

# Factors Influencing Space Closure After Early Extraction of Permanent First Molars: A Retrospective Cross-sectional Radiographic Study

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## Introduction

Permanent first molars (PFMs) are essential for dental arch stability but are highly susceptible to early caries and developmental defects such as molar-incisor hypomineralization (MIH). As a result, they are frequently extracted in children. Early extraction may facilitate spontaneous mesial migration of the second and third molars, potentially reducing malocclusions and the need for future orthodontic treatment. However, the success of spontaneous space closure is variable and influenced by several factors, with inconsistent findings reported in the literature.

## Aim

To evaluate variables associated with the degree of residual space closure following PFM extraction.

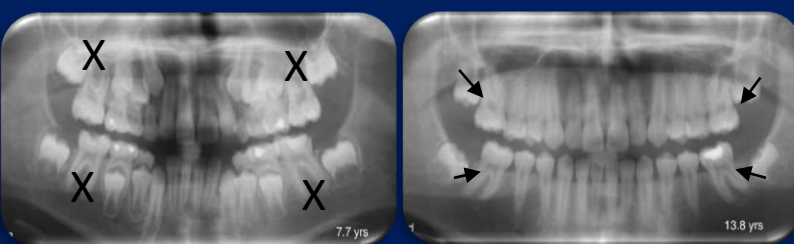


Figure 1. Pre- and post-extraction panoramic radiographs, 6.1 years follow-up.

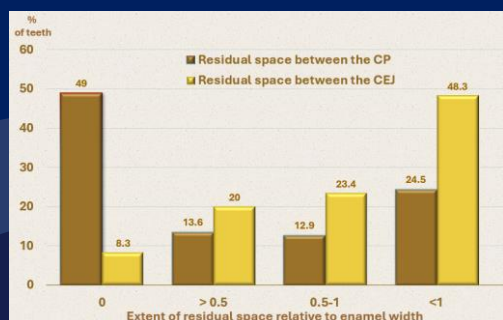


Table 1. Residual Space Measurement Between S-Pm and PSM: Comparison between Contact Points and between CEJ Relative to Enamel Width, in both arches

## Design

A total of 270 panoramic radiographs who underwent PFM extraction were evaluated. The degree of space closure at the contact points (CPs) and cemento-enamel junctions (CEJs) of the second premolar (S-Pm) and permanent second molar (PSM) were evaluated. Space closure was measured relative to the enamel width of the PSM, dental age was determined using Demirjian's method, and degree of angulation was assessed using Teo's method.



Figure 2. Demirjian Staging Of Tooth Development

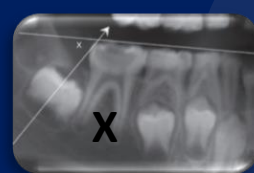


Figure 3. Teo's method

## Results

**Follow-up:** Mean 46.8 months. **Full closure:** CP 49% overall (66.7% maxilla; 31.3% mandible) vs CEJ 8.3% overall (15.6% maxilla; 1.6% mandible) - 5.9× more frequent at CPs. **Dental age:** Higher CEJ closure when PSM at stages D-E ( $p=0.018$ ) and S-Pm at stage E. **Chronological age:** Younger patients had better CEJ closure ( $p=0.032$ ). **Angulation:** Distal PSM ( $90-135^\circ$ ) → less residual space; mesial PSM ( $45-90^\circ$ ) → more residual space ( $p<0.05$ ). **Follow-up time:** Closure at CP ( $p=1.91 \times 10^{-9}$ ) and CEJ ( $p=1.18 \times 10^{-6}$ ) continued beyond 2 years; >90% of full closures occurred after 24 months. **No significant effect:** PTM presence, eruption status, periapical status.

## Conclusion

Most children who undergo early PFM extraction will require complementary orthodontic treatment. Proper timing increases the probability of better space closure.