COMPARISON OF DIAGNOSTIC ACCURACY OF FOUR ODONTOLOGICAL METHODS FOR AGE EVALUATION IN ITALIAN CHILDREN AT THE 14 YEARS THRESHOLD USING ROC CURVES

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Background and aim of the research: In the evaluation of the accuracy of the odontological methods for age evaluation, the age threshold of 14 years is relevant in Italy as the minimum age for criminal responsibility. It is of utmost importance to evaluate the diagnostic accuracy of every odontological method for age evaluation considering the sensitivity, or the ability to estimate the true positive cases, and the specificity, or the ability to estimate the true negative cases. The sensitivity and specificity of the methods are, however, inherently linked, as one increases, the other decreases. According to the aforisma "in dubio pro reo", in criminal cases it is therefore necessary to grant an absolute privilege to the specificity, favouring the methods with reduced false positives rate. A Receiver Operating Characteristic, or ROC curve, is a plot of the sensitivity of a test versus its false positive rate, or (1-specificity). Each point in the graph is generated by a different decision criteria. The Area Under the ROC Curve (AUC) is used to summarize the accuracy of a diagnostic test.

The objective of this research was to compare the AUC of four commonly adopted methods of odontological age estimation – Demirjian (D), Haavikko (H), Willems (W), Cameriere (C) – in a sample of Italian children between 11 and 16 years considering the 14 years as threshold to be estimated. In addition, new decision criteria are developed to increase the accuracy of the methods.

Materials and methods: The sample was composed of 501 digital OPGs of Italian children (257 females and 244 males) aged from 11 to 16 years (4015 to 5474 days).The stage of the morphological maturation of the teeth was evaluated, according to D, H, C and W methods, by three independent examiners. Intra-rater and inter-rater agreements among the operators have been performed using the Intraclass Correlation Coefficient (ICC).The AUC of the 4 methods was compared separately for male and female and for the 3 operators. New decision criteria were selected maximizing the Youden index (Sensitivity+Specificity-1).

Results: ICC ranged from0.85 to 0.92 for intra-rater agreement and ranged from0.81 to 0.88 for inter-rater agreement. At the established 14 years threshold, in the females cohort, in two of the three operators the Cameriere method had the higher AUC value. In the third operator, the Cameriere method showed a high AUC value but not statistically different to the other methods. Similar results occurred also in the males cohort. In Willems e Demirijan methods the decision criteria coincided with the 14 years threshold. In Haavikko and Cameriere methods the new decision criteria was lower than the 14 years threshold. In females using 12.867 years as a decision criterion for Cameriere, the sensitivity was 87% and the specificity was 85%.In males using 13.221 years as a decision criterion for Cameriere the sensitivity was 78% and the specificity was 81%.

Conclusion: Among the four odontological methods for age estimation adopted in the research, the Cameriere method showed the highest AUC either in the females or in the males cohort. Cameriere's method shows, therefore, a high accuracy at the 14 years threshold, even if it has not been developed to be used in individuals older than 14. Using Cameriere's method, to estimate the 14 years threshold more accurately, we suggest that the decision criterion be set at a lower value.

*KEYWORDS***:** Forensic Odontology, Age Estimation, Demirjian, Haavikko, Willems, Cameriere.