

Assessing Mesialization of Mandibular Second Permanent Molars After First Permanent Molar Extractions

Authors

Michelle Y. Kwan, DDS^{1,2}; Zameera Fida, DMD^{1,2}
1. Boston Children's Hospital, Boston, MA, USA
2. Harvard School of Dental Medicine, Boston, MA, USA

INTRODUCTION

- Treatment of first permanent molars pose numerous challenges in the pediatric population
- Current literature has examined a myriad of factors associated with successful space closure in the mandibular arch following first molar extraction
 - Chronological age
 - Demirjian developmental stage of second permanent molar
 - Mesial angulation of the second permanent molar
 - Presence of third molar
- We hypothesize that chronological age and Demirjian developmental stage of the SPM are significantly associated with successful space closure in the mandibular arch. We also aim to evaluate whether mesial angulation is significantly associated.
- This IRB-approved retrospective study aims to investigate predictive variables through radiographic assessment associated with the mesialization of mandibular second permanent molars after first permanent molar extraction

METHODS

- Retrospective chart review of 830 patients in the Boston Children's Department of Dentistry and Department of Oral and Maxillofacial Surgery from 2013-2023
- 54 mandibular quadrants with first permanent molar extractions were included
- Inclusion Criteria
 - ASA I or II
 - Ages between 6 and 16 at time of extraction
 - Available pre-extraction radiographs (panoramic, periapical) and post-extraction radiographs (bitewing, panoramic) that shows full eruption of second permanent molar and second premolar
- Independent factors
 - Chronological age defined as early (7-10 years) and late (11-16 years)
 - Second molar Demirjian development stage defined as early (D and E) and late (F, G, and H)
 - Second permanent molar angulation defined as mesial, upright, or distal
- Primary outcome of interest was presence of space closure, defined radiographically as acceptable contact within the middle third and without significant marginal ridge discrepancy between the second permanent molar and second premolar
- Logistical regression was used to examine continuous variables association on the rates of closure, with chi-square used to examine individual independent binary variables association with closure success

Chronological age (7-10 years), Demirjian Stage (D and E), and mesial angulation of second permanent molar are associated with a higher success of space closure following first permanent molar extraction

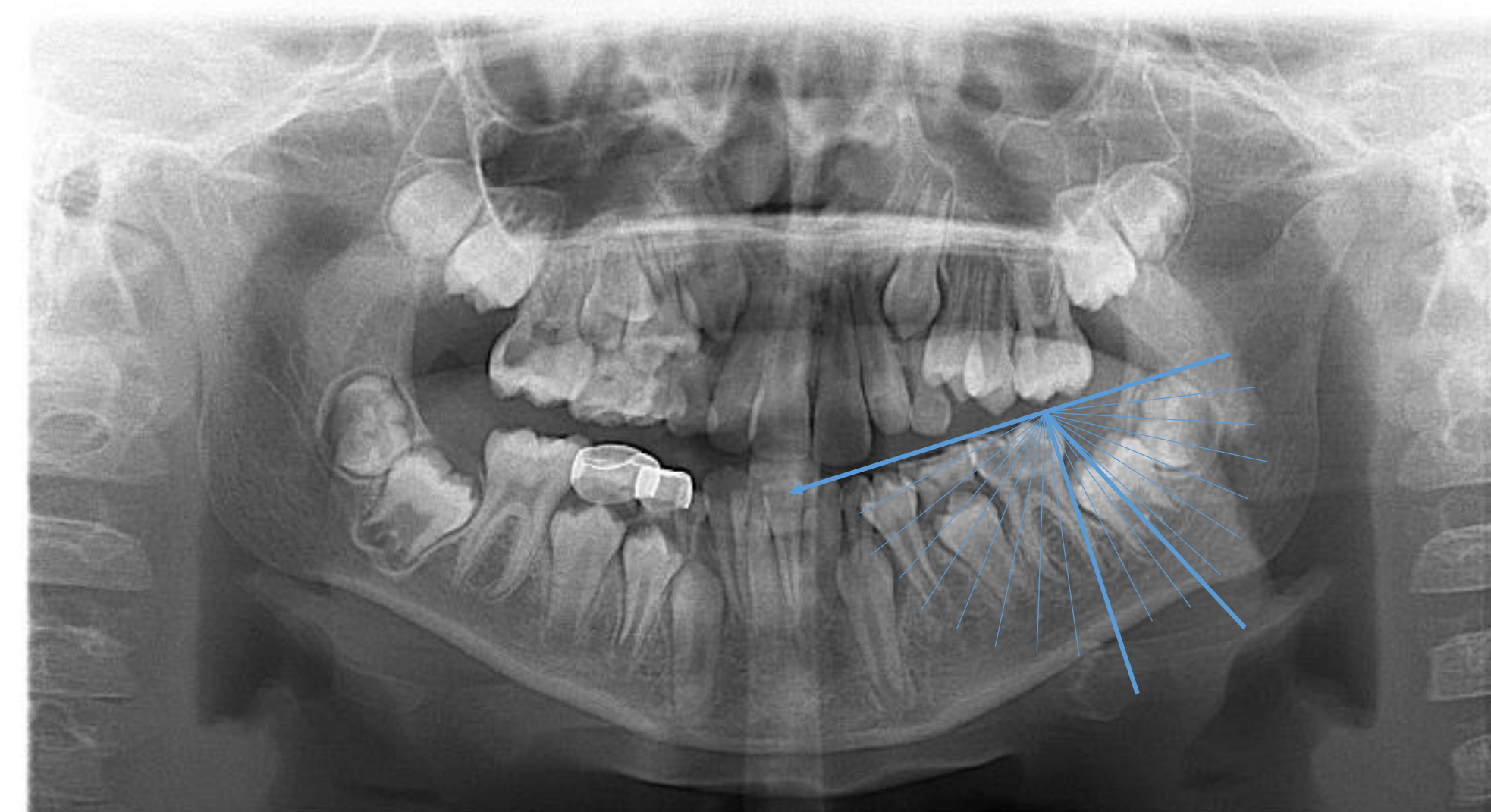
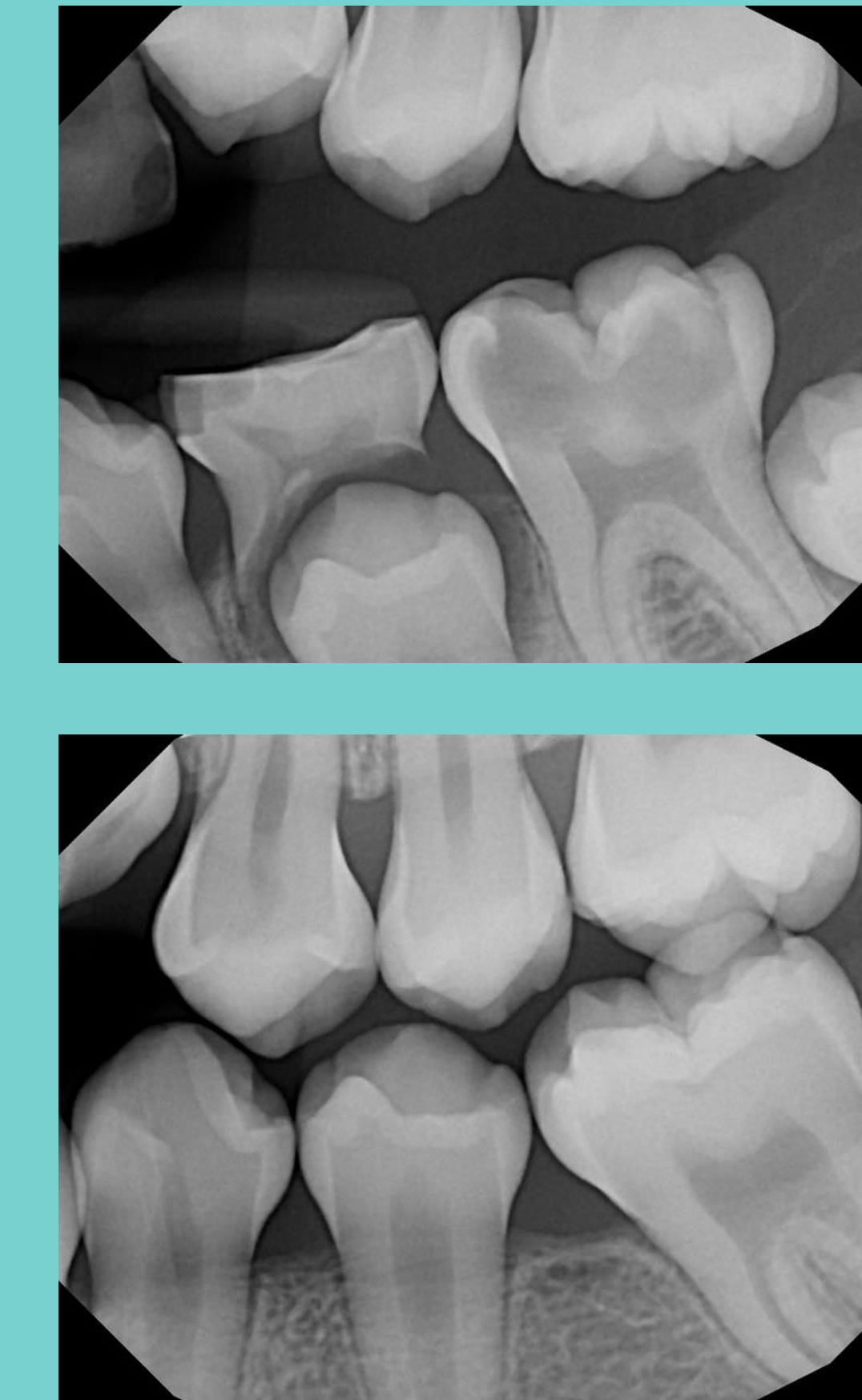


Figure 1. Patel et al. toolkit used to determine angulation of the second permanent molar (SPM). Toolkit was first aligned with occlusal plane (horizontal) and shifted to find the angular sector that best fit the long axis of the SPM.

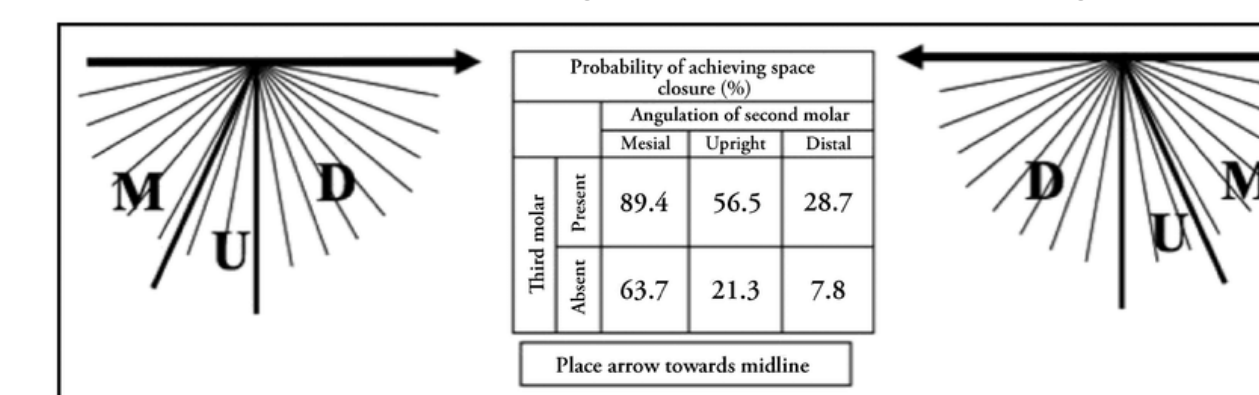


Figure 2. Patel et al. toolkit created to aid the clinician in determining SPM angulation and to predict probability of space closure in the mandibular arch based on presence of third molar and SPM angulation.

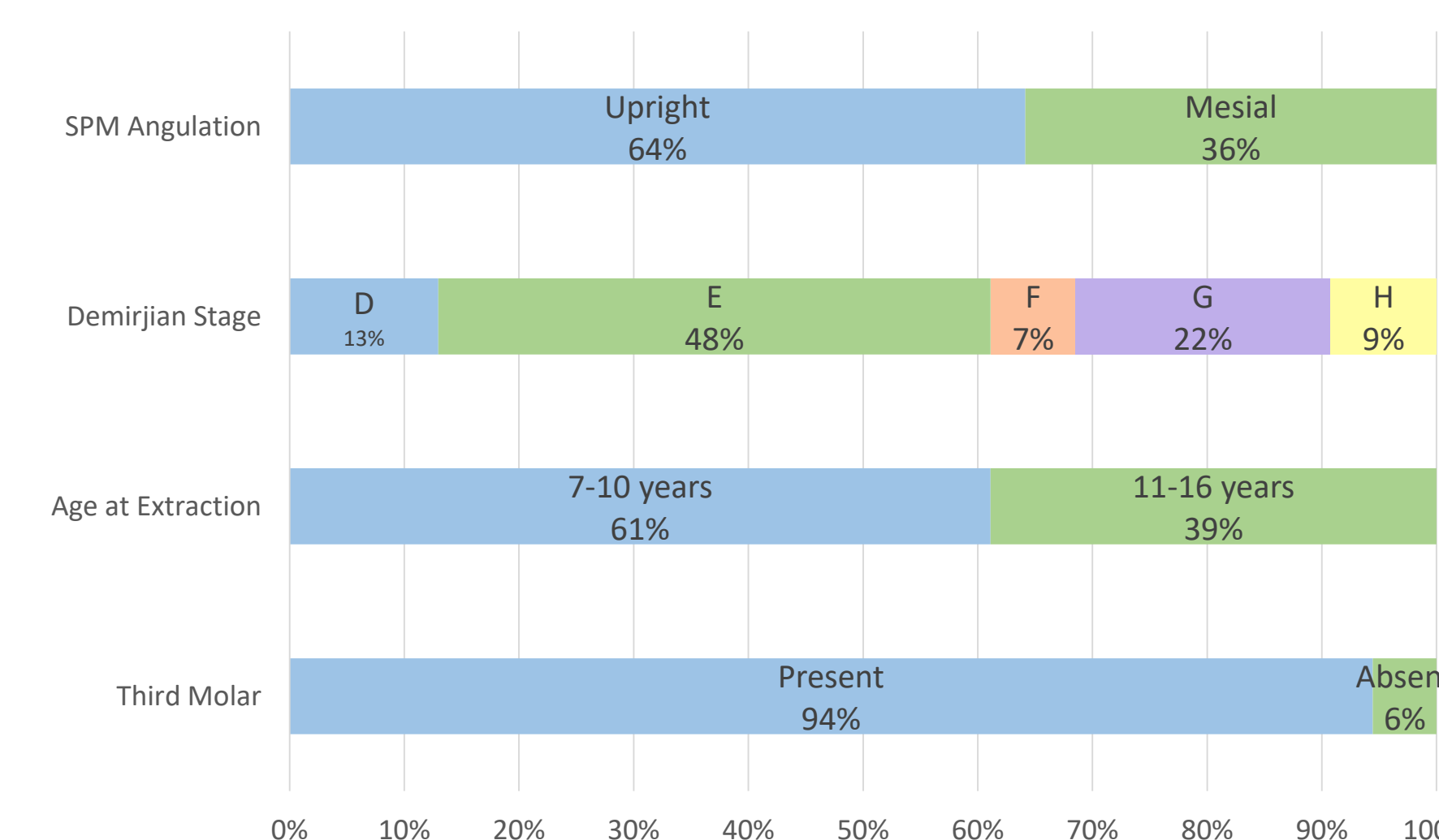


Figure 3. Independent factors examined

RESULTS

- There was a significant reduction in the success of space closure in patients with increase in age (OR = 0.32, $p < .001$)
 - On sub-analysis, patients aged 7-10 exhibited significant increase in success of space closure compared to ages >10 (OR = 0.03, $p < .001$).
 - When adjusted for angulation, age continued to show significance in increased occurrence of space closure (OR = 0.03, $p < .001$).
 - When adjusted for angulation and Demirjian stage, age continued to show significance in increased occurrence of space closure (OR = 0.33, $p < .05$).
- There was a significant increase in the success of space closure associated with Demirjian stage D and E ($p < .001$).
- Quadrants with mesial angulation of SPM had a significantly higher occurrence of space closure when compared to those with upright angulation ($p = .004$).
- Third molar was present in 51 quadrants (94%)

DISCUSSION

- Age was significantly associated with space closure when adjusted for SPM developmental stage and SPM angulation.
- When independently examined, early age, early Demirjian stage, and mesial SPM angulation were associated with increased occurrence of space closure.
- Limitations
 - Sample size
 - Overfitting of logistical regression model
 - Different population baseline characteristics
 - Time elapsed between initial referral and actual extraction
 - Loss to follow-up, as most patients did not return to Boston Children's for regular recalls
 - Generalizability and scope of application
- Our results confirm our hypothesis and support previous literature findings and the importance of the listed factors in determining space closure success.