

The process and timing of the primary molars exfoliation as key elements for the stability of the deciduous dentition-anchored maxillary expander

Simone Ettore Salvati¹, Vincenzo Quinzi¹, Fabio Federici Canova², Tommaso Castroflorio³, Rebecca Jewel Manenti¹

¹Department of Life, Health & Environmental Sciences, Post-Graduate School of Orthodontics, University of L'Aquila, Italy, ²Private Practice, Parma, Italy, ³Post-Graduate School of Orthodontics, Department of Surgical Sciences, University of Turin, Italy

Introduction

Rapid maxillary expansion is known as an effective method for the correction of maxillary constriction [1], especially when performed during the pre-pubertal growth phase [2]. High orthopaedic forces can be responsible for various adverse effects on anchoring teeth, including periodontal tissue damage [3, 4] and root resorption [3, 5–8]. Therefore, deciduous molars as anchoring teeth have been recommended [9–11] in the mixed dentition phase. In this case, the length of second deciduous molars roots should be considered to avoid appliance loss due to teeth exfoliation during treatment. A test of tooth mobility and the analysis of panoramic radiograph to check the extent of deciduous molars root resorption were suggested to evaluate the quality of such teeth for anchorage purposes [12]. It has been suggested that expanders anchored on second deciduous molars were clinically efficient when the anchoring tooth's root had at least the same length of its crown when assessed on panoramic radiographs [11]. Since such assessment is sometimes challenging due to overlaps of other structures frequently seen on panoramic radiographs, its validity might be questionable.

Objectives

The aim was to investigate the process and timing of the upper second primary molar exfoliation and establish a safe method to decrease the risk of early loss of maxillary expander when anchored to the deciduous dentition.

Materials & methods

The inclusion criteria were : 1. presence of dental arch constriction in the maxilla, 2. early or mixed dentition with a complete eruption of upper first molars, 3. availability of a pre-treatment panoramic radiograph, and 4. absence of caries or pulp pathology of the anchoring deciduous teeth. Subjects with aplasia of upper second premolars were excluded, as well as subjects that occasionally needed reactivations during the retention period. Ninety-two subjects (54 females and 38 males) aged 8.4 ± 1.1 years, treated with a Haas (see Fig. 1a) or hyrax (see Fig. 1b) expander, using second upper deciduous molars as anchoring teeth and adopting a semi rapid expansion protocol (0.2 mm/day) were included in this study.



Figure 1. Intraoral pictures of the Haas (a) and hyrax (b) expanders used in the study.

The appliances were firstly activated by the number of turns needed to correct the initial transverse discrepancy. Then, an individually determined number of turns was performed until clinically assessed overcorrection (i.e. palatal cusps of the upper molars touching the buc-

Statistical Analysis

Univariate logistic regression analysis was used to assess the associations expressed as odds ratios (ORs) with 95 per cent confidence intervals (CIs), entering the exfoliation of either deciduous molar (cause of anchorage loss and consequently loss of the appliance) as the dependent and gender, age (in years), presence of crossbite,

Results

As reported in Table 1, a significant association between the second deciduous molar exfoliation and the vertical position of the second premolar cusp in relation to the HPC line ($P = 0.002$; odds ratio = 5.7) was seen, while there was no association with gender, age, treatment duration, and type of expander. When at least one of the second premolar cusp was touching or crossing the HPC line, the probability for expander loss due to exfoliation of the second deciduous molar increased by 6.1 times. A significantly shorter ($P < 0.001$) survival time of the second deciduous molar was seen when the underlying second premolar cusp was touching or crossing the HPC line.

treatment duration (in months), expander type and the initial position of the upper second premolar cusp to the HPC line as explanatory (either continuous or categorical) variables. An OR of 1 indicates that the condition or event under study is equally likely to occur in the compared groups.

The second premolar cusp position in relation to the HPC line method showed high accuracy (at least 76.11 per cent) and substantial repeatability (at least 0.7).

Table 1. Univariate logistic regression analysis for estimates of the association of anchoring teeth exfoliation (dependent variable) with each explanatory variable.

Variable ($R^2 = 0.249$)	OR	95% CI (upper; lower)	Sig.
Gender*	0.647	(0.199; 2.101)	0.469; NS
Baseline age (in years)	1.233	(0.723; 2.104)	0.442; NS
Crossbite	0.688	(0.215; 2.200)	0.529; NS
Treatment duration (in months)	0.766	(0.570; 1.028)	0.076; NS
Expander type**	2.125	(0.488; 9.255)	0.315; NS
Initial position of upper premolar***	6.149	(1.929; 19.599)	0.002; S

* Females as reference category
** Hyrax expander as reference category
*** Apical position to half pulp chamber line as reference category

Conclusions

The position of the cusp of the second premolar in respect to the HPC line, assessed on pre-treatment panoramic radiographs, appears to be a valid prognostic factor for the corresponding second deciduous molar exfoliation and maybe considered as a valid and safe method to decrease the risk of early loss of the maxillary expander when anchored to the deciduous dentition.

Acknowledgements

Ethical approval for the present retrospective study was obtained from the Institutional Review Board at the University of L'Aquila (Protocol Number 001Q/2019). Informed consent was gained from each subject's parents or their legal representative to use their diagnostic and treatment records for research purposes before inclusion.

References

Scan the QR code to access the references

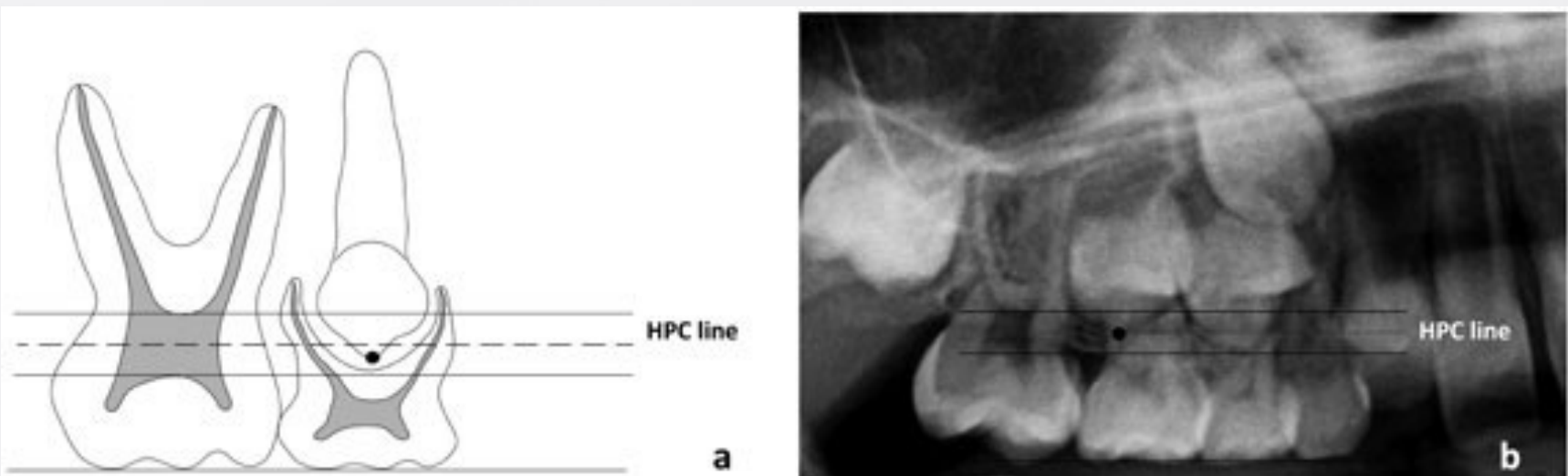


Figure 2. Schematic representation (a) and assessment of the position of the upper premolar cusp to the HPC line on a section of a panoramic radiograph (b). The HPC line (dashed line) crosses the pulp chamber of the upper first permanent molar at an equal distance from a point on the floor and roof of its chamber and parallel to the occlusal plane.

The HPC line was defined as a limit line beyond which the eruption of the second premolar has to be considered risky for the survival of the anchoring tooth and therefore of the expander during the retention period.