

Statistical Analysis Plan

Data will be collected using Microsoft Excel and analysed with SigmaPlot (v14.0). Statistical significance will be set at $p \leq 0.05$ (95% confidence level).

Sample size has been calculated to detect differences between groups in articulation disorders and pharyngeal lymphoid tissue size (power = 0.80, $\alpha = 0.05$). This requires at least 24 participants for articulation disorders (to be assessed by chi-square test) and 61 participants for lymphoid tissue size. The initial participant number will be increased to account for potential attrition during the follow-up period.

Descriptive statistics and one-way frequency tables will be used to describe the UPCB and control groups. Group differences in gender will be assessed using the chi-square test, and age differences will be analysed with the Student t-test. Data will be presented as mean \pm standard deviation (SD) or median (25th-75th percentile) unless stated otherwise.

Between-Group Comparisons (UPCB compared to Control)

Nominal Variables

Chi-square and Fisher's exact tests will be used to compare nominal variables between the UPCB and control groups. These variables include:

- Tongue posture
- Motor function of the tongue
- Mentalis muscle hyperactivity
- Swallowing pattern
- Articulation disorders
- Patient-reported presence of allergies or frequent throat infections

Odds ratios (OR) with 95% confidence intervals (CI) will be calculated for variables that show significant differences.

Ordinal Variables

The Mann-Whitney rank sum test will be employed to compare ordinal variables between groups, including:

- Eardrum condition
- Nasal mucosa condition
- Adenoid size
- Palatine tonsil size
- Lip posture
- Objective assessment of nasal breathing
- Patient-reported snoring or daily (diurnal) breathing pattern

Within-Group Comparisons (UPCB Group Only)

Pre-Post Treatment Analysis

Within the UPCB group, changes between baseline (before orthodontic treatment) and follow-up (after orthodontic treatment) will be assessed using the non-parametric Wilcoxon Signed Rank test for dependent samples.

Data Presentation

Relationships for selected parameters will be presented graphically using bar charts and boxplots. In boxplots: The center box will represent the 25th-75th percentile range, the dashed line will indicate the sample mean, the solid line will show the median, whiskers will denote the 5th and 95th percentiles, an asterisk (*) will signify a p-value ≤ 0.05 .