Evaluating Radiographic Tool Concordance for Crown Sizing and Associated Clinical Outcomes

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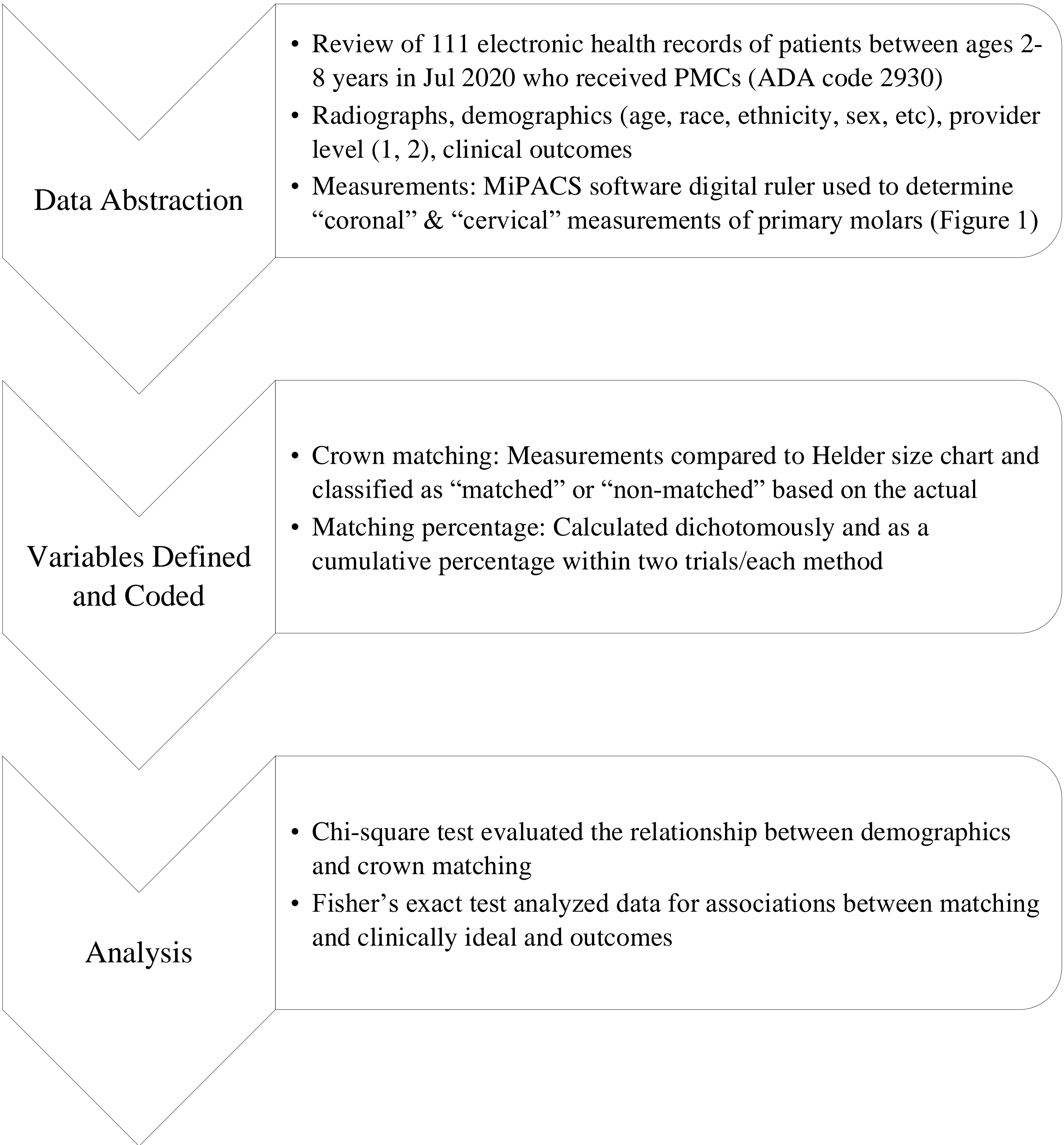
Background

- Accurate selection of preformed metal crown (PMC) size is traditionally based on visual estimation, a method reliant on experience
- Helder et al. developed an PMC sizing guide utilizing digital radiographic measurements of the mesiodistal width of primary molars

Purpose

- To evaluate the accuracy of Helder's PMC prediction guide within a unique population at a large teaching hospital in Washington Heights, NY
- To explore demographic influences on crown sizing and assess correlations between crown size concordance (matched vs. non-matched) and outcomes (ideal vs. non-ideal)

Methods

Data Abstraction
- Review of 111 electronic health records of patients between ages 2-8 years in Jul 2020 who received PMCs (ADA code 2930)
- Radiographs, demographics (age, race, ethnicity, sex, etc), provider level (1, 2), clinical outcomes
- Measurements: MiPACS software digital ruler used to determine "coronal" & "cervical" measurements of primary molars (Figure 1)

Variables Defined and Coded
- Crown matching: Measurements compared to Helder size chart and classified as "matched" or "non-matched" based on the actual
- Matching percentage: Calculated dichotomously and as a cumulative percentage within two trials/each method

Analysis
- Chi-square test evaluated the relationship between demographics and crown matching
- Fisher's exact test analyzed data for associations between matching and clinically ideal and outcomes

Findings

Demographics
- Mean Age: 5.9 years (Range: 3–11 years); sex distribution: 59% male, 41% female (n=66); ethnicity: 70% identified as Hispanic (n=78)

Crown Size Prediction Accuracy
- Predicted crown sizes matched clinical placements in: 92.5% of coronal measurements; 87% of cervical measurements
- Accuracy rates reflect cumulative results across two trials

Reliability Analysis
- Intraclass Correlation Coefficients (ICC): 0.98 for coronal measurements; 0.96 for cervical measurements

Statistical Analysis
- No significant associations were found between crown size matching and ethnicity, sex, and provider proficiency
- No significant difference in matching rates between coronal and cervical models (p>0.05)

Clinical Outcomes
- Matched crowns showed high rates of clinically ideal outcomes: 82.9% for coronal measurements; 83.6% for cervical measurements
- Non-matched crowns also demonstrated similarly high outcomes: 78.3% for coronal measurements; 82.8% for cervical measurements
- No significant differences in ideal outcomes between matched and non-matched crowns

Adverse Outcomes (Figures 2 and 3)
- Non-matched crowns were more frequently: oversized; improperly seated; abscessed
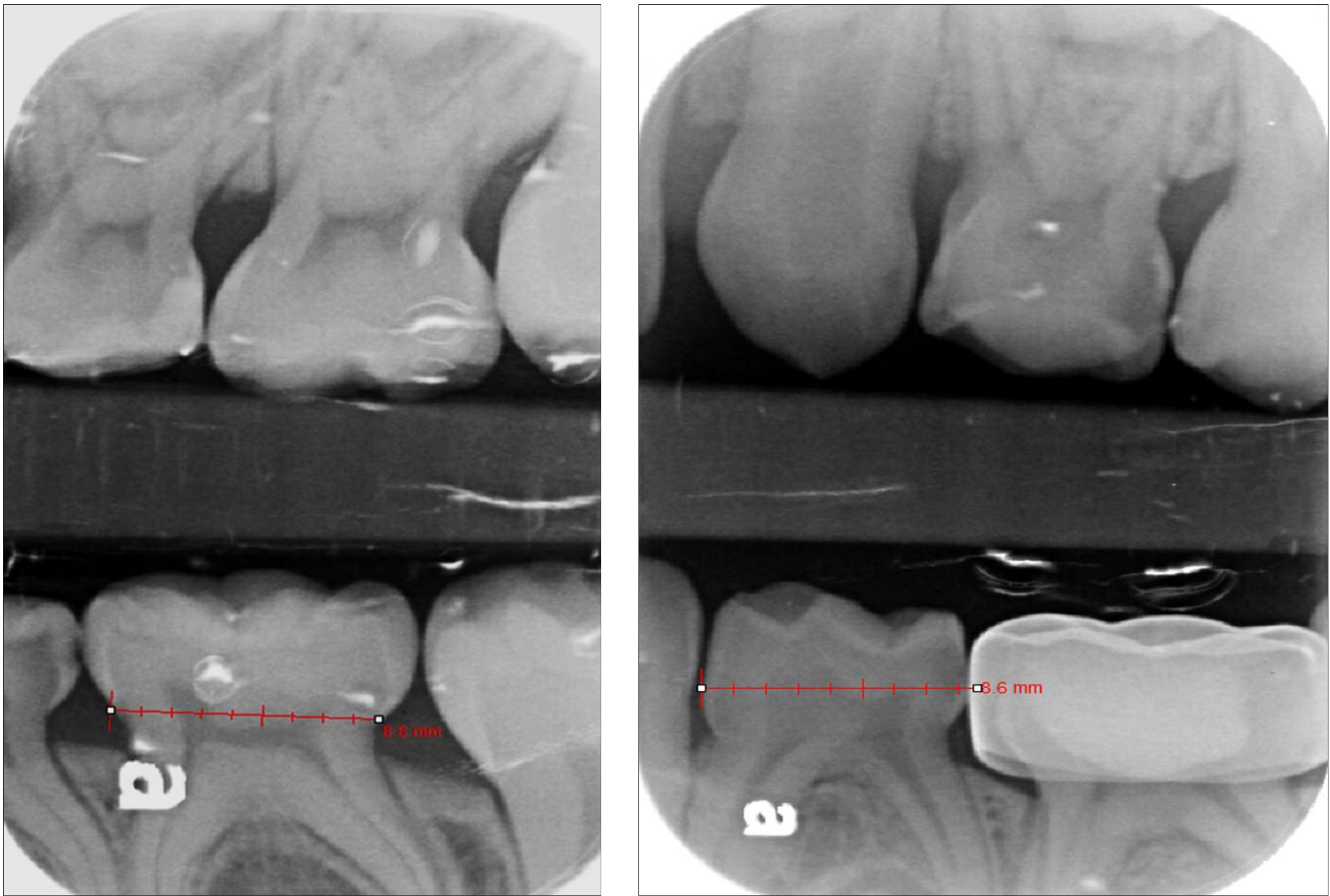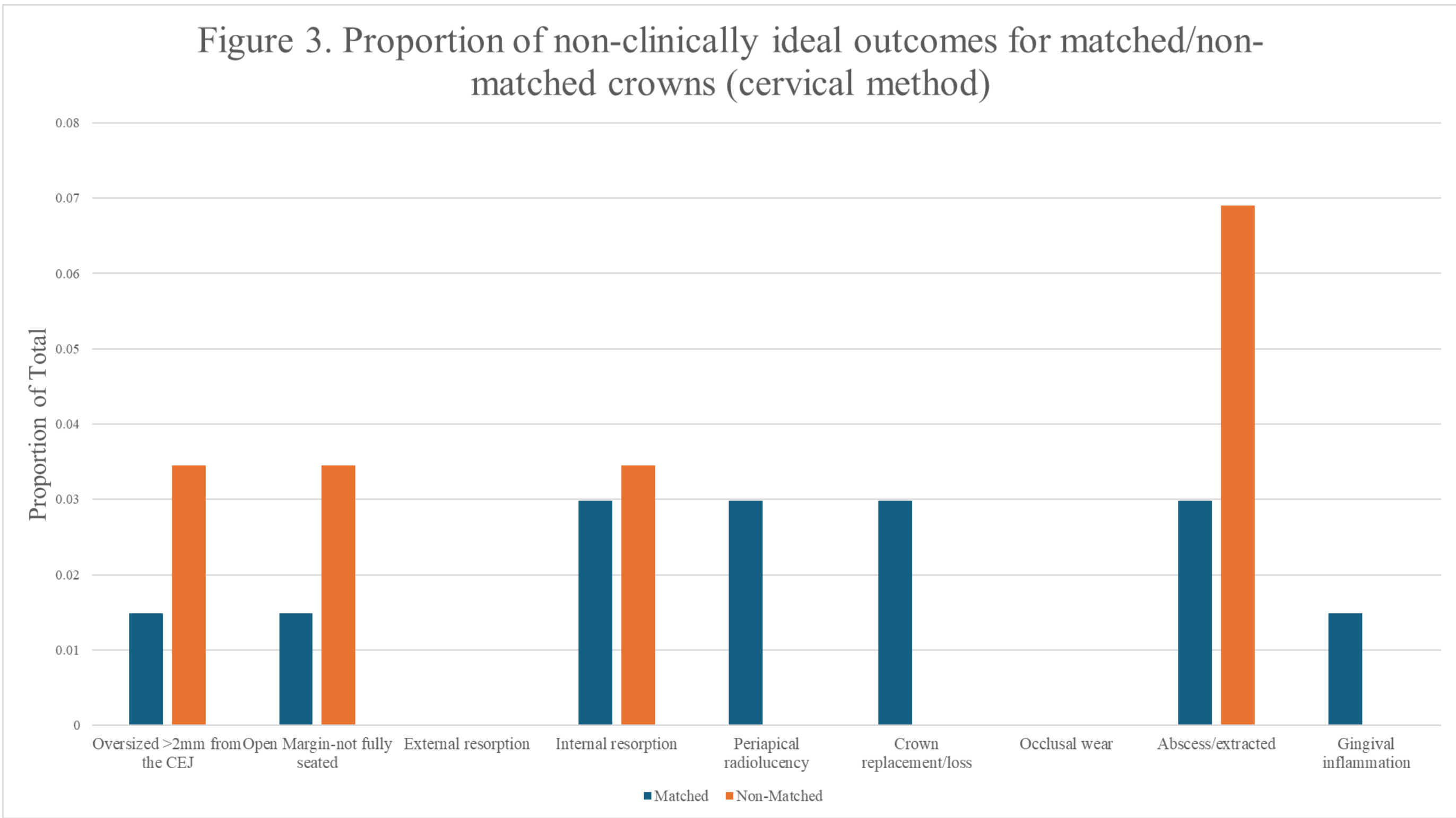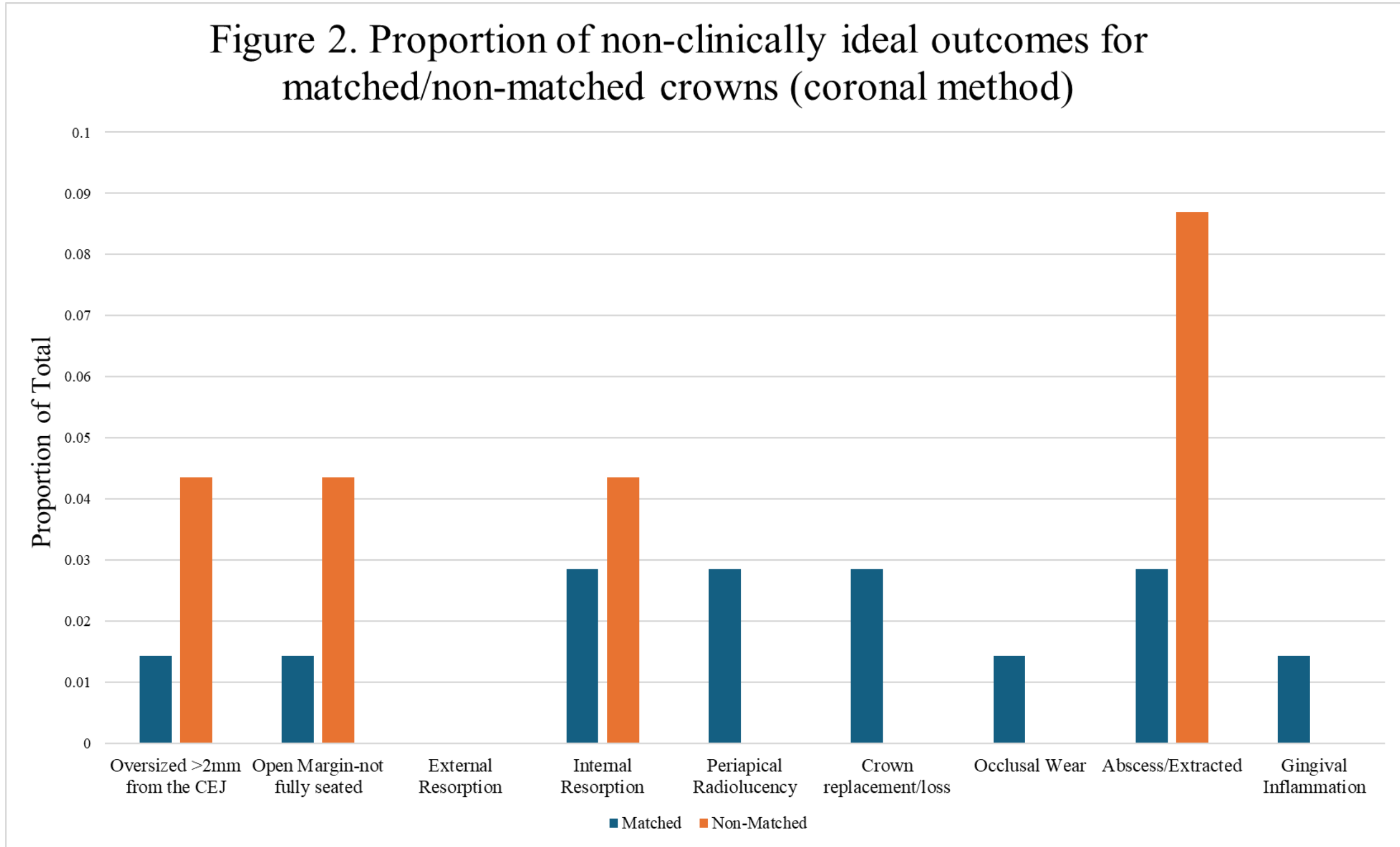- These differences were not statistically significant

Figure 1. Digital radiographic measurement of #K (8.8 mm, E5/E6, cervical technique [mesial CEJ to distal CEJ] (left image). Radiographic measurement of #L (8.6 mm, size: D5/D6, coronal technique [most convex portion of mesial wall to the most convex portion of the distal wall] (right image).

Findings (continued)

Figure 2. Proportion of non-clinically ideal outcomes for matched/non-matched crowns (coronal method)

Figure 3. Proportion of non-clinically ideal outcomes for matched/non-matched crowns (cervical method)

Limitations

- Calibrated radiograph imaging software to ensure accurate digital measurements of the mesiodistal width of primary teeth
- Small sample size may have limited its statistical power to detect true associations among the factors assessed

Discussion

- High concordance suggests the Helder tool is favorable in our population
- Applicable to MiPACS imaging software and Hu-Friedy crowns
- Matched crowns had fewer seating issues, as well as lower rates of associated abscesses, but more crown replacements/loss, although no significant link detected
- Further evaluation is needed to assess the predictive tool use in educational program such as pediatric dentistry clinical traineeships at intern level, efficiency, effectiveness, and material waste
- Larger sample to explore tool and adverse outcomes