



Photographic Study of Different Smile Parameters in the Newar Population Pursuing Orthodontic Treatment

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Abstract

Introduction: A smile is a facial expression that typically expresses joy, friendship and appreciation. Various parameters of smile play important role in esthetics of the patient. The study of smile parameters play crucial role and can be helpful in orthodontic diagnosis and treatment planning.

Methods: Frontal view photographs were assessed with a posed smile. This is the descriptive study of various smile parameters. The smile arc, upper lip curvature, smile line and the amount of teeth visible while smiling were studied.

Results: Average smile line (47.1%), consonant smile arc (43.8%), straight lip curvature (48.8%), and teeth displayed up to 2nd premolars (34.7%) while smiling were found.

Conclusion: It is concluded that the majority of the study participants had an average smile line, a consonant smile arc, a straight upper lip curve, and teeth that were visible up to their 2nd premolars while smiling.

Keywords: Esthetic, Newar, Orthodontic treatment, Smile, Study

Introduction

A smile is a facial expression that usually expresses gratitude, joy, and friendliness. Smile analysis is essential during the diagnosis and therapy planning stages. A person's natural smile is made up of several factors. These include the smile line, smile arc, upper lip curvature and teeth that are visible when smiling. Each plays a unique part in a beautiful smile and should be taken into account.¹

The majority of orthodontic patients want to improve their smiles. So smile analysis becomes an essential part of orthodontic diagnosis and treatment planning for a patient. Due to subjective variability in perception, the patient's expectations must be taken into consideration.² Following the "new esthetic paradigm," orthodontists have better studied the smile arc as an esthetic criterion. For professionals looking for more attractive and youthful natural esthetic results, its diagnostic examination and incorporation into the goals of orthodontic planning have become essential.³

One of the main problems in today's society is aesthetic smile. The number of orthodontic patients in orthodontic clinics is rising as a result of growing public awareness and the accessibility of orthodontic specialty services.⁴ Analysis of different smile characteristics can be of immense help to orthodontists and they can plan their treatment further. Many ethnic groups

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live in the Kathmandu Valley. Among them, Newar are the largest and most indigenous. The characteristic long and thin facial features of Newars make them clearly identifiable from other ethnic groups.⁵ This study was designed to study different smile characteristics in Newar patients of Lalitpur in Nepal which can be helpful in planning better orthodontic treatment for this population.

Methods

This study was carried out in Department of Orthodontics and Dentofacial Orthopedics, KIST MCTH, Lalitpur in Nepal. The study was carried out after ethical clearance was obtained from IRC (08182-2704025-38) of KIST Medical College and Teaching Hospital. This was a retrospective study of various smile parameters in Newari patients seeking orthodontic treatment. Photographs were taken of Newari patients from February 2023-February 2025.

Inclusion Criteria:

- Participants had fully erupted permanent teeth.
- Proper smiling photographs
- 18 years and above.

Exclusion Criteria:

- History of previous orthodontic treatment and mandibular surgeries.
- Facial asymmetry, trauma and syndromes.
- Short lip.
- Congenital deformities, hypodontia.

The primary outcome measure of the study is to study different smile characteristics in Newar population in Nepal.

- In a study by Ramaswamy et. al.⁶,2021 Standard Deviation of females in the study was 0.898 with probability of significance of 95% and power of 80%, Standard error is;

$$SE = S.D. = 0.898 = 0.082$$

$$\frac{\sqrt{n}}{\sqrt{120}}$$

where SE= standard error, n= number of samples

$$Z_{\alpha} = 1.96$$

$$SD = 0.898$$

$$n = (Z_{\alpha} \times SD)^2$$

$$(E)^2$$

$$= (1.96 \times 0.898)^2$$

$$(0.16)^2$$

$$= 121.0055$$

Total sample size is 121

A total of 121 smiling photographs were assessed. Photographs were reviewed and only those fulfilling the inclusion criteria were included in the study. Smiling photographs were assessed for smile arc types, different smile lines, types of upper lip curvature and teeth displayed while smiling.

Statistical Analysis:

The data were entered into Microsoft Excel and then imported into the Statistical Package for Social Sciences version 16 (SPSS) for statistical analysis. For analysis, photographs were coded. Data was collected and studied.

Statistical tests: Distribution frequency was calculated for all measurements.

The following were measured.

Smile arc was assessed. It is the relationship between the upper border of the lower lip and the curvature of the maxillary anterior teeth. The patient's consonant, flat, or reverse arc will be examined.



Consonant smile arc

Smile line was assessed. It is the height of the upper lip in respect to the maxillary incisors or the degree of vertical tooth display when smiling. It can be high, average and low.



Low smile line

Upper lip curvature was also assessed. The relationship between the corners of the mouth and the midway of the inferior border of the upper lip was assessed by drawing a straight line through it. It can be upward curvature, downward and straight upper lip curvature.



Downward upper lip curvature

And also teeth displayed while smiling was also assessed. Teeth displayed while smiling can be upto canines, 1st premolars, 2nd premolars and 1st molars while smiling.



Teeth displayed upto 2nd premolars

Results

In assessment of smile arc,

Table 1: showed consonant smile arc was seen in most patients (43.8%) whereas reverse smile arc was seen in lower Newari population which is 16.5%

Smile Arc	Frequency	%
Consonant	53	43.8
Flat	48	39.7
Reverse	20	16.5
Total	121	100.0

Table 2: showed average smile line was found in larger sample which was 47.1% whereas high smile line was found in least which is 16.5%

Smile line	Frequency	%
Average	57	47.1
High	20	16.5
Low	44	36.4

Table 5: illustrates the statistically significant difference in smile arc types when compared to the various sex groups. Other smile parameters did not show any statistically significant difference

Variable	Categories	Female (n=72)	Male (n=49)	Total (n=121)	p-value
Smile Arc	Consonant	40 (55.6%)	13 (26.5%)	53 (43.8%)	0.005
	Flat	21 (29.2%)	27 (55.1%)	48 (39.7%)	
	Reverse	11 (15.3%)	9 (18.4%)	20 (16.5%)	
Smile Line	Average	33 (45.8%)	24 (49.0%)	57 (47.1%)	0.939
	High	12 (16.7%)	8 (16.3%)	20 (16.5%)	
	Low	27 (37.5%)	17 (34.7%)	44 (36.4%)	
Upper Lip Curvature	Downward	16 (22.2%)	17 (34.7%)	33 (27.3%)	0.083
	Straight	34 (47.2%)	25 (51.0%)	59 (48.8%)	
	Upward	22 (30.6%)	7 (14.3%)	29 (24.0%)	
Teeth Displayed while Smiling	Upto 1st molars	14 (19.4%)	7 (14.3%)	21 (17.4%)	0.685
	Upto 1st premolars	23 (31.9%)	14 (28.6%)	37 (30.6%)	
	Upto 2nd premolars	22 (30.6%)	20 (40.8%)	42 (34.7%)	
	Up to canines	13 (18.1%)	8 (16.3%)	21 (17.4%)	

Total	121	100.0
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Table 3: Upward lip curvature seemed to be more than other two types which is 48.8% and upward and downward lip curvatures were seen 24% and 27.3% respectively

Upper lip curvature	Frequency	%
Downward	33	27.3
Straight	59	48.8
Upward	29	24.0
Total	121	100.0

Table 4: showed while smiling the teeth displayed were more upto 2nd premolars (34.7%) followed by upto 1st premolars (30.6%) and least teeth displayed were upto canines and 1st molars (17.4%).

Teeth displayed while Smiling	Frequency	%
upto 1st molars	21	17.4
upto 1st premolars	37	30.6
upto 2nd premolars	42	34.7
upto canines	21	17.4
Total	121	100.0

Table 6: When comparing the age groups using all of the smile parameters, there was no statistically significant difference which is shown in table below

Variable	Categories	Less than 20 (n=56)	More than 20 (n=65)	Total (n= 121)	p-value
Smile Arc	Consonant	24 (42.8%)	29 (44.6%)	53 (43.8%)	0.739
	Flat	24 (42.8%)	24(36.9%)	48 (39.7%)	
	Reverse	8 (14.4%)	12 (18.5%)	20 (16.5%)	
Smile Line	Average	26 (46.4%)	31 (47.7%)	57 (47.1%)	0.362
	High	12 (21.4%)	8 (12.3%)	20 (16.5%)	
	Low	18 (32.2%)	26 (40 %)	44 (36.4%)	
Upper Lip Curvature	Downward	15 (26.8%)	18 (27.7%)	33 (27.3%)	0.524
	Straight	25 (44.6%)	34 (52.3%)	59 (48.8%)	
	Upward	16 (28.6%)	13 (20%)	29 (24.0%)	
Teeth Displayed while Smiling	Upto 1st molars	8 (14.3%)	13 (20 %)	21 (17.4%)	0.569
	Upto 1st premolars	16 (28.5%)	21(32.3%)	37 (30.6%)	
	Upto 2nd premolars	23 (41.1%)	19 (29.2%)	42 (34.7%)	
	Upto canines	9 (16.1%)	12 (18.5%)	21 (17.4%)	

DISCUSSION

In modern society, an esthetic smile is valued in both social and professional contexts and plays a significant part in facial expression and look. Individuals' perceptions of aesthetics differ and are influenced by society and individual experiences.²

The current study evaluated common features of a posed smile in a sample of Newari people from Nepal. The smiling photographs were used in this study due to its ease of reproducibility. The aim of our study was to examine the various aspects of smiles in the Newari population. In this study we assessed 121 smiling photographs of the Newari patients undergoing orthodontic treatment. Out of 121, 49 (40.5%) were male and 72(59.5%) were female. Different smile parameters like smile arc, upper lip curvature, smile line and teeth displayed while smiling were assessed.

According to a 2020 study by Khan et al., average smile lines (43.3%) and consonant smile arcs (45.2%) are more common than other forms which was similar to our study.¹ Females had more consonant smile arcs than males, according to a 2006 study by Krishnan et al.⁷ In our study, it was found that 55.6% females had consonant smile arc compared to 26.5% males. In agreement to our study, upper lip curvature was straight (39.9%) which was seen more than upward(26.1%) and downward (34%), in the study by Liang et.al. in 2013.⁸ These similarities may be due to the similar facial forms and structures as these studies were done in south asia region.

In contrast to our study, Melo et.al. in 2020 the curvature of upper lip was more upwards (47.1%) than straight curvature (41.4%).⁹ The most prevalent characteristic among his research participants, which was comparable to

ours, was an upward lip curvature, in a study by Hulsey¹⁰. In contrast to our study, a greater number of participants had straight lip curvatures, followed by downward and upward lip curvatures, according to Liang et. al.⁸ These differences may be due to the different facial forms than ours as this study was done in Chinese population.

Straight smile arcs were found in 49% of participants in another study by Maulik and Nanda⁴, and they were followed by consonant (40%) and reverse (10%) smile arcs of patients. Their approach includes making videos of subjects in order to capture spontaneous smiles. This could be the cause of the dissimilar findings from our study, which used participants' posed smiles.

According to the current study, in a posed smile, patients typically reveal six maxillary anterior teeth and the 2nd premolars (34.7%). Similar to our study, Ritter et. al.¹¹ found out that teeth were displayed up to 2nd premolars while smiling in most participants. In contrast to our study, teeth were displayed up to 1st premolar in a study by Tjan et al.¹² Contrary to what we found, the majority of subjects 70% had their maxillary 1st molar visible when they smiled, and 26.7% had their 2nd premolar visible.² The contrasting results might have been found as this study was done in California, United states of America.

Extra caution should be taken when replacing anterior teeth in individuals with high smile lines to avoid excessive gingival exposure. In our study high smile line was seen in less participants, which was similar to the study by Tjan et. al.¹² In contrary to our study, Nold et. al.¹³ suggests low smile line was found least among the participants.

Lombardi¹⁴ and Desai¹⁵.found a correlation between an individual's age and the smile arc. Younger people have

more prominent central incisors, and consonant smile arc; however, as people grow old, the curve tends to flatten due to wear.^{14,15} In contrast to our findings, a study conducted in Nepal revealed that a higher percentage of individuals had low-type smiles (59.1%) and lower average-type forced smiles (40.0%).¹⁶

The results cannot be generalized to the entire population because this study was limited to Newari patients and only one medical college. To find out if there is a correlation between various parameters of smile, more investigation is required.

Conclusion

It is concluded that the majority of the study participants had an average smile line, a consonant smile arc, a straight upper lip curve, and teeth that were visible up to their 2nd premolars while smiling.

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