

Knee Alignment Patterns Amongst Children In Borikiri, Port Harcourt

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ABSTRACT

Knee alignment in which the mechanical axis (centre of gravity) bisects the knee when the patient is standing erect is termed normal, there are however deviations from this Genu varum and Genu valgus are the results of this mechanical axis deviation. In genu varum, the axis shifts laterally while in genu valgum, the shift is medial. The aim of this research is to determine the occurrence of various knee alignment patterns using the intercondylar and intermalleolar distance of children. A total number of 900 (450 boys 450 girls) school children ages from 2 years to 10 years were utilized in this study with a view to classifying them into normal knees, genu varum and genu valgum. The children with no demonstrable intercondylar or intermalleolar distance were 568 constituting 67%. Two hundred and sixty six (59.1%) male children had normal knee patterns while 169 (37.6%) had genu varum with a mean intercondylar distance of 0.75 ± 0.3 cm. and 15 (3.3%) had genu valgum with a mean intermalleolar distance of 3.25 ± 1.75 cm. Three hundred and two (67.1%) of the females had normal knee alignment patterns, while 125 (27.8%) of them had genu varum with a mean intercondylar distance of 0.6 ± 0.2 cm and 23 (5.1%) had genu valgum with mean intercondylar distance of 5.5 ± 1.7 cm. The differences in means in the intercondylar values was significant ($P < 0.01$) while that of the intermalleolar values was insignificant ($P > 0.05$). The work also showed that there are higher percentages of children with genu varum than those with genu valgum. Children with values above these figures may require careful follow-up.

Key words: Genu varum, Genu valgum, Intermalleolar, Intercondylar, Caucasians, Alignment patterns.

Normal knee alignment is when the lower, extremity lengths are equal and the mechanical axis (centre of gravity) bisects the knee when the person is standing erect with the patella facing forward. This position places relatively balanced forces on the medial and lateral compartments of the knee and the collateral ligaments, while the patella remains stable and centered in the femoral sulcus. In genu valgum deformity, the mechanical axis shifts laterally pathological stress is placed on the lateral femur and tibia, inhibiting growth, there is excessive compressive forces upon the epiphysis. Consequently, growth in lateral condyle of the femur is suppressed globally resulting in a shallow femoral sulcus. When genu varum is present, the medial aspect of the knee is subjected to increased compressive loading.

In a study done by Omololu et al (2003) in children between ages of 1 - 10 years, it was found out that intercondylar distance up to 0.2cm was accepted as physiological bow legs. Normal physiologic lower limb bowing also commonly occurs in walking children under two years (Cheema et al/2003). Genu varum deformity can also be as a result of pathologies such as Blounts Disease Rickets (Peltifor 2004) osteogenesis imperfecta etc.

Heath et al (1993) also measured the intermalleolar and intercondylar distances in Caucasian children aged 6 months to 11 years to establish normal limits. Normally when the femoral and tibial axes meet at the knee they form an obtuse angle of about 170 to 175.1f (Cynthia Norkin 1989), if this angle (Tibio Femoral) exceeds 180 then the result is Genu Varum and less than 165° is Genu Valgus. Angular deformities of the knee were found to be more common amongst urban dwellers than rural dwellers (Agaja 2001).

The aim of this study was to determine the percentages of the various knee patterns using intercondylar(IC) and intermalleolar(IM) distances, with a view to classify them into normal knees, genu varum and genu valgum.

MATERIALS AND METHODS

This study was carried out prospectively with the children selected randomly from all the four primary schools in Borokiri, a densely populated settlement in the suburb of Port Harcourt. The schools were (1) Fatima Nursery and Primary school, Borokiri Port Harcourt. (2) Nigeria Navy Primary School Borokiri Port Harcourt. (3) UPE Model Primary School Borokiri Port Harcourt and (4) Greatmen Generation School

Borokiri. A total number of 900 (450 males and 450 females) children with age range of 2 – 10 years were studied, Of the total number of children 332 (184 males and 148 females) had measurable intercondylar (IC) and intermalleolar (IM) distances. Of the 184 males, 169 had measurable intercondylar distance while the remaining 15 had measurable intermalleolar distances. In the female category, of the 148 females, 125 of them had IC distances and 23 of them had IM distances.

The measurements were carried out using a vernier caliper, a recording paper and pen, each child was asked to stand erect with the back against a wall, and asked to let both ankles and knees touch each other where possible. A caliper was then placed between the medial condyles of the knees or between the medial malleoli of the ankles to measure the IC distance or the IM distance respectively. The calliper was then adjusted until its pointed ends rested on the right and left medial condyles or on the right and left medial malleoli.

Error due to parallax was avoided while taking the readings on the caliper. Children with other limb deformities were excluded in the study. The distance (in cm if any) between the pointed ends of the caliper was then recorded for each child. The data collected from these measurements were analyzed statistically and inferences drawn from analyzed data

RESULTS

The total number of children with no demonstrable IC or IM distances was 568 constituting 63%. Those with genu varum were 294 (33%) and those with genu valgum were 34 (4%). It was also noted that more females 67% had normal knee patterns than males of the (59%) of the children with genu varum deformity, most of them were males (169 or 57.5%) while females were 125 of 42.5%. On the other hand more females had genu valgum deformity (23 or 67.6%) while males were 15 or 32.4%. The results in Table I shows the frequency, mean and percentage of occurrence of children with genu varum. It shows that about half of the male children with genu valgum had IC distances

ranging from 0.25 - 0.69 as compared to 69% of the female children.

Table 1: Frequency of occurrence, Percentage of occurrence; Mean and Standard deviation of Intercondylar distance in Male and Female children with Genu Varum

Range (cm)	Frequency		Percentage	
	Male	Female	Male	Female
0.25-0.69	82	87	47.9	69.6
0.70-1.14	65	32	38.5	25.6
1.15-1.59	18	5	10.7	4.0
1.60-2.04	3	1	1.8	0.8
2.05-2.47	1	0	0.6	0
2.50-2.94	1	0	0.6	0

Mean and Standard deviation of Intercondylar distance

Male 0.75±0.3cm

females 0.6±0.2cm

p<0.001

Table 2: Frequency of occurrence, Percentage of occurrence, Mean and Standard deviation of Intermalleolar distances in Male and Female children with Genu Valgum

Range (cm)	Frequency		Percentage	
	Male	Female	Male	Female
1.0-2.49	2	0	13.3	0
2.5-3.99	12	5	8.0	21.7
4.0-5.49	0	9	0	39.1
5.5-6.99	1	-	6.7	0
7.0-8.49	0	8	0	34.8
8.5-9.99	0	1	0	4.3

Mean and Standard deviation of Intermalleolar distance

Male 3.25±0.9cm

females 5.5±1.7cm P>0.05

There was a steady decline afterwards in frequency of children with IC distance of 0.7cm and above. Very few less than 4% of the children with genu valgum had IC distance greater than 1.6cm. The mean IC distance was for the males 0.75±0.3cm while that of females was 0.6±0.2cm. These results were significant (P<0.001)

Table 2 also shows the frequency, mean and percentage of occurrence of children with genu valgum. Out of 15 males with genu valgum only 2

(13%) had 1M range of 1.0cm-2.49cm, no female had 1M distance less than 2.5cm. Majority of the male children (80%) had 1M distance between 2.5cm±3.99cm. while majority of the female (39.1%) had IM distance between 4.0±5.49cm.. A sizeable percentage (34.8%) of the females had IM distance between 7.0cm±8.49cm. The mean intermalleolar distance for the males was 3.25cm±1.7cm, while that of females was 5.5:1:1.7cm there was no significant difference ($P > 0.05$)

DISCUSSION

The result of this study revealed that males with genu varum had a higher significant ($P < 0.001$) mean intercondylar distance than females and the females had higher mean intermalleolar distance than males, though not significant ($P > 0.05$). The values of the IC and 1M distances of the males and the females in this study were not the same with values reported by Cahuzac J P et al (1995) there was consistency with respect to the fact that IM distance of females were more than males and vice versa for values concerning IM distances. Their work showed acceptable IM and IC distances and above which regular follow up and further evaluation was required.

In the study by Heath C H et al (1993) 1M distances up to 8cm were regarded as normal but the existence of bowlegs after 2 years was regarded as abnormal. Azari et al (2001) determined mean value and normal limits for Tibiofemoral angles and intercondylar and intermalleolar distances in normal Turkish children and noted a significantly higher value than previous reports. They found out that these differences were due to racial differences.

Genu valgum and genu varum can be treated with a partial epiphysiodesis (Brown J R et al 1992). They concluded that genu valgum and genu varum in children with remaining growth can be corrected. Also adolescent type of genu valgum was treated with evaluation before the operation and during follow-up based on growth charts, photographs and measurement of the intermalleolar distance gave good result at skeletal maturity. Volpon J B 1997, Fraser R K et al (1995).

In conclusion, our work showed that there is more percentage of children with genu varum than genu valgum, more males with genu varum and more females with genu valgum. The mean intercondylar distance for males was 0.75 ± 0.3 cm and for females 0.6 ± 0.2 cm and the mean intermalleolar distance for males was 3.25 ± 1.75 cm lower than that of females at 5.5 ± 1.7 cm. Children at 10 years and below with values above these figures in our environment may require careful follow-up.

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