

Mean Leeway space in Nepalese children attending a tertiary care hospital, Bhaktapur: A radiographic evaluation

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Abstract

Background: Leeway space becomes important during the change of dentition and occlusal development.

Objectives: The study was designed to measure the mean leeway space of maxilla and mandible of Nepalese children using Orthopantomogram radiographs and also to compare the difference between mean leeway space in male and female children.

Methodology: After ethical approval, 270 OPG (Orthopantomogram) radiographs of age groups 6-12 years Nepalese children exhibiting mixed dentition were selected for the study after following the inclusion and exclusion criteria by convenience sampling method. A digital measurement in the OPG software was used to measure the mesiodistal width of deciduous canine and molars along with permanent canine and premolars in all quadrants.

Results: The mean leeway space on maxilla was seen to be (0.86 ± 1.97mm) while for mandible was (2.45 ± 1.85 mm). The leeway space in both maxilla and mandible was seen to be more in females (0.87 ± 1.87 mm) and (2.52 ± 1.85 mm) than in males (0.85 ± 2 mm) and (2.40 ± 1.90mm) respectively.

Conclusion: The mean leeway space in Nepalese children was found to be less than the standard "Leeway space of Nance" which could be due to population tooth crown differences and various environmental factors. Further studies could be recommended in the future both radiographically and clinically for obtaining a standardized leeway space for Nepalese population.

Key words: Dental occlusion; Leeway Space; Mixed dentition

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INTRODUCTION

Guidance of eruption and development of the primary, mixed, and permanent dentitions is an integral component of comprehensive oral health care for all pediatric dental patients¹. Nance observed the combined mesiodistal width of permanent canine and premolars to be less than that of deciduous canine

and molars. The difference was observed to be 1.8mm (0.9mm on each quadrant) in maxillary arch and 3.4mm (1.7 mm on each) in mandibular arch. Extra space is called Leeway Space of Nance and is utilized by mandibular molars to establish class I relationship through late mesial shift². The control of leeway space in terms of arch dimensional changes through space supervision may offer opportunities to significantly improve tooth size-arch size adjustments for the relief of typical levels of crowding³. The Leeway Space becomes important during the change of dentition and the occlusal development. Precise knowledge of the available Leeway Space forms the basis for decisions about possible orthodontic treatment. A common question/dilemma is whether there is enough space for all teeth or does one have to consider tooth extractions⁴. The previous studies on Leeway Space have been done in various population around the globe. The findings with respect to Nepalese

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population have not been extrapolated. Precision of the knowledge would enable the clinicians to make a sound decision on the space problems in Nepalese children. This study was designed to measure the mean leeway space of maxilla and mandible of Nepalese children using Orthopantomogram radiographs and to compare the difference between mean leeway space in male and female children of Nepal.

METHODOLOGY

A cross-sectional study was done in Department of Oral medicine and Radiology, Kathmandu Medical College and Teaching Hospital after getting clearance from institutional review committee of the same institution. The study was carried from October to November 2019.

The sample size calculation was done with the formula; $n = (ts/ME)^2$, where standard deviation (s) =0.2 taken from previous study⁴, if we permit 0.02mm error in leeway space with 90% confidence interval. In sample size calculation, since we are dealing with comparison of mean value of leeway space with population mean, we took formula $ME=ts/\sqrt{n}$. ME stands for margin of error, t value calculates the confidence interval and is dependent upon degree of freedom and desired confidence level. Since sample size is large that is more than 30, t value is close to z value and here 90% confidence interval is 1.645. So, the total sample $n=270$ was calculated. Convenience sampling technique was followed. Informed Consent was taken before commencement of the study. Orthopantomograms (OPG) of 6-12 year-old children taken for routine radiographic evaluation during dental consultation and fulfilling the inclusion criteria were selected for the study. The inclusion criteria for selection of the OPG was the presence of deciduous canine, first molar, second molar in all the quadrants with successors permanent canine, first premolar and second premolar.

OPG showing proximal caries on the deciduous canine and molar teeth, missing deciduous canine and molars teeth or permanent canine and premolar teeth, any pathology like cyst, tumors, defects of enamel or dentin and rotations, deformation of the involved deciduous teeth were excluded from the study.

Leeway space of maxilla and mandibles of 6-12 year old Nepalese children were measured and compared to see if any difference exists between genders. Panoramic radiographs were taken using Planmeca ProMax (Helsinki, Finland) under similar conditions (66 Kvp, 6 mA, 14 s). A metallic ball bearing was taken which was measured with digital Vernier caliper and found to be 10.3 mm in diameter. The ball bearing was placed on the dry mandible which was stabilized with modelling wax. The radiograph of dry mandible with ball bearing was taken with Planmeca Promax OPG machine and the radiographic image was analyzed with Planmeca Romexis Viewer 5.3.3.5. Digital measurement of radiographic image of ball bearing was done and the diameter was found to be 10.3 mm. So, the magnification factor was calculated as 1.

Planmeca Romexis Viewer 5.3.3.5 software was used to measure the mesiodistal width of deciduous canine and molars along with permanent canine and premolars in all quadrants. All the measurements of OPGs were performed by the same observer to avoid any error.

RESULTS

Out of the 270 OPG examined, males were 154 (57%) while rest belonged to female. The mean leeway space on maxilla was seen to be (0.86 ± 1.97) mm while for mandible was (2.45 ± 1.85) mm. The leeway space in both maxilla and mandible was seen to be more in females (0.87 ± 1.87) and (2.52 ± 1.85) mm than in males (0.85 ± 2) mm and (2.40 ± 1.90) mm respectively. (Table 1)

Table 1: Leeway space of maxilla and mandible

	Male (n= 154)		Female (n=116)		Total (n=270)
	Mean	Median	Mean	Median	
Maxilla (mm)	0.85 ± 2	1.1	0.87 ± 1.87	1.0	0.86 ± 1.97
Mandible (mm)	2.40 ± 1.90	2.7	2.52 ± 1.85	2.8	2.45 ± 1.85

DISCUSSION

Clinical decisions are presented daily that challenge pediatric practitioners in affecting outcomes in management of the developing occlusion. The decision for managing space in the mixed dentition poses a dilemma to the practitioners and among them reliability on the leeway space is one of them.

This study showed mean leeway space on maxilla to be (0.86 ± 1.97) mm while for mandible was (2.45 ± 1.85) mm. These findings are less as compared to the findings given by Moyers⁵ where leeway space in maxilla was 2.6 mm and mandible was 6.2 mm and Botero P et al⁶ where the maxillary leeway space was 1.55 ± 2.64 mm and the mandibular space was 3.62 ± 2.76 mm.

The findings in this study fall within the variation of 0.7 to 1.5 mm in the maxilla and 1.7 to 3.3 mm in the mandible as suggested by various authors⁶. These range of variations could depend on regional or population tooth crown differences plus sampling variation⁷. The deciduous crowns mature perinatally⁸ depending mostly in the maternal physiology⁹ which remain same throughout the years but improvement in childhood nutrition¹⁰ in these days could promote the formation of larger postnatal permanent teeth¹¹ leading to the differences in the deciduous and permanent tooth sizes.

This study showed leeway space in mandible to be more in females (2.52 ± 1.85) mm than in males (2.40 ± 1.90) mm, similar to studies done by Hille et al¹². This finding also shows similarity to study by Tarvade et al⁴. Leeway space in mandibular arch is more critical. There are fewer therapeutic options in this arch because of its limited

potential for expansion, unstable labialization of incisors and difficulty of molar distalization¹³. The Leeway Space becomes important during the change of dentition and the occlusal development. It can be utilized to solve the physiological crowding in the lower front area caused by the eruption of permanent incisors by preventing the mesial drift of the lower 1st molars by a lingual arch placed before the exfoliation of the 2nd primary lower molars. So, preservation of Leeway Space is necessary for gaining space for alignment in mixed dentition⁴.

Disadvantages of using panoramic radiograph are the unequal magnification and distortion that may occur when the patient's jaws are not positioned within the focal trough of the X-ray beam¹⁴. Even though precautions had been taken to minimize the unequal magnification and distortion, yet it is still undeniable that it didn't exist. Cone Beam Computed Tomography (CBCT) has been found to be the most accurate radiographic technique in measuring the tooth, root, and crown lengths than IOPAR (Intraoral Periapical Radiographs) and OPG¹⁵ which could highly influence the measurement of leeway space so, further studies could be planned on CBCT.

CONCLUSION

The mean leeway space in Nepalese children was found to be less than the standard "Leeway space of Nance" which could be due to population tooth crown differences and various environmental factors. Further studies could be recommended in future both radiographically and clinically for obtaining a standardized leeway space in Nepalese population.

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