Original Research Article

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A cross-sectional study evaluating the specific effects of lip form, age, and gender on maxillary and mandibular incisal display with lips at rest in the Kashmiri population

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Abstract

Introduction: Most patients want a smile that looks good and is attractive. Subsequently, front teeth should turn out to be the focal point of attention for both patients and dental specialists. Speech, food incisions, and esthetics are the major functions of the anterior teeth. Hence, determining the relative positions of the anterior teeth becomes a subjective decision when the maxillary anterior teeth are missing.

Aim: The main aim of our study was to evaluate the relationship between the lip form and incisal and canine display of the Kashmiri population with respect to gender and age.

Material and Methods: A total of 60 subjects were randomly selected from the Department of Prosthodontics aged between 30 and 60 years. A flexible ruler was used to measure the exposure of the maxillary right and left incisors and canine in both males and females. The subjects were divided into three groups on the basis of age groups A, B, and C and lip form into groups 1, 2, and 3. The data were collected and measured accordingly.

Results: The data were assessed using categorical variables of frequency, percentage, mean, and standard deviation, whereas descriptive analysis was done using Pearson correlation and independent Student's *t*-test. Significant results were obtained in cases of patients with the age group more than 40 and above. The smile line was significantly higher in females when compared to males.

Conclusion: Maxillary right and left incisor exposure was higher in females and higher age groups, whereas canine exposure represented little or no variation with respect to age, gender, and lip form.

Keywords: Esthetics, canine, incisors, lip form, prosthodontics, smile

Introduction

A significant component of the psychosocial prosperity of an individual, which usually favors his or her social acknowledgment, is the pleasant dental esthetic "smile." It is viewed as perhaps one of the most attractive facial expressions that address the gesture of a person.[1] The display of the lips, maxillary, and mandibular incisors is known for framing and defining the esthetic zones.[2] The esthetics of the smile are of utmost importance in contemporary dentistry.[3] Thus, it becomes the

best objective of supportive dentistry, particularly prosthetic dentistry, to re-establish occlusion, esthetics, phonetics, form function, and contour of the stomatognathic framework. Other important aspects of smile esthetics include the outline of the vermilion border of lips and the type of lip form. When it comes to fixed dental prostheses for anterior or full mouth rehabilitation, dentures (full or partial), and implant-supported prostheses, both patients and dentists prioritize each of these aspects.[4]

The appearance of dentures and prostheses, also known as "that typical facial appearance common to most denture wearers," is most likely due to improper tooth placement.[5] Many researchers have accepted Pound's philosophy, which is widely supported in contemporary prosthodontic literature, and recommends restoring the teeth to their original positions.[6] Consequently, the prosthodontist should try to place the artificial teeth in the same way that the patient's natural teeth were arranged or in a way that is similar to how the ideal patient's teeth would be arranged if they were the same age, gender, race, and facial structure. A few studies instructed placing the upper central incisor vertically so that 0–2 mm of the incisal edge could be seen below the upper lip. Age, gender, and the length of the upper lip can, however, affect the position of the teeth.[7]

A study conducted on the white American population has let the authors Kim *et al*. classify the lip forms into high, moderate, and straight lip form based on the measurements from the highest portion of the lower vermilion border of the upper lip from a line passing through the commissures of the mouth.[8] Another study conducted by Kundu[9] and Kundu and Shah[10] reported a relationship between lip structure and incisal edge in the young and elderly Indian population. Table 1 represents the parameters that helped the smile line in the determination of vertical position by different authors. Based on all these evaluations, the main aim of our study was completely emphasized to appraise age and gender-related changes of maxillary and mandibular incisor display to the form of the lip at rest in cases of the elderly Kashmiri population.

Materials and Methods

This cross-sectional study included a total of 60 random subjects aged 30–60 years visiting

Table 1: Relationship between the vertical position of maxillary central incisal edge relative to the maxillary lip line in the repose of dentate patients in various studies

S. No.	Authors	Observation
1	Frush and Fisher[11]	Observed that the curvature of the upper teeth tends to follow the curvature of the upper border of the lower lip during smiling, and the central incisor is longer when compared to other teeth in the quadrant
2	Boucher[12]	Found that the vertical position of the maxillary anterior teeth was determined by phonetics, mainly labiodental sounds. Maxillary central and lateral incisors touched the lower lip during the articulation of letters F and V
3	Payne[13]	Used phonetics to estimate the position of maxillary anterior teeth, especially Z, S, and C. Furthermore, reported that if the vertical position of the maxillary teeth was low, clicking of teeth would be seen
4	Misch[14]	Used canine teeth to evaluate the vertical position of maxillary anterior teeth through with a narrow range
5	Heartwell and Rahn[15]	Evaluated the correlation between lip and teeth exposure and disclosed that the vertical position of the central incisor primarily determined the relationship with lip in repose irrespective of age and gender
6	Vig and Brundo[7]	Were the first who evaluate the relationship between gender, race, age, and lip length on exposure to maxillary teeth
7	Sharry *et al*.[16]	Observed occlusal part of the maxillary occlusal rim to an extent approximately 1–2 mm below the upper lip at rest.

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the Department of Prosthodontics, Crown and Bridge, Government Dental College and Hospital, Srinagar, Jammu and Kashmir. Before starting any procedure the study protocol was approved both by the Institutional And Departmental Ethical Committee. Systematically healthy subjects with no previous history of any maxillofacial trauma and/or orthodontic treatment, presence of anterior teeth in both the jaws, and first molar occlusion were included in the study. While partially or completely edentulous subjects, especially in the maxillary anterior region, severe dental attrition, neuromuscular disorders, with any prosthodontic or orthodontic work were excluded from the study. A brief discussion about the study was done with each patient so that they could be more comprehensive and well-coordinated with the instruction. The subjects who were willing to participate were asked to sign an informed consent and were allowed to quit the study at any point in time.

The patients were seated comfortably on the dental chair and underwent a complete dental examination of both soft and hard tissue. They were then informed to sit upright with unsupported heads, relaxed facial muscles, and eyes looking straight. Ask the patient to swallow and relax his/her lower lips and lower jaw. A flexible, clean, transparent millimeter ruler was used to measure the vertical distance estimated from the vermillion border of the upper lip at rest to the maxillary central incisor, first from the left and then from the right, followed by both the canines. The procedure was followed in all the patients by the same examiner to avoid any biases. Each patient was examined individually in a well-ventilated and brightly lit room. All the measurements were recorded separately according to age, gender, and length of the upper lip. The data obtained were then arranged according to the following age groups and gender.

In group A, 20 patients in the age group 30–39 years were included. In group B, 20 patients in the age group 40–49 years were included, whereas in group C, 20 patients in the age group >50 years were included in the study.

Each subject, irrespective of age and gender, was divided into further groups based on their lip length: Group 1: Straight lip form (Type 1): 0–3 mm, Group 2: Moderate lip form (Type 2): between 3 mm and 6 mm and Group 3: High lip form (Type 3): >6 mm.

Sample size estimation

Calculation of the sample size was done according to the formula $n = z2*p\,(1-p)/e^2$, where $z = 2.576$ for the confidence of interval (a) of 99%, $P = 0.0013$ for proportion expressed as decimal and $e = 0.04$ as margin of error. The sample size was estimated to be around 58. To increase the validity and estimation of the study, the sample was increased to 60 and divided into three groups and six subgroups, with each group having a sample of 10.

Statistical analysis

The data collected were arranged and transferred to Microsoft Excel, where further analysis was done using the Statistical Packages for the Social Sciences software version 20.0. Categorical variables were analyzed using mean and standard deviation, whereas the demographic data were assessed using Pearson correlation and Student's *t*-test with a two-tailed *P*-value measuring 0.05 as statistically significant.

Results

A total of 60 patients participated in the study, out of which 34 were males and 26 were females. Out of the total, around 70% ($n = 42$) were of the straight lip form, 20% had moderate, whereas only 10% ($n = 6$) had high lip form, hence making Type 1, i.e., straight lip forms the most common type in Kashmiri population. On evaluating the average incisal displays of both right and left maxillary teeth, it was found to be 1.9125 ± 1.6 on the right with a mild deviation of about 0.01 on the left side (1.9025 ± 1.2) in cases of males and 2.9615 ± 1.4 on the right side with a deviation of 0.001 on the left side (2.9605 ± 1.3) in cases of females. When the canine display was measured in cases of both males and females, no measurable

Table 2: Representing the descriptive analysis of the study population W

Characteristics	Study population	Straightlip form (Group 1)	Moderate lip form (Group 2)	High lip form (Group 3)	Maxillary incisal display (Right)	Maxillary incisal display (Left)	Maxillary canine display (Right)	Maxillary canine display (Right
		Frequency/percentage (n/%)			Mean standard deviation			
Gender								
Male	34	27	5	4	1.9125±1.6	1.9025±1.2	−0.3821±1.2	−0.3821±1.2
Female	26	15	7	2	2.9615±1.4	2.9605±1.3	−0.3102±1.4	−0.3102±1.4
Total	60	42 (70)	12 (30)	6 (10)	2.473	2.432	−0.346	−0.315
		Frequency/percentage (n/%)			Mean			
Age group								
30–39 (Group A)	20	16 (38.09)	8 (66.67)	4 (66.66)	2.35±1.575	2.35±1.575	−0.13±0.99	−0.13±0.0.99
40–49 (Group B)	20	14 (33.34)	3 (25)	1 (16.67)	1.6±1.585	1.6±1.585	−0.75±1.506	−0.75±1.506
>50 (Group C)	20	12 28.57)	1 (8.33)	1 (16.67)	0.4±1.675	0.4±1.675	−0.12±1.563	−0.12±1.563
Total	60	42 (100)	12 (100)	6 (100)	1.450	1.450	−0.333	−0.333

deviation was observed between the right and left sides of the quadrants.

Based on age, patients were divided into three groups with ages ranging from 30 to 60 years. In group A, 38.09% (n = 16) had straight lip form, 66.67% (n = 8) had moderate, whereas 66.67% (n = 4) had high lip forms. In group B. 33.34% (n = 14) had straight, 25% (n = 3) had moderate and 8.33% (n = 1) had high lip form. Similarly, in group C, 66.67% (n = 12) had straight, and an equal number, 16.67% (n = 1) had both moderate and high lip forms.

Pearson correlation was used to determine the relationship between male and female lip form with regard to the maxillary incisal and canine display. The R-value between the right and left maxillary incisal and the canine display was found to be statistically significant [Table 3].

An independent t-test was used to compare the means of incisal and canine displays on the basis of age groups. Statistically significant results were obtained in cases of maxillary incisal displays of the age group 40 years and above (difference = −1.200, t = −2.327, df = 38, and P = 0.0254) [Table 4]. No significant difference was found between the maxillary incisal and canine display of the age group 30–39 years in cases of the incisal display, whereas in all age groups (30–60 years) in cases of the canine display.

Table 3: Correlation between lip form and incisal and canine display in cases of gender

Gender	Parameters	Pearson correlation	P-value
Lip form in males	Right incisal display	0.318	0.0132*
	Left incisal display	0.480	0.0001*
	Right canine display	0.435	0.0050*
	Left canine display	0.330	0.0100*
Lip form in females	Right incisal display	0.377	0.0029*
	Left incisal display	0.410	0.0011*
	Right canine display	0.403	0.0010*
	Left canine display	0.390	0.0020*

*Statistically significant

On evaluating the correlation between the means of gender and incisal and canine display, statistically significant results were obtained (difference = 1.053, t = 759.637, df = 58, and $P \leq 0.0001$) in cases of incisal display with females having more mean values. No significant results were obtained in cases of canine display between the males and females [Table 5].

Discussion

The primary goal of prosthodontic treatments is to restore and maintain facial esthetics and allurement. Smile ability and facial attractiveness are strongly linked. A person's perceived attractiveness is influenced by their smile, which is an important part of social interaction. Esthetics and attractiveness were found to be equally important for men and women in each field. In current dentistry, smile examination and configuration have become key components of prosthodontic diagnosis and treatment planning.[17] It is challenging to develop a universally applicable, accurate, and reproducible method for evaluating the display of the maxillary incisors when at rest and smiling. The incisal display at rest can be affected by a number of things, including age, gender, emotional state, muscle coordination, and circadian rhythms.[18] Upper and lower gingival exposure, midline and incisal plane tilting, upper and lower incisal visibility, and other methods were used in the majority of studies evaluating dental and facial esthetics.[19] In this study, a specific focus was made to lay emphasis on the effects of age and gender on maxillary incisal and canine display and its correlation with lip form.

The results of our study evaluated that low smile lines are specifically seen in males with a gradual increase in age. These results were inconsistent with results obtained from the studies of Tjan *et al*. in the year 1984.[20] The measurements used in our study to evaluate the lip form were similar to the quantification observed from the study of Kim *et al*. in the year 2017,[8] Kundu *et al*. in 2022,[9] Padmasree *et al*.,[6] and Motta *et al*.[21] Female subjects had moderate lip form more frequently than male subjects did. Prosthodontic treatment planning, which tends to ignore long-term changes in the incisor-lip relationships, may benefit greatly from these findings. Depending on the patient's age and gender, the incisor visibility provided by

Table 4: Correlation between different age groups and incisal and canine display

Parameters	Age group in years	Mean	Standard deviation	Difference	T-statistic	Df	Significance level
Maxillary right and left incisal display	30–39	2.35	1.575	−0.750	−1.501	38	0.1416*
	40–49	1.6	1.585	−1.200	−2.327	38	0.0254*
	>50	0.4	1.675				
Maxillary right and left canine display	30–39	−0.13	0.990	−0.620	−1.538	38	0.1322*
	40–49	−0.75	1.506				
	>50	−0.12	1.533	0.630	1.311	38	0.1977*

*Statistically significant

Table 5: Correlation between different incisal and canine displays with that of gender

Parameters	Age group in years	Sample size	Mean	Standard deviation	Difference	T-statistic	Df	Significance level
Maxillary right and left incisal display	Male	34	1.908	0.007	1.053	759.637	58	<0.0001*
	Female	26	2.961	0.001				
Maxillary right and left canine display	Male	34	−0.3821	1.2	0.072	0.214	58	0.8313
	Female	26	−0.3102	1.4				

*Highly statistically significant

complete or partial dentures and anterior esthetic rehabilitations using conventional fixed dentures or implants must be adjusted. In the event at that point, the prostheses will wind up in dental replacement as a fake look. The effects of gravity on the lips and the changes in facial tissues caused by age and sex should be understood by a prosthodontist.

The central incisor had a wider range of exposure in this study (0.0–5.0 mm) than the canine (−2–2 mm). As for sex or age, it was also observed that the canine position varied less than the central incisor position. This indicates that when the lip is at rest, canine exposure is more consistent across all age groups than central incisor exposure.

Limitations

For more reliable results, a large study with a large number of samples from each age group and lip length should be used. More specific evaluations, such as photographs or any specific software, can be used to give highly authentic results.

Conclusion

Within the limitations of the study, it can be concluded that exposure to teeth usually decreases with increasing age, the basic reason behind this being the lip form, which eventually increases with respect to gender and age. More exposure was seen in cases of female patients when compared with males. In addition, a narrower range of exposure for the maxillary canine's cusp tip was revealed in this study.

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