G19 The Use of Cone Beam Computed Tomography (CBCT) to Examine the Relationship Between Mandibular Bone Density and the Disappearance of the Clarity of Root Pulp Visibility (RPV) and Periodontal Ligament Visibility (PLV)

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Learning Overview: After attending this presentation, attendees will be aware of the potential for CBCT to measure the dimension of bone buccal to the roots of the mature lower third molar. Attendees will be able to understand how the increase in the dimension of bone buccal to the mature third molar contributes to the gradual obliteration of both RPV and PLV.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by contributing to increased precision when estimating the probability that a subject is over 18 years old.

Introduction: The loss of visibility of RPV and PLV related to lower mature third molars (Demirjian Stage H) has been reported by European workers with more recent confirmation of their findings.[1-4] Although the Balance of Probability was 50% for civil cases in the United Kingdom, the Immigration Court is now demanding "beyond a reasonable doubt," which is 100% certainty.

It is perceived that the CBCT will offer the opportunity to measure the thickness of dentin and bone leading to loss of RPV and PLV.

Materials and Methods: Approval for the study was obtained from Guys and St. Thomas's NHS Trust (IRAS 231512). CBCTs and corresponding Panoramic radiographs (DPTs) were drawn from the radiographic archive. Three points were identified in the sagittal plane at the bifurcation, half way down the root and approximately 1mm up from the root apex. The view was switched to the horizontal plane and, at each of these points, the distance from the buccal pulpal wall to the buccal surface of the bony cortex was measured.

For both RPV and PLV separately, the measurements were averaged to give a single figure for the buccal bone dimensions.

Results:

There was concordance between the Left and Right sides (Table 1)

Bone Dimension	Right			Left				
	n	$\bar{x}$	sd	n	$\bar{x}$	sd	t	p
RPV	15	8.0	0.88	18	7.85	1.24	0.3928	0.6971
PLV	15	8.7	1.19	18	8.49	1.24	0.1849	0.8545

There is no significant difference in the thickness of buccal bone between the left and right sides of the mandible; *n*=17 for left side PLV as some measurements contributing to the average could not be made.

There were slight differences between females and males (Table 2)

Bone Dimension	Females			Males				
	n	$\bar{x}$	sd	n	$\bar{x}$	sd	t	p
RPV	16	8.01	1.14	11	8.17	0.97	0.7093	0.3547
PLV	16	8.46	1.14	11	8.09	2.55	-0.5083	0.6157

This indicates a slight trend toward slightly thinner buccal bone in females compared with males for RPV. This trend is reversed for PLV.

Discussion: These data confirm that the bone buccal to the lower left third molar has symmetrical growth on both the left and right sides. This is important because it has been suggested that differences in the appearance of the left and right sides of dental panoramic tomographs account for differences in RPV and PLV assessments.[5] It has not been possible to fully resolve this issue because in the present study, there are insufficient DPTs to match with the corresponding CBCTs of individual patients. This would be a specific topic for future work.

Conclusions: The important outcome is the strong similarity of the mandibular bone dimensions on the left and right sides.

The CBCT technique has shown great potential for overcoming the limitations of the DPT technique for assessing RPV and PLV of the mature third molar.

Reference(s):

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2. Olze A., Solheim T., Schulz R., Kupfer M., Pfeiffer H., Schmeling A. *International Journal of Legal Medicine*. 2010; 124: 445-448.
3. Lucas V.S., McDonald F., Andiappan M., Roberts G. *Forensic Science International* 2017; 270: 98-102. (RPV).
4. Lucas V.S., McDonald F., Andiappan M., Roberts G. Dental Age Estimation. *International Journal of Legal Medicine*, DOI 10.1007/s004–16-1468–3. (PLV).
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Root Pulp Visibility (RPV), Periodontal Ligament Visibility, Bone Dimensions