hypermobility and skin elasticity: The hereditary disorders of connective tissue. ClinDermatol 2006;24:521-33.

3. Kirk JA, Ansell BM, BywatersEG.The hypermobility syndrome, Musculoskeletal complaints associated with generalized joint hypermobility.Ann Rheum Dis 1967;26:419-25.

4. Cattalini M,Khubchandani R,CimazR.When flexibility is not necessarily a virtue: A review of hypermobility syndromes and chronic or recurrent musculoskeletal pain in children.PediatrRheumatol Online J2015;13:40.

5. Palmer S, Bailey S, Barker L, Barney L, ElliottA.The effectiveness of therapeutic exercise for joint hypermobility syndrome: A systematic review.Physiotherapy2014;100:220-7.

6. Guidelines for Management of Joint Hypermobility Syndrome in Children and Young People. A Guide for professionals managing young people with this condition.

7. Beighton P, Solomon L, Soskolne CL. Articular mobility in an African population. Ann Rheum Dis 1973;32:413-8.

8. Junge T, Jespersen E,Wedderkopp N,Juul-KristensenB.Inter-tester reproducibility and inter-method agreement of two variations of the Beighton test for determining Generalised Joint Hypermobility in primary school children.BMC Pediatr2013;13:214.

9. van Trijffel E, van de Pol RJ,Oostendorp RA, LucasC.Inter-rater reliability for measurement of passive physiological movements in lower extremity joints is generally low: A systematic review.JPhysiother2010;56:223-35.

10. Carter C, wilkinson J.Persistent joint laxity and congenital dislocation of the hip.J Bone Joint Surg Br1964;46:40-5.

11. Wynne-Davies R. Acetabular dysplasia and familial joint laxity: Two etiological factors in congenital dislocation of the hip. A review of 589 patients and their families. J Bone Joint Surg Br 1970;52:704-16.

12. Grahame R, Bird HA, ChildA.The revised (Brighton 1998) criteria for the diagnosis of benign joint hypermobility syndrome (BJHS).JRheumatol 2000;27:1777-9.

Conflict of Interest: NIL
Source of Support: NIL

How to Cite this Article

Patel N G, Riddlestone P, Gunalan R, Gough A, Metcalfe J, Holroyd B.Reliability of Beighton's Score in a Pediatric Population. International Journal of Paediatric Orthopaedics Jan-June 2017;3(1):9-11.