Eruption rate of mandibular second premolars during intraosseous stage: A CBCT Evaluation

Jang D, DMD; Bollu P, DMD, MS, MBA; Chaudhry K, MD; Tamimi D, DDS, DMSc

INTRODUCTION

Lower second premolar (LPm2) eruption time is of special interest to orthodontists because these are usually the last succedaneous teeth to emerge, signaling the best timing to begin full orthodontic treatment.[1,2] The goal of the study is to explore the possibility of using three-dimensional measurements of alveolar bone height from alveolar crest to buccal cusp of LPM2 obtained from CBCT scans as a supplemental tool to assess and predict eruption time of mandibular second premolars.

OBJECTIVES

1. To determine the possibility of predicting eruption time of mandibular second premolars using three-dimensional measurements of alveolar bone height from alveolar crest to buccal cusps of second premolars obtained from CBCT scans.
2. To determine whether secondary variables such as gender, angulation, inclination and dental maturity status of LPM2 have association with LPM2 eruption rate.

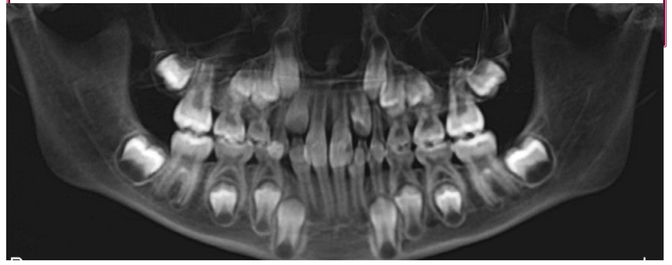

Figure 1: Panomaric X-ray of a patient in mixed dentition with right and left mandibular second premolars in intraosseous stage of active eruption.

PRESENTED BY DR. JANG AT THE ROSEMAN UNIVERSITY RESEARCH SYMPOSIUM, HENDERSON, NV ON April 14, 2021.

RESEARCH DESIGN & SAMPLE

- Retrospective Cohort Study
- Sample population: 90 patients at Roseman University Orthodontic clinic with a DOB between 2001 and 2011 who has had at least two sets of CBCT records taken at separate timepoints (minimum of 6 months apart) with mandibular right and left second premolars(LPm2) in their intraosseous stage of active eruption. Mainly interphase retention patients or patients with CBCT records prior to start of treatment. (Total of 180 samples of LPm2)
- T0 – Pretreatment records with LPm2 in intraosseous stage after crown completion
  T1 – Pretreatment records with LPm2 in intraosseous stage (T0 + ≥6 months)
  T2 (if available) – Pretreatment records with LPM2 in intraosseous stage (T1 + ≥6 months)

INCLUSION & EXCLUSION CRITERIA

Inclusion Criteria:

- Patients in early to late mixed dentition
- CBCT scans taken at initial diagnostic records appointment (T0) and at least one additional scan taken at a minimum of 6 months later (T1)

Exclusion Criteria:

- Poor quality CBCT films
- Genetic syndromes
- Systemic diseases that would impact tooth eruption rate
- Congenitally missing LPm2
- Ankylosed primary second molars and/or LPm2
- Ectopic eruption of LPm2
- Severe crowding limiting eruption paths of LPm2
- Recorded extraction of deciduous mandibular second molars
- Abnormal anatomy of LPm2
- Incomplete crown formation of LPm2 at T0

METHODS

1. Anatomage Invivo6 imaging software version 6.0.3 will be used for all linear and angular measurements on DICOM files.
2. Linear distances from the alveolar bone crest to LPM2 crown tip are measured at each timepoint to assess eruption rate.
3. Potential confounding factors are recorded including dental maturity status as determined by the Simpson and Kunos index[3] and mesiodistal and buccolingual angulations of each LPM2 measured from long axes of tooth to vertical reference lines.

NULL HYPOTHESES

1. There is no association between remaining alveolar bone height and eruption rate of mandibular permanent second premolars.
2. There is no association between remaining alveolar bone height and dental maturity status of mandibular second premolars in growing patients.

VARIABLES

1. **Independent Variable**: Gender, age, dental maturity index, inclination and angulation of LPM2, alveolar bone height measured from alveolar crest of buccal cusp of LPM2
2. **Dependent Variables**: Eruption rate of LPM2

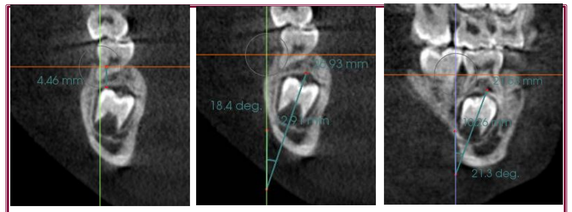

Figure 2: Sample measurements from the study. (Left) Alveolar bone height measurement from buccal cusp of LPM2 to alveolar crest. (Center) Buccolingual inclination measured against vertical orientation line. (Right) Mesiodistal angulation measured against vertical orientation line.

STATISTICS

Statistical Package for the Social Sciences (SPSS) version 27.0 will be used to run the following analyses:

- Descriptive statistics will be performed for demographic data
- Independent T-Test will be performed to compare independent variable (alveolar bone height, dental maturity scores) with the dependent variable (eruption rate)
- Regression analysis will be used to measure correlation between the variables

REFERENCES

1. Moyers, R. E. (1988). Handbook of orthodontics. Chicago, IL: Year Book Medical Publishers.
2. Rinaldi, M. R. L., Lima, E. M. D., Menezes, L. M. D., Rizzatto, S. M. D., Matje, P. R. B., & Ribeiro, R. V. P. (2017). Eruption rates of lower second premolars at different development stages evaluated with cone-beam computed tomography. The Angle Orthodontist, 87(4), 570–575.
3. Simpson, S. W., & Kunos, C. A. (1998). A radiographic study of the development of the human mandibular dentition. Journal of Human Evolution, 35(4-5), 479–505.