Analysis of smile pattern at a tertiary care centre

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Abstract

Background: The treatment of the aesthetic region of mouth is complicated. Knowledge of the smile pattern which includes smile line, smile curvature, smile arc, labiodental relation, and tooth exposed determines the success of treatment. This is helpful in the diagnosis and treatment planning phases of aesthetic dentistry.

Objectives: To determine the smile pattern in aesthetic region and to compare the different smile patterns.

Methods: This analytical cross-sectional study was done in the department of Prosthodontics and Maxillofacial Prosthesis, Universal College of Medical Sciences, Nepal from 15th October 2021 to 15th March 2022. A total number of 355 samples were taken by convenience sampling technique. After receiving participant's consent, study was carried out using a digital camera. The camera was set to primarily capture the area between nose and chin, with lens parallel to the apparent occlusal plane of the participants. For study purpose, individuals were told to sit and hold head normally with their head in level with Frankfort horizontal plane.

Results: The total number of participants were 355 out of which 153 (43.09%) were male and 202 (56.91%) were female. In the smile line pattern, the "Average" smile line was prevalent in a maximum number of participants (223, 62.8%) followed by the high and low smile lines. There was a significant relationship between the smile arc, labiodental relationship, and the tooth displayed.

Conclusion: The findings of this study determines the smile pattern of this region, thus this will be helpful in the diagnosis and treatment planning during the treatment.

Key words: Lip; Prevalence; Smile line; Smiling.

INTRODUCTION

A harmonious interaction between teeth, gingival scaffold and lip structure is necessary for an attractive smile. The value of facial attractiveness may be significantly affected by smiles.[1] The ten commandments of smiling include following: the ideal color, anatomical shape, lip volume, vertical positioning of the maxillary incisors, the proper level of the gingival margin, the intermediate buccal corridor, minimal gingival exposure, and proportionate distribution of the maxillary anteriors.[2] Smile analysis has frequently been utilised to determine diagnosis, prognosis, and treatment strategy in order to attain aesthetic objectives.[3]

Understanding smile pattern analysis would improve communication, help to identify and determine treatment goal.[3] Smile analysis is a component of facial aesthetics, orofacial aesthetics, oral aesthetics, dentogingival aesthetics, and dental aesthetics. It uses prosthodontic, periodontics, conservative or orthodontic

treatment to replace the missing teeth, bring back the face's distinctive characteristic. Any such procedure focusses more on generating a balanced smile than an ideal smile as its main goal.[5]

There are very few research of the smile patterns in Nepali population. Thus, the present study was conducted to evaluate the components of smiling pattern in a tertiary centre, which can further be applied as a guide in the fabrication of anterior aesthetic restorations.

METHODOLODY

This analytical cross-sectional study was done in the department of Prosthodontics and Maxillofacial Prosthesis, Universal College of Medical Sciences, Siddharthanagar, Rupandehi, Nepal from 15th October 2021 to 15th March 2022 after approval from the Institutional Review Committee (Ref. UCMS/IRC/125/21). The Cochrane formula ($n=Z^2pq/d^2$) was used to calculate the sample size where, Z= level of significance at 5% which is 1.96; d = 0.05 as allowable error 5%; p = 0.357, the prevalence of commissure smile taken as 35.7%;[5] and q = 1- p = 0.643. The computed sample size was 352.74 ≈ 355. Exclusion criteria included the carious mandibular and maxillary anterior teeth, missing anterior teeth, undergoing orthodontic treatment, and any skeletal or soft tissue abnormality in the face. After receiving the participants' written consent, the study was carried out using a digital camera. The camera was set to primarily capture the area between the nose and chin, with the lens parallel to the apparent occlusal plane of the participants. During the study time, the participant was told to sit with head held normally in level with the Frankfort horizontal plane. The participant's lip was in relaxed posture and then a dynamic smile with a maximum commissure-to-commissure was recorded. These pictures were converted into a JPEG file and renamed. Each file was opened in Adobe photoshop and the image of each sample was examined.

The parameters evaluated in this study were the smile line (categorised as a high: Figure 1; average: Figure 2; or low smile: Figure 3), upper lip curvature (categorised as upward, straight or downward), parallelism of the maxillary incisal curve with the upper border of the lower lip, also known as smile arc (categorised as parallel, straight or reverse), relationship of the maxillary anterior teeth to the lower lip, labiodental relation (categorised as slightly covered, touching or not touching) and number of teeth exposed. A low smile displays fewer than 75% of the maxillary anterior teeth, a medium grin reveals 75–100% of the maxillary anterior teeth and a high smile

displays the entire cervico-incisal length of the maxillary anterior teeth and a continuous band of gingiva. In an upward curvature the corner of the mouth is higher than the lower border of the upper lip's middle. In the straight curvature the corner of mouth is at same level at lower border of upper lip's middle, whereas, downward curvature means the corner of mouth is lower than lower border of upper lip's middle. IBM SPSS Statistics for Windows, version 1 (IBM Corp., Armonk, N.Y., USA) was used for data analysis. Frequency distribution of the parameters of smile was determined. Pearson Chi-square test was used to determine the gender-based differences.

RESULTS

Out of total number of 355 participants, 153 (43.09%) were male and 202 (56.91%) were female (Table 1). In the smile line pattern, the average smile line was seen in maximum number of participants (223, 62.8%) followed by the high and low smile lines (Table 1). Average smile was found prominent both in males and females. Upper lip curvature was maximum in the upward direction followed by a downward direction and straight line (Table 1). The smile arc shown by the maximum number of participants was parallel followed by the straight and reverse (Table 1). There was significant difference between the male and female in the smile arc.

In the labiodental relationship, lip was found to be not touching (172, 48.5%) with the upper incisors in the maximum number of participants, followed by touching and slightly covered by the lips (Table 1). There was significant difference between the male and female participants in the labiodental relationship. Teeth displayed by the maximum participants were till the second premolar followed by till first premolar and distal to the second premolar (Table 1). While taking the photograph nobody displayed tooth till canine or before canine. There was significant difference between the male and female participants in the teeth displayed.

Figure 1: High smile line

Figure 2: Average smile line

Figure 3: Low smile line

Table 1: Frequency distribution of various parameters of smile (N = 355)

| Smile pattern | Parameters | Frequency (%) | | Total (n) | p-value |
		Male	Female		
Smile line	High	22 (6.2)	53 (14.9)	75 (21.1)	0.250
	Average	105 (29.6)	118 (33.2)	223 (62.8)	
	Low	26 (7.4)	31 (8.7)	57 (16.1)	
Upper lip curvature	Upward	64 (18)	107 (30.1)	171 (48.1)	0.114
	Straight	28 (7.9)	29 (8.2)	57 (16.1)	
	Downward	61 (17.2)	66 (18.6)	127(35.8)	
Smile arc	Parallel	91 (25.6)	166 (46.8)	257 (72.4)	0.001*
	Straight	38 (10.7)	25 (7)	63 (17.7)	
	Reverse	24 (6.8)	11 (3.1)	35 (9.9)	
Labiodental relationship	Slightly covered	13 (3.7)	26 (7.3)	39 (11.0)	0.003*
	Touching	50 (14.1)	94 (26.4)	144 (40.5)	
	Not touching	90 (25.4)	82 (23.1)	172 (48.5)	
Teeth displayed	Less than canine	-	-	-	0.006*
	Till canine	-	-	-	
	Till 1st premolar	39 (11.0)	72 (20.3)	111 (31.3)	
	Till 2nd premolar	84 (23.7)	112 (31.5)	196 (55.2)	
	Distal to 2nd premolar	30 (8.4)	18 (5.1)	48 (13.5)	

Pearson Chi-square test; * = clinically significant at <0.05

DISCUSSION

In restorative dentistry, the smile pattern is crucial to treatment planning, especially when the anterior dentition is involved and the patient has high aesthetic expectations. In this study common features of a smile among 355 samples were analysed. The smile was employed in the present study mainly because it is easy to replicate. The common findings in current study were: average smile line, upper lip curvature in upward direction, parallel smile arc, not-touching labiodental relationship and the teeth displayed was up to second premolars.

Consideration of the smile line has a practical application in patient care; in patients with high smile lines, extreme caution must be taken to prevent excessive gingival show during restoration of anterior teeth. The average smile line was found to be the most prevalent among study participants in this study. Similar findings have also been observed by other research, including those by Tjan and Miller[6] and Nold et al.[7] In contrast to this study, Nold et al.[7] found that among the research participants, low smile line was the least common, whereas, high smile line was the least common in this study which is supported by Tjan and Miller.[6]

An upward upper lip curvature was the most common in upper lip curvature feature in this study, which is similar to the finding of study by Husley.[8] However, Liang et al.[9] found a significant proportion of those with straight lip curvatures, followed by downward and upward. These contrasting findings are a result of demographic

variance, making it difficult to achieve the optimum smile in a patient with downward lip curvature.

Majority of the participants showed parallel smile arc in this study which is similar to finding of study by Khan et al.[5] There was statistical differences between the male and female in smile arc. On the other hand, in the study done by Maulik and Nanda[10] majority had straight smile arc followed by parallel and reverse. The difference in the study may be due to different methodology of data collection.

During the capture of the smile photograph maximum number of the participants in this study demonstrated the non-touching labiodental relation which is similar to study with Basnet et al.[4] and Nold et al.[11] While capturing the pictures of the participants instructing them to pose a smile, they tended to widen their lips and show teeth, it may be the reason of not touching labiodental relationship.

Teeth displayed during the smile also helps to determine the treatment planning with aesthetic considerations. Maximum number of the participants in this study displayed their teeth maximum till the second premolar, similar to the finding in study by Agarwal and Pillai,[12]

followed by teeth showing till first molar. In other studies,[4,5] maximum number of teeth displayed by the participants was till first premolar. The variation in result in this study may be due to inclusion of unilateral visualisation of second premolar.

Limitations of this study are: the other commandments of smiling, which are equally important as the parameters in this study in defining treatment plans with aesthetic considerations, were not investigated. The picture was concentrated on the lip and chin area rather than the entire face. So, the other aesthetic factors, such as the distance between the canthal and pupillary surfaces, were ignored.

CONCLUSION
It can be concluded that the most common smile line is average, most common upper lip curvature is in upward direction, most common smile arc is parallel, most common labiodental relationship is not-touching and the maximum teeth displayed while smiling was till second premolar.

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