G33 Minimum Values for Mandibular Maturity Markers

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Learning Overview: After attending this presentation, attendees will understand that for clinical dental age estimation in Europe, there is a prevailing view that only the minimum value of age at assessment reference data is the legally acceptable threshold in Europe. This applies at all ages, but particularly at the 18-year threshold.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by showing that for the European Union, the legal burden of proof is 100% certainty for determining whether or not a subject is below or above 18 years of age. This has considerable impact because in the United Kingdom and European Courts, the civil burden of proof of "greater or less than 50%" no longer applies. In the United States, this is called the "preponderance of the evidence."

Introduction: The use of human biological growth markers to help estimate chronological age has undergone a shift from the use of normal distribution statistics with the "preponderance of the evidence" to the rigorous use of age marker-based assessment criteria using the minimum value (0th%ile) of an age marker as the criterion.[1,2] The purpose of this report is to review published data to determine if the variability of the age at assessment for the minimum value of Root Pulp Visibility (RPV) discriminates between <18 years and >18 years.

Materials and Methods: The data used as the starting point are from a previously presented paper.[3]

The summary statistics for males only in decimal years are shown in Table 1.

	n-tds	$\bar{x}$-tds	sd-tds	Minimum	25th%ile-	50th%ile	75%ile	Maximum
RPV-Am	213	21.27	2.05	17.16	19.67	20.91	22.80	25.49
RPV-Bm	272	22.61	2.15	17.71	21.06	22.77	24.38	25.93
RPV-Cm	66	23.34	1.98	18.16	22.13	23.76	25.05	25.96
RPV-Dm	9	23.46	1.67	20.19	22.41	23.47	24.87	25.19

It can be seen that the minimum values for RPV-Am and RPV-Bm are below the 18 year threshold whereas the minimum values for RPV-Cm and RPV-Dm are above the 18 year threshold.

This is offered as compelling evidence that the mandibular maturity marker of RPV discriminates between a juvenile and an adult.

This was rejected by the United Kingdom Court of Immigration as it was "too novel" and needed confirmation from other studies. Further support has been provided by studies in Germany-2, Portugal, Western China, the United Kingdom, and Malta.

Results: The minimum values for RPV-Cm and RPV-Dm for the seven countries are shown in Table 2 (decimal years).

Stage	Germany -1	Portugal	United Kingdom	Germany-2	Northern China	Malta
RPV-Cm	24.70	18.80	18.58	22.10	24.68	18.23
RPV-Dm	25.20	21.20	22.45	25.10	27.66	23.99

Discussion: These multi-ethnic data from several disparate countries, but using the same methods, provide similar results. All the studies provide satisfactory assessments of between assessor and within assessor performance.

Conclusion: RPV stages C and D at the minimum value demonstrates the validity of using this age-related growth marker to determine in legal terms whether a subject is a juvenile or an adult.

Reference(s):

1. Kasper K.A., Austin D., Kvanli A.H., Rios T.R., Senn D.R. Reliability of third molar development for age estimation in a Texas population: A comparison study. *Journal of Forensic Sciences.* 2009; 54(3): 651-657. Doi:10.1111/j.1556-4029,2009.01031.x. www.blackwell-synergy.com.
2. Schumacher G., Schmeling A., Rudolf, E. Medical age assessment of juvenile migrants—An analysis of age marker based assessment criteria. *European Commission JRC Science for Policy Report*. doi: 10.2760/47096 European Union.
3. Lucas V.S., McDonald F., Andiappan M., Roberts G. Dental age estimation—Root Pulp Visibility (RPV) patterns: A reliable Mandibular Maturity Marker at the 18 year threshold. *Forensic Science International.* 2017; 270: 98–102.

Mandibular Maturity Markers, Root Pulp Visibility, Minimum Age Threshold

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