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Flexible Flat Feet in Children: A Real Problem?

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ABSTRACT. Objectives To estimate the prevalence of flexible flat feet in the provincial population of 4- to 13-year-old schoolchildren and the incidence of treatments considered unnecessary.

Setting. Province of Málaga, Spain.

Methods. We examined and graded by severity a sample of 1181 pupils taken from a total population of 198 858 primary schoolchildren (CI: 95%; margin of error: 5%). The sample group was separated into three 2-year age groups: 4 and 5 years, 8 and 9 years, and 12 and 13 years. The plantar footprint was classified according to Denis1 into three grades of flat feet: grade 1 in which support of the lateral edge of the foot is half that of the metatarsal support; grade 2 in which the support of the central zone and forefoot are equal; and grade 3 in which the support in the central zone of the foot is greater than the width of the metatarsal support.

The statistical analysis for the evaluation of the differences between the groups was performed with Student's t and χ² tests as appropriate.

Results. The prevalence of flat feet was 2.7%. Of the 1181 children sampled, 167 children (14.2%) were receiving orthopedic treatment, but only 2.7% had diagnostic criteria of flat feet. When we inspected the sample, we found that a number of children were being treated for flat feet with boots and arch supports. Most of them did not have a flat plantar footprint according to the criteria that we used for this work. Furthermore, in the group of children that we diagnosed as having flat feet, only 28.1% were being treated. We found no significant differences between the number of children receiving orthopedic treatments and the presence or absence of a flat plantar footprint. Children who were overweight in the 4- and 5-year-old group showed an increased prevalence for flat feet as diagnosed by us.

Conclusion. The data suggest that an excessive number of orthopedic treatments had been prescribed in the province. When extrapolated to the 1997 population of schoolchildren within the age groups studied the figures established an experimental protocol that used several variables such as age, height, weight, social class, etc, and other variables that are associated directly with the foot such as plantar footprint, valgus calcaneus, abducted forefoot, and whether or not the child had orthopedic supports such as insoles (Tables 2 and 3). The children were divided also into groups of town or country dwellers and again into another two groups according to the type of schooling that they were receiving: private or public.

When the different sample groups were separated clearly, we established an experimental protocol that used several variables such as age, height, weight, social class, etc, and other variables that are associated directly with the foot such as plantar footprint, valgus calcaneus, abducted forefoot, and whether or not the child had orthopedic supports such as insoles (Tables 2 and 3). The plantar footprint was classified according to Denis1 into three grades of flat feet: grade 1 in which the support of the lateral edge of the foot is half that of the metatarsal support; grade 2 in which the support of the central zone and forefoot are equal; and grade 3 in which the support in the central zone of the foot is greater than the width of the metatarsal support. This is described in detail in Fig 1.

In this study, we defined those children who displayed a second or third degree plantar footprint as flat-footed. Children with first degree plantar footprints were not included in this study, because they were considered to have evolutionary foot problems without pathologic significance according to Meary11 and Stewart.12
The prevalence of flat feet in our series was 2.7%. This differs greatly from the prevalence of 12.3% that was mentioned by Denis,1 but it is very similar to the prevalence that Gil13 reports.

Some relevant results of the different variables that were studied such as height, weight, knee valgus, internal and external rotation of hip are shown in Table 4.

Our analysis of data aimed to determine whether the existence of flat feet was related to the presence or absence of other independent variables that may cause the development or evolution of flat feet. The three variables that revealed a significant relationship (P < .05) were age, social level or class of the family or parents, and sex. Table 5 shows that 75% of flat feet were found in the first 2-year age group (4 and 5 years). The remaining 25% were distributed between the second and third groups (8 and 9 years, and 12 and 13 years, respectively).

We detected a decreased prevalence of flat feet in the children of lower and lower-middle class families, and males predominated in both classes.

The effect of obesity on the incidence of flat feet was calculated by using the body mass index. We found no significant differences in our series, but when the results were adjusted by age, being overweight was seen to increase the prevalence of flat feet diagnosed in group 1 (4 and 5 years).

At the time that we inspected the samples, 168 of the 1181 children (14.2%) were receiving orthopedic treatment (Table 6). We considered this percentage excessive because only 2.7% of these children had the diagnostic criteria of flat feet. Paradoxically, we must emphasize that we found no significant difference between the number of children who received orthopedic treatments and the number of children who were diagnosed as flat-footed, and this figure suggests that an excessive number of orthopedic treatments had been prescribed. It was even more surprising that only 9 of the 32 children who were diagnosed as having flat feet (28.1%) were receiving orthopedic treatment.

When we extrapolated these figures to the 1997 population of schoolchildren within these age groups, we found that ~28 167 children in the Malaga province probably would have been receiving orthopedic treatments with boots and insoles at the time of our study. If we take into account normal wear and tear and growth, we can assume that each pair of orthopedic boots (~12 000 pesetas; $79 in US currency) will need changing every 6 months. Consequently, the total expenditure on orthopedic boots and insoles that year was ~676 008 000 pesetas ($4 447 422 in US currency).

### RESULTS

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### DISCUSSION

Our study of the literature revealed that there is a great variation in the prevalence of infantile flexible flat feet reported by different authors.2,3,13,14 In our opinion, these differences could be explained by the fact that the authors used different age groups or perhaps only made their diagnosis at the end of the usual evolutionary period when additional evolution toward healthy feet was improbable.

Rose3 states that the critical age for development of the plantar arch is 6 years, and consequently, if the prevalence of flat feet is evaluated before this age, the finding will overestimate the problem.

Our figures agree with those that have been quoted previously. We found that 75% of all the flat feet found in this present work were in the youngest
TABLE 4. Results of Some Relevant Variables Studied

<table>
<thead>
<tr>
<th>Variables</th>
<th>Age (4–5 Years)</th>
<th>Age (7–8 Years)</th>
<th>Age (10–12 Years)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>118.3</td>
<td>10.7</td>
<td>144.6</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>23.7</td>
<td>6.7</td>
<td>42.2</td>
</tr>
<tr>
<td>Knee valgus*</td>
<td>5.5</td>
<td>2.6</td>
<td>5.2</td>
</tr>
<tr>
<td>Internal rotation hip*</td>
<td>43.0</td>
<td>14.1</td>
<td>41.3</td>
</tr>
<tr>
<td>External rotation hip*</td>
<td>33.6</td>
<td>8.4</td>
<td>37.0</td>
</tr>
</tbody>
</table>

* Degrees.

TABLE 5. Relationship Between Flat Feet and Age (P < .05)

<table>
<thead>
<tr>
<th>Age</th>
<th>Normal Feet (%)</th>
<th>Flat Feet (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4–5 y</td>
<td>24.5</td>
<td>75.0</td>
</tr>
<tr>
<td>8–9 y</td>
<td>33.1</td>
<td>66.9</td>
</tr>
<tr>
<td>12–13 y</td>
<td>42.4</td>
<td>57.6</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

TABLE 6. Children Receiving Orthopedic Treatment

<table>
<thead>
<tr>
<th>Flat Feet</th>
<th>Other Type</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>9</td>
<td>159</td>
</tr>
<tr>
<td>No</td>
<td>23</td>
<td>990</td>
</tr>
</tbody>
</table>

TABLE 7. Years Receiving Orthopedic Treatment

<table>
<thead>
<tr>
<th>Without orthopedic treatment</th>
<th>Frequency</th>
<th>Percentages</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20</td>
<td>1.7</td>
</tr>
<tr>
<td>2</td>
<td>97</td>
<td>8.2</td>
</tr>
<tr>
<td>3</td>
<td>66</td>
<td>5.6</td>
</tr>
<tr>
<td>4</td>
<td>27</td>
<td>2.3</td>
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<td>5</td>
<td>26</td>
<td>2.2</td>
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<td>6</td>
<td>60</td>
<td>5.1</td>
</tr>
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<td>7</td>
<td>13</td>
<td>1.1</td>
</tr>
<tr>
<td>8</td>
<td>11</td>
<td>.9</td>
</tr>
<tr>
<td>9</td>
<td>5</td>
<td>.4</td>
</tr>
<tr>
<td>10</td>
<td>12</td>
<td>1.0</td>
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<tr>
<td>11</td>
<td>1</td>
<td>.1</td>
</tr>
<tr>
<td>12</td>
<td>1</td>
<td>.1</td>
</tr>
</tbody>
</table>

In summary, according to our study, we have noted that an excessive number of orthopedic treatments have been prescribed unnecessarily.

ACKNOWLEDGMENT

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REFERENCES

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