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CHILDREN'S ORTHOPAEDICS

Validation of central peak height method for final adult height predictions on long leg radiographs

M. Brenneis,
N. Thewes,
J. Holder,
F. Stief,
S. Braun

From Goethe University Frankfurt, Frankfurt, Germany

Aims

Accurate skeletal age and final adult height prediction methods in paediatric orthopaedics are crucial for determining optimal timing of growth-guiding interventions and minimizing complications in treatments of various conditions. This study aimed to evaluate the accuracy of final adult height predictions using the central peak height (CPH) method with long leg X-rays and four different multiplier tables.

Methods

This study included 31 patients who underwent temporary hemiepiphysiodesis for varus or valgus deformity of the leg between 2014 and 2020. The skeletal age at surgical intervention was evaluated using the CPH method with long leg radiographs. The true final adult height (FH_{TRUE}) was determined when the growth plates were closed. The final height prediction accuracy of four different multiplier tables (1. Bayley and Pinneau; 2. Paley et al; 3. Sanders – Greulich and Pyle (SGP); and 4. Sanders – peak height velocity (PHV)) was then compared using either skeletal age or chronological age.

Results

All final adult height predictions overestimated the FH_{TRUE}, with the SGP multiplier table having the lowest overestimation and lowest absolute deviation when using both chronological age and skeletal age. There were no significant differences in final height prediction accuracy between using skeletal age and chronological age with PHV ($p = 0.652$) or SGP multiplier tables ($p = 0.969$). Adult height predictions with chronological age and SGP ($r = 0.769$; $p \le 0.001$), as well as chronological age and PHV ($r = 0.822$; $p \le 0.001$), showed higher correlations with FH_{TRUE} than predictions with skeletal age and SGP ($r = 0.657$; $p \le 0.001$) or skeletal age and PHV ($r = 0.707$; $p \le 0.001$).

Conclusion

There was no significant improvement in adult height prediction accuracy when using the CPH method compared to chronological age alone. The study concludes that there is no advantage in routinely using the CPH method for skeletal age determination over the simple use of chronological age. The findings highlight the need for more accurate methods to predict final adult height in contemporary patient populations.

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Introduction

Accurate estimation of skeletal maturity is important for the treatment of various paediatric endocrinological and orthopaedic conditions, such as leg length discrepancies or malalignment of the lower limbs in the frontal plane. In this context, precise prediction of residual growth is essential to determine the optimal timing for growth-guiding interventions, and to reduce the rate of over-correction, under-correction, and the development of rebounds.[1-3] Various approaches exist for determining remaining growth potential and the optimal timing for epiphysiodesis procedures.

Correspondence should be sent to Marco Brenneis; email: marco.brenneis@kgu.de

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These methods can be categorized into two primary groups: those that rely on chronological age and those that use skeletal age for their calculations. Studies comparing these methods have yielded mixed findings about whether skeletal age- or chronological age-based techniques have superior accuracy in final body height predictions. While studies by Little et al[4] and Aguilar et al[5] found no significant difference between methods using skeletal age or chronological age, more recent research has demonstrated greater accuracy when using skeletal age-based methods. In a 2011 study by Sanders et al,[6] the authors compared the effectiveness of chronological age and skeletal maturity for predicting mature limb length in children. Their findings suggested that chronological age-based predictions were more accurate for younger children, while skeletal age-based predictions provided better estimates during adolescence.

The most commonly used methods to determine skeletal age are the Greulich and Pyle (GP) bone age atlas,[7] the Sauvegrain method,[8] and the Tanner-Whitehouse classification.[9] These assessments are limited by the subjective nature of interpretation and the need to obtain additional radiographs, e.g. of the hand or elbow.[10] The additional radiation exposure must be considered, especially in young patients, because the likelihood of radiation-induced malignancy is a function of the patients' age.[11] In order to prevent unnecessary radiation exposure, Knapik et al[12] published the first purely numerical method for determining skeletal age on anteroposterior (AP) knee radiographs (central peak height (CPH) method). This method was validated by using a historical dataset from the Bolton-Brush study collection, which was also used to develop the GP bone age atlas.[12]

To calculate the final adult height, additional calculations based on the determined skeletal age or chronological age are required, for example by using multiplier tables.[13] The best known multiplier tables were published by Bayley and Pinneau,[14] Paley et al,[13] and Sanders.[15,16] Multiplier tables have been commonly used in paediatric orthopaedics to estimate final adult height using either skeletal age or chronological age. While the use of multiplier tables can provide a quick and easy way to estimate final adult height, their accuracy has been called into question in recent years and no multiplier could clearly emerge as the most accurate.[6] Furthermore, the multiplier tables by Bayley and Pinneau as well as by Sanders were developed using historical data from the Brush Foundation Study of Child Growth and Development and Berkeley Guidance Studies of the Institute of Human Development, which mainly enrolled Caucasian, affluent, and healthy children.[14,15,17,18] Thus, their applicability on a current, diverse patient clientele with an axial deviation in the frontal plane may be limited.

The goal of the present study was to evaluate the accuracy of final adult height predictions using the CPH method with long leg radiographs and four different multiplier tables. We asked the following research questions: is the CPH method in combination with multiplier tables an accurate method to determine skeletal age and the final adult height on AP long leg radiographs? Is the accuracy of this method superior to the simple use of chronological age for final adult height predictions? Which combination of chronological age or skeletal age (calculated by CPH method) and multiplier table correlates best with final adult height?

Methods

Patients. This single-centre, retrospective study was approved by the review board of the Goethe University in Frankfurt. All investigations were performed in accordance with relevant guidelines and regulations. Using our prospectively maintained institutional database, we identified 52 patients who were treated for idiopathic varus or valgus deformity of the leg and underwent temporary hemiepiphysiodesis between October 2014 and September 2020. All patients had – as standard of care – a preoperative long leg radiograph in an AP orientation. Criteria for a valid full leg length AP radiological image were: patient standing in a weightbearing and upright position; both legs parallel to each other; fully extended knees; and patella centred over the femoral condyles pointing straight forward in order to avoid rotational errors.

The indication for implant-mediated growth guidance with hemiepiphysiodesis plating (Eight-Plates (Orthofix, USA) or Pedi-Plates (OrthoPediatrics, USA)) was set for skeletally immature patients with a pathological idiopathic valgus or varus alignment deformity of both lower limbs.[19,20] Patients were followed frequently in three- to six-month intervals until reaching adult stature (at least until 1.5 years after implant removal (mean age 15.80 years (standard deviation (SD) 1.22)). The true final adult height (FH_{TRUE}) was set as the primary endpoint. FH_{TRUE} was determined when growth plates of the knee joint were closed and when there was no further increase in body height within 12 months. Patients' heights were measured in a standardized manner using the same calibrated measuring device.

Patients were excluded if FH_{TRUE} could not be determined (n = 19) or if the imaging was not suitable for evaluation (n = 2) due to incomplete or rotated visualization of the area of interest. Further exclusion criteria were: neuromuscular disorders, rheumatoid arthritis, achondroplasia or hypochondroplasia, knee surgery within 12 months before enrolment in this study, sagittal plane deformities (genu pro- and recurvatum), flexion contractures in the hip or knee joint, leg length discrepancy of > 10 mm, avascular necrosis of the femoral head or knee condyles, or history of severe trauma or sport injury to the lower limbs. Ultimately, 31 patients (62 knees) with a mean age of 13.15 years (SD 1.09) at the time of implantation of the plates were included in the study.

Fig. 1

Determination of skeletal age using the central peak height method on a long leg radiograph (age 11 years 9 months, female). First, a scalable, standardized, digital long leg radiograph was taken in an anteroposterior orientation no more than one month before surgery and used to evaluate the central peak value (CPV). The CPV was calculated by dividing the distance between the central peak of the distal femoral physis and a line between the medial and lateral ends of the distal femoral physis (7 mm) by the width of the distal femoral physis (73 mm). The CPV value was then used to determine skeletal age.

Central peak height method. Skeletal age at the time of surgical intervention (SA_{SI}) was determined using the CPH method.[12] First, a scalable, standardized, digital long leg radiograph was taken in an AP orientation no more than one month before surgery and used to evaluate the central peak value (CPV). The individual magnification factor was determined by a 25.4 mm-diameter metal ball, which was placed between the legs at the level of the knee joint line. The CPV was calculated by dividing the distance between the central peak of the distal femoral physis and a line between the medial and lateral ends of the distal femoral physis by the width of the distal femoral physis (Figure 1). According to Knapik et al,[12] patients' chronological age at 90% of final height ($CA_{90\%FH}$) was calculated using chronological age at the time of surgical intervention (CA_{SI}) using the following equation:

$$CA_{90\%FH} = 3.495 + (15.409 \times CPV) + (0.658 \times CA_{SI}) + (-0.661 \times sex\,[female = 0; male = 1]) \tag{1}$$

In previously studied populations, females reached 90% of final height at age 11 years 4 months and males at age 13 years 2 months.[21] Under this assumption, skeletal age at the time of surgical intervention (SA_{SI_CPH}) was calculated by the following equations:

$$\text{Females: } SA_{SI\_CPH} = CA_{SI} - (11.4 - CA_{90\%\ FH}) \tag{2}$$

$$\text{Males: } SA_{SI\_CPH} = CA_{SI} - (13.2 - CA_{90\%\ FH}) \tag{3}$$

Since all patients received surgery on both legs, the mean of the right and left CPV was calculated and used for further analysis.

Multiplier tables. Next, four different multiplier tables were used to predict the final adult height of the patients (FH_{PRE}) based on either CA_{SI} and/or SA_{SI_CPH}:

A) Multiplier according to Bayley and Pinneau:[14] Bayley and Pinneau (BP) differentiated between delayed (SA_{SI} - CA_{SI} < -1), average (SA_{SI} - CA_{SI} = ± 1), and accelerated (SA_{SI} - CA_{SI} > 1) skeletal maturity. They published three different multiplier tables for the respective groups. After the type of skeletal maturity was determined, the final adult height of the patients (FH_{PRE_BP}) was calculated using the following equation:

$$FH_{PRE\_BP} = Height_{SI} * (100\ /\ \text{BP multiplier value}) \tag{4}$$

Since the CPH method also determines skeletal ages that lie between the intervals of three months, a linear relationship between two neighbouring multiplier values was assumed and thus the missing percentages were added (Supplementary Table i).

B) Multiplier according to Paley et al:[13] Paley et al (P) used data from the Centers for Disease Control and Prevention to create multiplier tables. The tables were developed considering CA_{SI} (and sex) to determine the respective multiplier value. The final adult height of the patients (FH_{PRE_P}) was then calculated using the following equation:

$$FH_{PRE\_P} = Height_{SI} * P \text{ multiplier value} \quad (5)$$

C) Multiplier according to Sanders – Greulich and Pyle:[15] Sanders et al (SGP) used data from the Bolton-Brush Study Foundation to predict SA_{SI} and FH_{pre} by using the GP atlas. Again, a linear relationship between two neighbouring multiplier values was assumed and thus the missing percentages were added (Supplementary Table ii). The final adult height of the patients (FH_{PRE_SGP}) was calculated using the following equation:

$$FH_{PRE\_SGP} = Height_{SI} * SGP \text{ multiplier value} \quad (6)$$

D) Multiplier according to Sanders – peak height velocity (PHV) (2021):[16] Sanders et al developed multiplier tables based on 90% final adult height. To use these multipliers for final adult height predictions, the distance between the mean age at 90% final adult height of the reference population (male: 11 years 4 months; female: 13 years 2 months) and the skeletal age or chronological age was calculated and used to create the adapted multiplier tables (Supplementary Table iii). The final adult height of the patients (FH_{PRE_PHV}) was calculated using the following equation:

$$FH_{PRE\_PHV} = Height_{SI} * PHV \text{ multiplier value} \quad (7)$$

CA_{SI} as well as SA_{SI_CPH} were used to evaluate the respective multiplier value. The use of CA_{SI} or SA_{SI_CPH} in combination with four different multiplier tables (A to D) resulted in a total of eight predictions of FH_{PRE}.

Statistical analysis. Statistical analysis was performed using SPSS version 29 (IBM, USA). The accuracy of adult height prediction was determined by comparing the mean differences ($\delta = FH_{PRE} - FH_{TRUE}$) and the mean absolute differences (δ Absolute = $|FH_{PRE} - FH_{TRUE}|$) between the respective FH_{PRE} and FH_{TRUE}. The Shapiro-Wilk test was used to test normal distribution of the analyzed parameters. Continuous and normally distributed variables were presented as the mean (SD). Non-parametric variables were presented as the median and interquartile range (IQR), and were compared between two groups using the Wilcoxon signed-rank test. Multiple paired groups were compared with the Friedman test. If the significance level for the Friedman test was less than 0.05, multiple comparisons were performed using the Dunn-Bonferroni post-hoc test. The calculated and normally distributed FH_{PRE} values were correlated to FH_{TRUE} using the Pearson correlation coefficient (r). The significance level was set at $p \leq 0.05$.

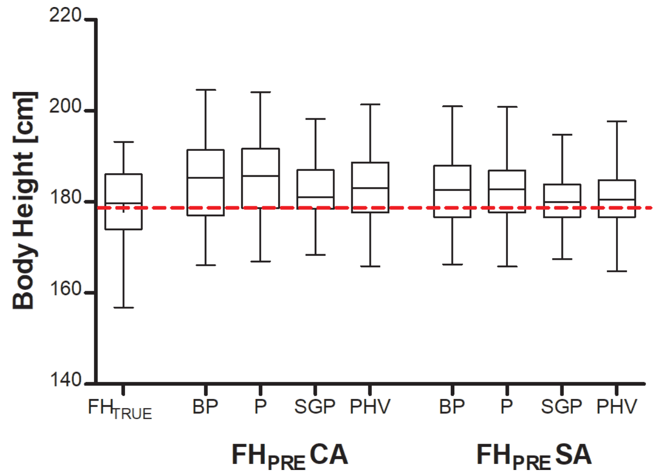

Fig. 2

Overview of the calculated final adult height predictions compared to the true adult height (FH_{True}). First, the chronological age at the time of surgery was used to predict the final size (FH_{PRE}CA) using the four different multiplier tables (Bayley and Pinneau (BP); Paley et al (P); Sanders – Greulich and Pyle (SGP); Sanders – peak height velocity (PHV)). Second, skeletal age was determined using the central peak height method. SA at the time of surgery was used to predict the final size (FH_{PRE}SA) using the four different multiplier tables. The red line shows the mean true adult height. Data represent medians with interquartile ranges. Whiskers represent minimum and maximum values.

Results

All FH_{PRE} overestimated FH_{True}. The mean FH_{True} was 178.6 cm (156.8 to 193.2). Comparing the means of all adult body height predictions, all of these predictions overestimated the FH_{True} (Figure 2). When simply using CA_{SI} for adult height predictions, the SGP multiplier table showed the lowest overestimation (mean 3.51 cm (-10.8 to 15.1)), followed by the Sanders PHV multiplier table (mean 4.19 cm (-8.6 to 14.2)). In addition, the SGP multiplier table showed the lowest overestimation (mean 1.38 cm (-12.0 to 17.8)) when using SA_{SI_CPH} (Table I).

The SGP multiplier table had the lowest absolute deviation between FH_{PRE} and FH_{True}. When comparing the absolute deviation between FH_{PRE} and FH_{True} (δ Absolute = $|FH_{PRE} - FH_{TRUE}|$), SA_{SI_CPH} in combination with the SGP multiplier table showed the lowest median value (3.86 cm (IQR 2.2 to 7.3)) (Figure 3). In addition, the SGP multiplier table showed the lowest median absolute deviation (4.71 cm (IQR 1.4 to 9.7)) when using CA_{SI} (Table I).

CPH method did not significantly improve adult body height prediction accuracy. When using CA_{SI} for adult height predictions, the δ absolute values between the four multiplier tables differed significantly (p = 0.027, Friedman test). There was a significant difference between the δ absolute values calculated by Sanders PHV-multiplier and the δ absolute values calculated by

Table I. Final adult height predictions.

Body height specifications	Mean, cm	SD, cm	Range, cm	Mean delta (FH_{PRE} - FH_{TRUE}), cm	SD, cm	Range, cm	Median delta absolut (FH_{PRE} - FH_{TRUE}), cm	IQR, cm
Body height$_{SI}$	169.74	8.21	152.50 to 183.00					
FH_{TRUE}	178.55	9.03	156.80 to 193.20					
Chronological age								
FH_{PRE}_CA_BP	184.55	8.75	166.12 to 204.59	6.01	4.96	-5.91 to 15.99	7.31	3.30 to 10.00
FH_{PRE}_CA_P	184.99	8.35	166.99 to 204.12	6.45	4.99	-5.48 to 15.52	7.40	3.48 to 10.03
FH_{PRE}_CA_SGP	**182.05**	**6.07**	**168.36 to 198.26**	**3.51**	**5.84**	**-10.76 to 15.14**	**4.71**	**1.44 to 9.66**
FH_{PRE}_CA_PHV	182.73	7.58	165.92 to 201.37	4.19	5.14	-8.55 to 14.19	4.80	2.36 to 7.75
CPH								
FH_{PRE}_SA_BP	182.14	7.92	166.33 to 200.99	3.59	5.98	-8.30 to 13.62	4.82	2.83 to 9.09
FH_{PRE}_SA_P	182.45	7.75	165.83 to 200.82	3.90	6.41	-8.04 to 18.54	4.69	2.81 to 8.13
FH_{PRE}_SA_SGP	**179.92**	**6.00**	**167.46 to 194.79**	**1.38**	**6.80**	**-11.95 to 17.83**	**3.86**	**2.23 to 7.30**
FH_{PRE}_SA_PHV	180.61	7.12	164.74 to 197.71	2.06	6.43	-10.42 to 17.83	3.98	2.27 to 7.02

Bold font highlights lowest mean delta value and lowest median delta absolute value of both adult height prediction methods.
BP, Bayley and Pinneau; CA, chronological age; CPH, central peak height; FH_{PRE}, predicted final adult height; FH_{TRUE}, true final adult height; Max, maximum; Min, minimum; P, Paley et al; PHV, peak height velocity; SA, skeletal age; SD, standard deviation; SGP, Sanders – Greulich and Pyle.

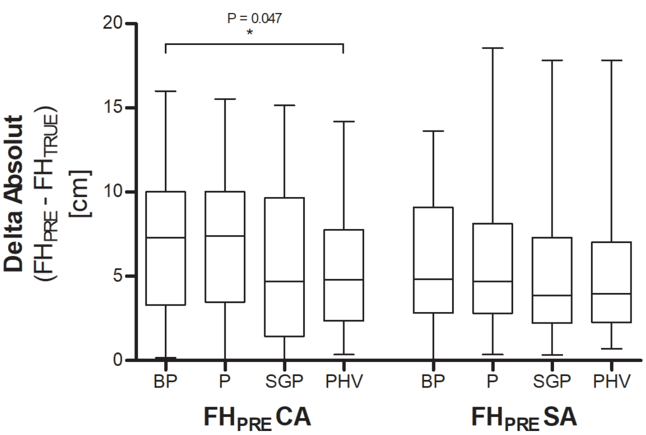

Fig. 3

Final adult height prediction accuracy. The accuracy of adult height prediction was determined by comparing the mean absolute differences between the respective predicted final adult height (FH_{PRE}) using the four different multiplier tables (Bayley and Pinneau (BP); Paley et al (P); Sanders – Greulich and Pyle (SGP); Sanders – peak height velocity (PHV)) and the true final adult height (FH_{TRUE}) (δ Absolute = $|FH_{PRE}$ - $FH_{TRUE}|$). Data represent medians with interquartile ranges. Whiskers represent minimum and maximum values. *p = 0.047, Dunn-Bonferroni post-hoc test.

BP-multiplier (p = 0.047, Dunn-Bonferroni post-hoc test). No significant differences between the δ absolute values of the other multiplier tables were detected. When using SA_{SI_CPH} for adult height predictions, we found no significant difference between the four multiplier tables (p = 0.838, Friedman test).

No differences in final height prediction accuracy (δ absolute values) between SA_{SI_CPH} and CA_{SI} were found when using the most accurate PHV multiplier (p = 0.652) or SGP multiplier tables (p = 0.969, both Wilcoxon signed-rank test). Furthermore, adult height predictions with CA_{SI} and SGP (r = 0.769; p ≤ 0.001), as well as CA_{SI} and PHV (r = 0.822; p ≤ 0.001), showed higher correlations with FH_{TRUE} than adult height predictions with SA_{SI_CPH} (r = 0.657; p ≤ 0.001) and SGP, as well as SA_{SI_CPH} and PHV (r = 0.707; p ≤ 0.001) (Table II).

Discussion

In this study, the accuracy of different methods for predicting final adult height in patients who underwent temporary hemiepiphysiodesis for leg deformities was evaluated. SA_{SI} was determined using the CPH method, and four different multiplier tables were used to predict FH_{PRE}. All final adult height predictions overestimated FH_{TRUE}. The SGP-multiplier table showed lowest absolute deltas, and thus the most accurate results, in final adult height predictions using both CA_{SI} and SA_{SI_CPH}. However, the use of the more complicated and time-consuming CPH method did not increase the final height prediction accuracy.

It remains unclear why even validated multiplier tables, such as the one according to Bayley and Pinneau,[22,23] significantly overestimated FH_{TRUE}. Two possible explanations could account for this discrepancy. First, the patients in this study – or patients with varus or valgus malalignment in general – have growth characteristics that are not considered in the multiplier tables or in the CPH method. Most multiplier tables and the CPH method were developed on historical patient cohorts, which might have different skeletal maturity patterns compared to contemporary populations. Paley et al[13] showed that height multipliers were consistent across generations. However, as the performance of the Paley multipliers was unsatisfactory in this study, we suggest further inquiries and, if necessary, an updated version that reflects better a current, diverse population with malalignment. It is

Table II. Correlation analysis between predicted and true final adult height.

		FH_{PRE}_CA_BP	FH_{PRE}_CA_P	FH_{PRE}_CA_SGP	FH_{PRE}_CA_PHV	FH_{PRE}_SA_BP	FH_{PRE}_SA_P	FH_{PRE}_SA_SGP	FH_{PRE}_SA_PHV
	Pearson correlation (r)	0.845	0.838	0.769	0.822	0.759	0.718	0.657	0.707
FH_{TRUE}	Sig. (two-sided)	≤ 0.001	≤ 0.001	≤ 0.001	≤ 0.001	≤ 0.001	≤ 0.001	≤ 0.001	≤ 0.001

BP, Bayley and Pinneau; CA, chronological age; FH_{PRE}, predicted final adult height; FH_{TRUE}, true final adult height; P, Paley et al; PHV, peak height velocity; SGP, Sanders – Greulich and Pyle; Sig., significance.

possible that growth-guiding interventions could result in a lower final height. To test this latter hypothesis, a study design with patients who have undergone hemiepiphysiodesis on only one side could be considered, as growth inhibition caused by the intervention would manifest as a difference in leg length.

We compared four different multiplier tables: Bayley and Pinneau,[14] Paley et al,[13] SGP,[15] and Sanders – PHV.[16] We found that using the Paley multiplier table was by far the easiest, as the use of the app 'Paley Growth' eliminated the need for multiplication tables and calculators. Our study showed that height predictions using CA_{SI} and the Paley multiplier table had a high correlation with actual height ($r = 0.838$; $p < 0.001$). However, the table tended to overestimate FH_{TRUE} by a mean delta of 6.45 cm, which was the highest among the four tables compared. We did not find a significant difference between Paley's multiplier table and the Bayley and Pinneau multiplier table (CA_{SI}: $p = 1.000$ (Dunn-Bonferroni post-hoc test); SA_{SI_CPH}: $p = 0.838$ (Friedman test)), which was expected due to the small differences between the multiplier values as previously stated by Paley et al.[13] In 2017, Sanders et al[15] published a multiplier table based on the Brush Foundation Study of Child Growth and Development dataset and skeletal ages using the GP atlas.[18] It has not yet been further validated for height predictions. The additional multiplier table published by Sanders et al[16] in 2021 takes a different approach than any multiplier previously developed. The timepoints with the highest growth rates were identified and used as a baseline to develop the multiplier tables. Sanders et al[16] found that their multiplier table – Sanders PHV – provided better results than the Paley multipliers during the ages of pubertal growth spurt. This is confirmed in our study. In addition, a superior accuracy of the SGP multiplier could be shown by our study, as it elucidated less overprediction than the Paley multiplier table when using CA_{SI} (mean 3.51 cm (SD 5.84) vs 6.01 cm (SD 4.96)). Future studies should consider using the SGP multiplier for improved accuracy.

The CPH method is the first purely numerical method for skeletal age determination,[12] developed with the intention of being user-friendly and to reduce the need for additional imaging and associated radiation exposure. However, the use of the CPH method did not significantly increase the accuracy of final height prediction. This contrasts with the findings of Knapik et al,[12] who compared their method with the GP atlas method in combination with sex and chronological age, as well as sex alone. For both combinations, they developed corresponding equations to predict $CA_{90\%FH}$ and showed that the CPH method was better at predicting this timepoint than the combination of chronological age and sex, as well as sex alone. To validate their method, Knapik et al[12] used data from 81 healthy children who were enrolled in the Bolton-Brush Growth Study between 1929 and 1942, whereas our study included a more diverse patient population with axial deviation in the frontal plane. Furthermore, we found that the practical application of the CPH method is limited by the fact that the acquisition and measurement of radiological images is prone to error. The growth plate is often depicted more than once due to its 3D nature on a 2D (AP) radiograph, and the medial or lateral margins of the epiphysis can be difficult to distinguish. Additionally, even small deviations in the measurement of CPV can result in significant changes in skeletal age estimation. This is reflected in the high standard deviations of the height predictions.

There are limitations of the study. First, no healthy control group was included in the study. Therefore, it cannot be conclusively assessed whether the study is transferable to a healthy patient population or a patient population with a different pathology. Likewise, it cannot be assessed whether an axial deformity in the frontal plane and its correction using tension band plating have an influence on the final body height. However, the inclusion of a healthy control group would not have been justifiable from an ethical point of view due to radiation exposure. It is worth noting that in this study, chronological age and skeletal age were used with each multiplier table, even though the tables of Bayley and Pinneau, SGP, and Sanders – PHV were intended to be used with skeletal age. This decision was made to avoid potential sources of error in determining skeletal age. However, although we used skeletal age as well, we found that it did not improve the accuracy of the multiplier tables intended for use with skeletal age. This suggests that skeletal age only enhances height predictions if it more accurately reflects true biological age compared to current chronological age. Whether this is the case depends on the performance of the skeletal age determining method in use, the quality of the radiograph image, and the examiner's experience.

In conclusion, the CPH method for determining skeletal age did not improve final adult height predictions. Therefore, the results of this study suggest that routine use of the CPH method for skeletal age determination in patients with idiopathic varus or valgus deformity of the leg offers no advantage over the simple use of chronological age in terms of accuracy of final height prediction. Of all four multiplier methods tested in this study, the most accurate size predictions were obtained using the SGP multiplier table. Overall, this study highlights the importance of considering the accuracy of the methods used to predict final adult height in young patients. It suggests that the currently available methods may not be accurate for modern patient populations and that more accurate methods may need to be developed and validated.

Take home message

- The study concludes that there is no advantage in routinely using the central peak height (CPH) method for skeletal age determination over the simple use of chronological age.
- The findings highlight the need for more accurate methods to predict final adult height in contemporary patient populations.

Supplementary material

Respective multiplier tables used in this study.

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Author information:
- M. Brenneis, MD, Orthopaedic Surgery Resident
- N. Thewes, Student
  Department of Orthopedics (Friedrichsheim), University Hospital, Goethe University Frankfurt, Frankfurt, Germany.
- J. Holder, PhD, Postdoctoral Researcher, Department of Orthopedics (Friedrichsheim), University Hospital, Goethe University Frankfurt, Frankfurt, Germany; Department of Sport and Exercise Science, University of Salzburg, Salzburg, Austria.
- F. Stief, PhD, Head of Movement Analysis Laboratory, Department of Orthopedics (Friedrichsheim), University Hospital, Goethe University Frankfurt, Frankfurt, Germany; Dr. Rolf M. Schwiete Research Unit for Osteoarthritis, Department of Orthopedics (Friedrichsheim), University Hospital, Goethe University Frankfurt, Frankfurt, Germany.
- S. Braun, MD, Orthopaedic Surgery Resident, Department of Orthopedics (Friedrichsheim), University Hospital, Goethe University Frankfurt, Frankfurt, Germany; Center for Musculoskeletal Surgery, Charité - University Hospital Berlin, Berlin, Germany.

Author contributions:
- M. Brenneis: Conceptualization, Data curation, Investigation, Methodology, Formal analysis, Visualization, Writing – original draft, Writing – review & editing.
- N. Thewes: Data curation, Investigation, Visualization, Writing – original draft, Writing – review & editing.
- J. Holder: Investigation, Visualization, Writing – original draft, Writing – review & editing.
- F. Stief: Conceptualization, Investigation, Visualization, Formal analysis, Supervision, Validation, Methodology, Project administration, Writing – original draft, Writing – review & editing.
- S. Braun: Conceptualization, Data curation, Investigation, Methodology, Formal analysis, Visualization, Writing – original draft, Writing – review & editing.

- F. Stief and S. Braun contributed equally to this work.

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