Introduction

Hallux valgus (HV): 
- is characterised by a progressive subluxation of the first metatarsophalangeal joint leading to a lateral deviation of the hallux
- aetiology is multifactorial, yet the main cause attributed is the biomechanical constraints due to inadequate shoe wear
- can be hereditary and secondary to other pathologies (e.g., rheumatoid arthritis)
- has a higher incidence in adult individuals, especially females
- though seldom reported in archaeological skeletal remains

The present research tested the application of three angles – currently employed in Medicine – to diagnose HV in disarticulated skeletal specimens

Sample

- Identified Skeletal Collection of the University of Coimbra, Portugal
- 146 individuals: 68 Female and 78 Males
- Age at death: 18 to 96 years (mean age: 48 ± 20.1 years)
- The sample does not have individuals with foot gross pathologies not-associated with HV
- Individuals with osteoarthritis were not excluded since it can be secondary to HV

Methodology

1) A retrospective diagnosis was performed following the clinical criteria adapted by Mays since no medical records of HV presently exist for the Coimbra collection. The retrospective diagnosis allowed comparing measurements between individuals with and without HV.

2) The first metatarsal and proximal phalange of both sides were photographed on the dorsal norm

3) Measurements of the distal metatarsal articular angle (DMAA), proximal (PPAA) and distal angles (DPAA) of the proximal phalange were performed with Adobe Photoshop CS2® version 9.0

4) Significant asymmetry between left and right angle measurements were determined with an independent samples t-test

5) A Spearman’s Rank and Pearson product-moment correlation coefficients were calculated for the correlation between HV and age, and angles and age respectively for left and right sides

6) A Mann-Whitney test was calculated to determine if the median measurements differences exist between individuals with and without HV

7) Establishment of the upper limit of normality and the lower limit of possible HV cases were carried out with a cut-point value for DMAA with the formula: (Mean without hallux valgus + Mean with hallux valgus)/2

Results and discussion

Hallux valgus frequency according to Mays’ criteria
- 37 individuals (25.3%): 25 (67.6%) unilateral and 12 (32.4%) bilateral cases
- 17 females (45.9%): 10 unilateral (6 left and 4 right) and 7 bilateral cases
- 20 males (54.1%): 15 unilateral (12 left and 3 right) and 5 bilateral cases

In the sample analysed HV was more frequent in male individuals while current clinical data there is the opposite tendency.

Indeterminate diagnosis in 13 individuals and 96 (65.7%) individuals were not diagnosed with HV.

17 individuals with osteoarthritis (45.9% - 6 females and 11 males):
- 14 bilateral (10 left and 4 right) and 3 bilateral cases

In the 19th–20th century, the production and sale of shoes was reported in Coimbra and, therefore, it is possible these individuals worn shoes during their life and that may contributed to the presence of hallux valgus

Asymmetry

PPAA exhibited significant asymmetry (p<0.05 – data not showed), and, therefore, left and right side were analysed separately for subsequently statistical analysis.

For DMAA and DPAA the analysis was performed only on the left side due to the lack of significant asymmetry (p>0.05 – data not showed)

Correlation with age at death

Individuals with HV: 19 to 88 years; mean= 53 ± 18.6 years

Females: 19 to 88 years; mean= 56 ± 21.1 years; Males: 20 to 77 years, mean: 51 ± 17.0 years

Spearman’s Rank correlation coefficient between HV and age: low correlation (r values from 0.210 to 0.364) or non-existence (p>0.05 – data not shown)

Pearson-product-moment correlation coefficient between angles and age: non-existence (p>0.05 – data not shown)

Angles values

Table presents the descriptive statistics for each angle for individuals with and without HV. Only DMAA shows a significant median difference for the pooled sexes.

For PPAA a significant median difference for the females on the right side was obtained.

For DPAA, the difference is significant for the pooled sexes and female sample.

In medical literature no standard values have been recommended to distinguish a normal and pathological deviation of the first metatarsal and proximal phalange for these angles. However, the obtained results are in concordance with clinical literature, except for DPAA.

Cut-point

The cut-point was calculated to help in HV diagnosis for DMAA, and not for PPAA and DPAA. The PPAA and DPAA show less significant median differences between individuals with and without HV. Furthermore, PPAA shows a significant asymmetry between right and left sides and DPAA does not present similar values to those obtained in literature.

Cut point for DMAA: Females = 10 degrees; Males = 12 degrees; Pooled sexes = 12 degrees, e.g., HV diagnostic for the female sample: <10º normal; 10º indeterminate; >10º possible HV.

1) The values obtained were in conformity with medical references, except for DPAA.

2) DMAA can be accessory in HV diagnosis alongside the pathological criteria described in Mays and Manfair. The DMAA provides a quantification of the medial deviation of the distal epiphysis of the first metatarsal, one of the criteria pointed out by Mays. Divergent opinions have emerged regarding the use of the DMAA as a diagnosis of HV in the clinical literature.

3) Most of the discussion is centred on the lack of a standard cut-point value between a normal and pathological deviation, and its replicability. However, the DMAA has been applied to determine the type of surgery procedure to follow in a patient.

4) The use of the PPAA should be performed with caution since no significant difference was found for the median values between individuals with and without HV. Mays reported the deviation of the proximal epiphysis of the proximal phalange for some individuals, but as a consequence of the presence of HV, and not as a discriminant characteristic. The calculation of the PPAA should be only be used as a quantification of this deviation, instead of a subjective analysis discriminating its absence or presence. Specially, since no significant difference was found for PPAA median values between individuals with and without HV.

5) It is not advised the application of the DPAA for diagnosed of HV.

Final comments

DMAA can be accessory in hallux valgus diagnosis alongside the morphological pathological criteria.

DMAA cut point values were established for both sexes.

Hallux valgus should be further studied in past populations.

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References
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