

Incisal Display and Smile Line during Posed Smile in a Young Nigerian Population

Monica Adekoya^{*a}, Oluwarantida Costa^b and Ifeoma Utomi^c.

^aUniversity of Calabar, College of Medicine, Faculty of Dentistry, Calabar, Cross Rivers, P.M.B. 1115, Nigeria.

^bUniversity of Lagos, College of Medicine, Faculty of Dental Sciences, Lagos, P.M.B, 12003, Nigeria.

^cUniversity of Lagos, College of Medicine, Faculty of Dental Sciences, Lagos, P.M.B, 12003, Nigeria.

Corresponding Author: Monica Adekoya

Abstract

OBJECTIVES: The purpose of this study was to determine the ideal range of values for dental and soft tissues relationships as related to the aesthetics of smile in a young adult Nigerian population.

MATERIALS AND METHODS: The 170 subjects included in this study were dental students of the Lagos University Teaching Hospital, Lagos, Nigeria and the University College Hospital, Ibadan, Oyo state, Nigeria. They had an age range of 18-25 years (mean age, 21.6±2.2 years) with 102 females and 68 males. Frontal posed smile photographs were taken of all subjects. Quantitative measurements of both soft and hard tissues were made by using a Photoshop, CS, 1995-2010 adobe system incorporated.

RESULT: The incisal display for an aesthetic smile in this population was 9.2mm, the smile line was an average smile and the smile index was 7.55mm.

CONCLUSIONS: More than half of the study population displayed between 75 – 100% of the maxillary incisors during smile.

Keywords: hard and soft tissues, posed smile, aesthetics

Date of Submission: 07-05-2018

Date of acceptance: 22-05-2018

I. Introduction

Smile aesthetics has become a central concern for patients and orthodontists because it is a primary reason patient seek orthodontic treatment and orthodontists are now using this as a focus for treatment planning (1). Aesthetics involves the study of beauty and psychological responses (2,3). It denotes concern about beauty or appreciation of beauty.

The smile is the most effective means by which people convey their emotions. Smiling is a signaling system that evolved from a need to communicate information of many different forms (4). Female smiles are appealing to males, increasing physical attraction. There are two forms of smile- the enjoyment or Duchenne smile, and the posed or social smile (4,5). Posed smiles gained importance in dentistry and orthodontics mainly because they are repeatable overtime (6,7). The components of the smile include the smile line, smile arc, buccal corridor, smile symmetry, dental components, lip curvature and the gingival components (8). The smile, along with the associated perioral tissues, most visibly displays the results of orthodontic treatment therefore it is not surprising that smile aesthetics is a major goal of orthodontic mechano-therapy. A smile begins at the commissure and extends laterally, the lips may initially remain in contact, except in people who do not feature passive lip seal or have a short upper lip. As the smile expands, the lips separate, the commissures curve upwards and the teeth are exposed. The arches are separated and a dark space develops between the upper and the lower teeth known as negative space (9,10).

Many factors have been suggested in the orthodontic literature as contributors to an aesthetic smile, including the display and condition of teeth and gingivae, arch size and shape, symmetry and width, skeletal base relationship and the smile arc (11,12,13). Lip position and the amount of tooth and gingival display during smiling and speech are important diagnostic criteria in orthodontics, dentofacial surgery and aesthetic dentistry (14,15).

The author in (4) reported that in an attractive smile, the upper lip is elevated to reveal 10 mm of maxillary incisors, the mouth is increased to 130 % of its original width and the lips separated approximately 12 mm (8). In general, women have more facial animation than men (4,8). Orthodontically treated subjects displayed more maxillary incisors and gingivae than the untreated (4,16). In adults, clinical crown height is normally between 9mm and 12mm, with an average of 10.6mm in males and 9.6mm in females (6,9,17). The authors in (18) reiterated what the authors in (19) reported, that if a patient displays less than 75% of the central incisor crown at smile, tooth display is considered inadequate. Incisor inclination also affect incisor display, proclined

maxillary incisors, whether in a Class II, division 1 malocclusion or in a Class III compensation, tend to reduce the incisor display at rest and in smiling. On the other hand, uprighted or retroclined maxillary incisors, as seen in Class II, division 2 malocclusion or after orthodontic retraction without torque control, tend to increase the incisor display.

It is generally accepted that the gingival margin of the maxillary incisors should be coincident with the upper lip in the social smile, figure 1, (16,20,21,23).

Incisal display, (figure 1), can be termed as toothrevealed (18).Exposure is the term used to quantify the dental structures or gingivae that appear during a smile (2,23,24).The amount of dental and gingival exposure during speech or smiling varies from person to person due to individual variables such as upper and lower lip muscle mobility and strength, lip vertical length, clinical crown length and skeletal relationship especially maxillary length (22,23,25).During a smile maxillary central incisor exposure varies from three quarters of the crown to 2mm of gingival exposure (26,27).

The upper lip position can be of three types- high smile line,which reveals the complete and cervico-incisal length of maxillary incisors and a contiguous band of gingival tissues. An average smile line reveals 75-100% of the maxillary incisors and a low smile line displays less than 75% of maxillary incisors (10,28,29).

The smile index describes the display zone, (figure 2). It is determined by dividing the intercommissural width by the interlabial gap (This is the distance between the most inferior portion of the tubercle of the upper lip and the deepest midline point on the superior margin of the lower lip) during smiling (3,6,30). The smile index was developed by the authors in(31), the lower the smile index, the less youthful the smile appears (6,31). The smile index is used for comparing smiles among patients (3).

The aesthetic principles that govern facial and dental harmony and achieving optimal tooth position within the soft tissue and skeletal characteristics of each patient are vital components (24). Most lay people use smile attractiveness as a parameter to judge treatment success (32). In Nigeria, there is an increasing awareness and demand for orthodontic treatment. The knowledge of the correlation between incisal display, smile line and smile aesthetics will add important clinical meaning to orthodontic diagnosis, treatment planning and treatment success. The aim of this study was to assess the ideal incisor display, smile index and the lip position for an aesthetic smile.

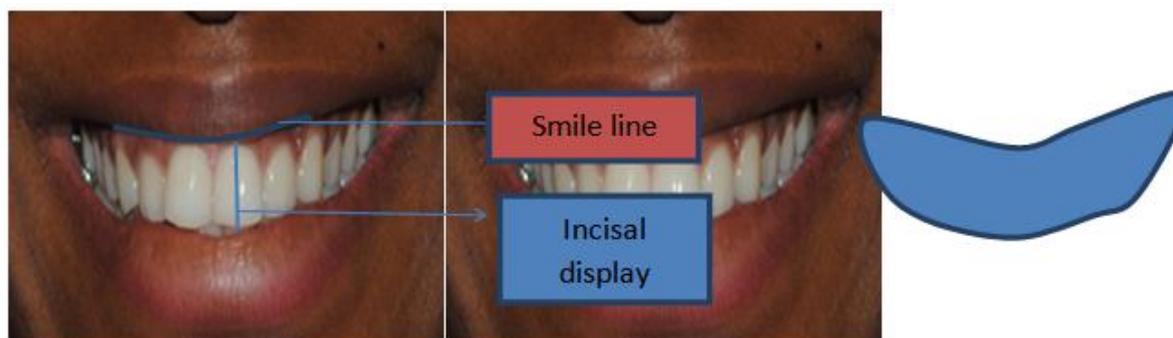


Figure. 1. Figure. 2. Display zone

II. Materials and Methods

This was a cross-sectional descriptive study carried out at theLagos University Teaching Hospital, Lagos State, Nigeria and University College Hospital, Ibadan, Oyo State, Nigeria. There were 170 subjects (ages 18-25 years), who were dental students of both institutions. The sample population consisted of 102 females and 68 males. The following inclusion criteria were strictly followed, 1) no previous orthodontic treatment or oral and maxillofacial surgery, 2)complete permanent dentition except for third molars with no missing teeth or supernumerary teeth, 3) overjet of 2-4mm and normal overbite, 4) no active periodontal disease, 5) normal upper lip length, 6) no craniofacial anomalies or other pathologies, 7) no severe malocclusion 8) no canting of the maxillary occlusal plane. The variables assessed include the incisal display, smile line and the smile index.

Ethical clearance was approved by ethical committee of Lagos University Teaching Hospital. A letter of permission was granted at the University College Hospital, Ibadan and informed consent was signed and obtained from the each subject. Each subject was seated with the Cephalostat rod placed in the external auditory meatus with natural head position. The photographs were taken in the same environment with the same lighting conditions. Two photographs of each subject were taken, one at rest and followed by a posed smile using a Nikon D3000 camera with high definitive capturing ability. The camera was mounted on a tripod and placed at a distance of 77.6cm from the subject. A constant focal length of 55mm with aperture of f/5 was maintained. All

the pictures were transferred to the computer software (adobe photoshop, CS5 1990-2010, adobe system incorporated). All images were cropped with vertical (nose tip and soft tissue pogonium) and transverse (perpendicular drawn down from the zygomatic prominence) limits. All images were then adjusted to a standardized image, using measurement between two points (both inner canthus of the eyes) to check the magnification error. This was compared with the clinical measurement and was found to have a statistically significant correlation of 0.90. All the measurements were done using the ruler in the software. The photographs of 17 randomly selected subjects were retaken under the same setting to verify the repeatability of the measurement. The smile index was calculated by dividing the intercommissural width by the interlabial gap.

2.1 Statistical Analysis

The data were analyzed using Epi-info version 3.5.1 statistical software. Pearson's correlation coefficient was applied to initial and repeat measurement on 17 subjects for assessment of intra-examiner reliability. It showed a high consistency between the first and second readings for all measurements (Table 1). Numerical and categorical data were generated. Descriptive statistics such as the mean and standard deviation for numerical data were calculated, while the frequency tables were used to summarize categorical variables. Students't-test was used to test the differences in the mean of two groups. Pearson's coefficient analysis was used to assess the relationship between two numerical variables. All tests were carried out at 5% level of significance.

III. Results

Table 2 showed 102 (60%) of the 170 subjects were females and 68 (40%) were males. The age range was 18-25 years with the mean of 21.6 ± 2.2 .

Table 3 showed that the range of incisor display during smiling in this population was 2.8-18mm with a mean 9.2 ± 2.0 mm. The mean incisor display for the males was 9.8 ± 2.2 mm and 8.4 ± 2.0 mm for the females. There was no statistically significant association between the gender of the respondents and their incisor display. Figure 3(Pearson's correlation coefficient, $r=-0.2$) showed a weak correlation between the incisor display and the age of the respondents, as age increases, the incisor display decreases.

About 38% of all subjects showed a high smile line, 57% had an average smile line and about 5% of the subject had a low smile line. About 32% of males had high smile line, 60% had average smile line and 7.4% had low smile line. This compared with 41% of the female respondents who had high smile line, 55% had average smile line and 4.0% had a low smile line. Chi square was used to test the association between gender and age of respondents and their smile lines. There was no statistically significant association between the incisor display and gender of respondents and their smile line (pvalue=0.376).

The range of the smile index as shown in table 3 was 4.3- 26.6mm with a mean of 7.55 ± 5.7 mm. Chi square test was used to test the association between gender and the smile index this showed the smile index for males to be 7.4 ± 2.7 mm and for females, it was 7.6 ± 7.4 mm. There was no statistically significant difference between the gender of the respondents and their smile index (p value=0.78, Table 4).

Table 1:
Evaluation of intra-examiner reliability using Pearson's coefficient

	Correlation coefficient (r)
Incisal display	0.96
Gingival display	0.98
Inter commissural width	0.97
Interlabial gap	0.94

Table 2:
Socio-demographic Characteristics of Subjects

Variable	Frequency	Percent
Age Range (yrs)	18 -25	
Mean Age \pm SD (years)		21.6 ± 2.2
Age Group (years)		
18 -19	36	21.2
20- 21	49	28.8
>21	85	50.0
Total	170	100
Sex		

Male	68	40.0
Female	102	60.0
Total	170	100

Table 3:
Association between gender of subjects and their incisal display

Incisal Display	Frequency	Male	Female
Range	2.8 – 18	3.1-18	2.8-17
Mean ± SD	9.2 ± 2	9.8±2.2	8.4±2.0

$\chi^2 = 1.9$ p value = 0.393

Mean Age ± SD (years)	21.7 ± 2.1	21.3 ± 2.3	21.9 ± 2.3
-----------------------	------------	------------	------------

F = 0.4 P value = 0.668

Table 4:
Smile line distribution related to age and gender of subjects

Smile line	Male	Female	Total
Low	5 (7.4)	4 (3.9)	9 (5.3)
Average	41 (60.3)	56 (54.9)	97 (57.1)
High	22 (32.4)	42 (41.2)	64 (37.6)
Total	68 (100)	102 (100)	170 (100)

$\chi^2 = 2.0$ p value = 0.376

Table 5:
Distribution of gingival display of subjects by gender

Gingival display	Male	Female	Total
Gingival smile (>2mm)	7 (46.7)	12 (41.4)	19 (43.2)
High smile (<2mm)	8 (53.6)	17 (58.6)	25 (56.8)
Total	15 (100)	29 (100)	44 (100)

$\chi^2 = 0.1$ p value = 0.737

Gingival Display	Range	Mean ± SD
	1.0 – 13.0	3.1±0.2

Table 6:
Distribution of smile index

Smile Index (IW/IL) (mm)	Frequency	Percent
High	102	60.0
Low	68	40.0
Total	170	100

Range	4.3 – 26.6
Mean ± SD	7.55 ± 5.7

Table 7

Association between the gender of subjects and their smile index

Sex	Male	Female
Smile index (mm)	7.4 ± 2.7	7.6 ± 7.1
Mean ± SD		
T=0.3		P=0.784

IV. Discussion

One of the primary aims of orthodontic treatment is to attain and preserve facial attractiveness (3,15). Facial attractiveness and smile attractiveness appear strongly connected to each other (15,19). The success of orthodontic treatment is often measured by smile aesthetics. Many factors have been suggested in the orthodontic literature as contributors to an aesthetic smile, including the display and condition of teeth and gingivae, arch size and shape, symmetry and width, skeletal base relationship and the smile arc.¹³ Smile analysis and smile design have² become key elements of orthodontic diagnosis and treatment planning over the last decade (9,15,19).

The authors in (3) stated that younger age group expose more teeth than older age group. In the present study, the range of incisal display was 2.8-18 mm. This result varies slightly from that of McNamara et al (33) who reported 2.6-11mm as the range of incisal display in their study population, aged between 10-15 years. Age and race are factors that strongly influence incisal display. It has been reported that there is more incisal display in younger age group but other factors like lip elevation, vertical lip thickness come to play. In a study of North American white descent, the author in (33) reported a mean of 7.7±1.6mm, which is lower than that of the present study.

As one ages the upper lip displays less maxillary incisor on smile. This is in accordance with the study conducted by author in(20) and Those in (28). Similar result were obtained by authors in (25) who noted a decrease in maxillary incisor exposure of about 3.41mm from less than 29 years to over 60 years of age. In this present study, the subjects were not grouped by age because the study population age range was narrow (18-25 years), but the results clearly showed a reduction in the incisor display with age, figure 3, which is consistent with those of previous reports (20,25,28).

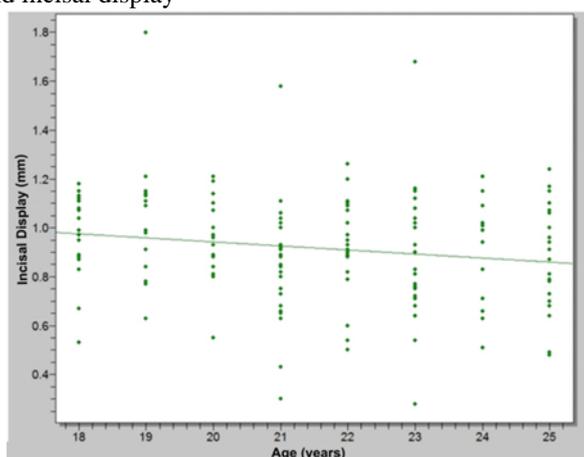
4.1 Incisal display

In this study, the incisal display during smiling was 9.8mm for the males and 8.4mm for the females which is lower than the 10mm reported by Rigsbee et al(4). Previous studies have shown that females displayed more maxillary incisors during smiling than males (17,18), which is not in agreement with the results of this present study. In this study, about nine per cent of the males displayed more than 12mm of the incisor crown length as against four per cent of females. Longer lip length of 24.50mm have been reported in the Nigerian population compared to 23.7mm in Caucasians by Isiekwe et al (34), and may have an effect on the incisal display in this population. In cases of inadequate incisor display, it must be determined whether the condition is a consequence of insufficient tooth eruption, attrition or gingival hyperplasia. In such situations, aesthetic surgery, such as crown lengthening or periodontal surgery should be performed (33).

The proportion of females with high smile line (58.6%) was higher than that of the males (53.3%). There was a higher number of males with low smile lines. Sexual dimorphism was apparent in smile line extremes in this study. In a study by authors in (2) high smile line (exposing greater than 1mm of gingival tissue) appeared to be a female characteristic and low smile line (covering more than 2mm of incisal crown) seemed to be a male characteristics. The result of the present study is in agreement with those of the authors in (2) and also authors in (28) who reported that low smile line was predominantly a male characteristic and high smile line, a predominantly female characteristic.

In the present study population, more than half of the study population showed average smile line which has been reported to be the ideal smile line by previous studies (16,20,21). In contrast, some studies reported that high smile line with 1mm-2mm gingival display is acceptable (36). In this study, about 37.6 % of the study population showed high smile line, which some authors have agreed to also be an aesthetic feature of an attractive smile (36,37).

Correlation between age and incisal display



$r = -0.2$, F test = 4.1, p value = 0.050

Figure. 3

In orthodontics and surgery, the gingival smile line or gummy smiles provokes stronger concern from clinicians than a low smile line (2,38). The upper limit for gingival display in the present study was 13mm and the lower limit was 1mm with a mean of 3.1 ± 0.2 mm. The authors in (39), stated that aesthetically the ideal amount of visible gingivae was 1mm, although 2-3mm of gingivae may still be aesthetically acceptable. This result corroborated that of the authors in (40). The result of this study showed that 46.7% of males showed gingival smile line while 41.4% of females showed gingival smile. This result differed from findings of other authors (24,26,27), who reported that the gingival smile is a more common characteristic of females.

In general, when a low smile line is determined, intrusion therapy in adolescents should be avoided as this will lead to a premature aged oral appearance and tooth display will be even more reduced by sagging of the lips in middle age (13,35,44). Treatment of very high upper lip line (severe gummy smiles) may require surgical impaction of the entire maxilla (Le Fort 1) or of only the anterior part (segmental osteotomy) (35,44). To lengthen the upper lip, a V-Y cheiloplasty can be done or Botox injection, which mechanically reduces lip elevation, can be used as a temporary improvement (9,35,45). If an average smile line height is determined, orthodontic intrusion should also be avoided.

4.2 Smile index

The smile index describes the display zone (3). In this study the smile index was calculated by dividing the intercommissural width with the interlabial gap. Significant association between the age and smile index was not expected in the present study because the age range is narrow. The mean for the males and females was 7.4 ± 2.7 mm and 7.6 ± 7.1 mm respectively which is higher than findings of the authors in (35) who reported a range of 4-6mm. The smile index of the perceived most attractive smiles in this study population were calculated and found to be 5.05mm. Comparing that with the results of this study, it can be deduced that 60% of the subjects in this study had a high smile index, which indicates youthfulness and 40% had a low smile index of below 4mm. The lower the smile index, the less youthful the smile appears (31,33). The height of smile depends on the elevation of the upper lips, which is muscle driven and not under the control of the orthodontist. The reports from the authors in (31) and those in (32), clearly agree with the age range of the subjects in this study.

V. Conclusion

An optimal smile is characterized by an upper lip that reaches the gingival margin with an upward or straight curvature between the philtrum and commissures; an upper Incisal line coincident with the border of the lower lip; minimal or no lateral negative space (buccal corridor); a commissural line and occlusal frontal plane to the papillary line; and harmoniously integrated dental and gingival component. . It is important to have general guidelines to aid clinicians in optimizing dento-facial aesthetics while satisfying other treatment goals. The following observations were made

1. The incisal display during smile was 9.2mm.
2. More than half of the study population had the upper lip at the height of the gingival margin of the upper central incisors.
3. The mean smile index for the males and females was 7.4mm and 7.6mm and the smile index was for the perceived most attractive smile was 5.05mm.

References

- [1]. W.R Proffit, H.W Fields, Contemporary orthodontics, St Louis; Mo.Mosby, 2007, pp. 586-87.
- [2]. S.Peck, L.Peck. "Selected aspects of the art and science of facial aesthetics"Seminar in Orthodontics; vol. 1, pp. 105-26, 1995.
- [3]. V. Krishnan, T.D.Sunish, L. Don, A. Abin."Characterization of posed smile by using visual analog scale, smile arc, buccal corridor measures and modified smile index"Am J OrthodDentofacialOrthop; vol. 133, pp. 515-23, 2008.
- [4]. O.H. Rigsbee, T.P.Sperry, E.A. BeGole "The influence of facial animation on smile characteristics" Int. J Orthod Res, vol. 3, pp. 23-9, 1998.
- [5]. D.M. Sarver, M.B. Ackerman. "Dynamic smile visualization and quantification, Part 1. Evolution of the concept and dynamic records for smile capture" Am J OrthodDentofacialOrthop, vol. 124, pp. 4-12, 2003
- [6]. J.L Ackerman, M.B. Ackerman, C.M. Brensinger, J.R.A. Landis 'Morphometric analysis of posed smile"Clinical Ortho Res, vol. 3, pp. 233-39, 1998.
- [7]. T. Hosseinzadeh-Nik, L. Yazdan-Dama-Vandi,M.J. Kharazi-Fard"The correlation of smile line with the vertical Cephalometric parameters of anterior facial height"J Dent, vol. 2, pp. 21-8, 2005.
- [8]. R Sabri."The eight components of a balanced smile"J ClinOrthod, vol. 39, pp. 155-65, 2005.
- [9]. S. Peck, L. Peck, M. Kataja. "Some vertical lineaments of lip position" Am J Orthod, vol. 101, pp. 519-24, 1992.
- [10]. C.A. Camara. "Aesthetics in orthodontics six horizontal smile lines"Dental press J Orthod, vol. 15, pp. 118-31, 2010.
- [11]. A. Holmes. "The subjective need and demand for orthodontic treatment"Br J Orthod, vol. 19, pp. 287-97, 1993
- [12]. K. Birkeland, O.E. Boe, P.J. Wisth."Orthodontic concern among 11-year old children and parents compared with orthodontic treatment need assessed by index of orthodontic treatment need"Am J OrthodDentofacialOrthop, vol. 110, pp. 197-205, 1993
- [13]. C.R. Scott, M.S. Gooviewardene,K. Murray."Influence of lips on the perception of malocclusion"Am J OrthodDentofacialOrthop, vol. 130, pp. 152-62, 2006.
- [14]. P. Van Der Geld, P. Oosterveld Jan Schols, A. M. Kuijpers-Jagtman. "Smile line assessment comparing quantitative measurement and visual estimation"Am J. OrthodDentofacialOrthop, vol. 139, pp. 174-80, 2011.
- [15]. K. Sachdeva, A. Singla, V. Mahajam,H.S.Jaj, A. Negi."Aesthetic and smile characteristics at rest and during smiling"IndOrthodSoc, vol. 48, pp. 17-25, 2012.
- [16]. E. IsiksalS. Hazar, S. Akyalcin."Smile aesthetics: Perception and comparison of treated and untreated smiles"Am OrthodDentofacialOrthop, vol. 129, pp. 8-16, 2006.
- [17]. R.J. Gillen, R.J. Schwartz, D.B. Evans."An analysis of selected normatic tooth proportions"Int J Prosthodont, vol. 7, pp. 410-17, 1994.
- [18]. B.S. Chandrashekar, P. Sujit, K.J. Ashok. "Smile designing in orthodontics"The Orthodontic Cyberjournal, [http://www. Orthocj.com](http://www.Orthocj.com). 10/01/12.
- [19]. J. Morley,J. Eubank."Advanced smile design. Course presented at 141st Annual session of the American Dental Association. 2000
- [20]. C. M. Husley. "An esthetic evaluation of lips-teeth relationship present in smile"Am J. Orthod.; vol. 57, pp. 132-44, 1970.
- [21]. R.J. Mackley. "An evaluation of smile before and after orthodontic treatment" Angle Orthod, vol. 63, pp. 183-90, 1993.
- [22]. J.K. Dong, T.H. Jin, H.W.Cho. S.C.. Oh."The aesthetics of the smile: A review of some recent studies"Int J Prosthodont, vol. 12, pp. 9-19, 1999.
- [23]. J.P. Frush, R.D.Fisher. "Complete dentures: The dynesthetic interpretation of the dentogenic concept" J Prosthet Dent, vol. 8, pp. 558-81, 1958.
- [24]. D.E Ritter, L.G. GandiniJr,APinto, D.B. Ravelli, A. Locks."Analysis of smile photographs"World J Orthod, vol. 7, pp. 279-85, 2006.
- [25]. R. G. Vig, G. C. Brundo."The kinetics of anterior tooth display" J Prosthet Dent, vol. 39, pp. 502-504, 1978.
- [26]. C.R Rufenacht.Fundamentals of aesthetics, Chicago; Quintessence, 1990, pp. 80.
- [27]. G. W. Arnett, R. T. Bergman."Facial keys to orthodontic diagnosis and treatment planning. Part I" Am J OrthodDentofacialOrthop, vol.103, pp. 299-312, 1993.
- [28]. A. H. Tjan, G.D. Miller,J.G. The."Some aesthetic factors in a smile"J Prosthet Dent, vol. 51, pp. 24-8, 1984.
- [29]. S. Desai, M. Upadhyaj, R. Nanda. "Dynamic smile analysis: changes with age"Am JOrthodDentofacialOrthop, vol. 136, pp. 310.e1-310.e10, 2009.
- [30]. M.B. Ackerman."Digital video as a clinical tool in orthodontics, dynamic smile analysis and design in diagnosis and treatment planning. In: McNamara J.A.Jr. editor. Information technology and orthodontic treatment. Monograph 40. Craniofacial Growth Series. Ann Arbor. Centre for Human Growth and Development" University of Michigan, pp. 195-205, 2003.
- [31]. M.B. Ackerman, J.L. Ackerman. "Smile analysis and design in the digital era"J Clinical Orthodontics, vol. 36, pp. 221-336, 2002.
- [32]. D. Roden-Johnson, R. Gallerano, J. English. "The effects of buccal corridor spaces and arch form on smile aesthetics"Am J OrthodDentofacialOrthop, vol. 127, pp. 343-45, 2005.
- [33]. L. McNamara, J.A. McNamara Jr, M.B. Ackerman, T. Bacceti."Hard and soft tissuecontributions to the aesthetics of posed smile in growing patients seeking orthodontic treatment"Am J OrthodDentofacialOrthop, vol. 133, pp. 491-99, 2008.
- [34]. M.C. Isiekwe."Lip positions and incisor relationship in Nigerian children"African Dental Journal, vol. 2, pp. 26-30, 1988.
- [35]. S.G. Durgekar, K. Nagaraj, N. Vijay. "The ideal smile and its Orthodontic complications"World J Orthod, vol. 11, pp. 211-20, 2010.
- [36]. V.O. Kokich, H. Kiyak, P.A. Shapiro."Comparing the perception of dentist and lay people to altered dental aesthetics"J Aesthet Dent, vol. 11, pp. 311-24, 1999.
- [37]. K.H. Zawawi, G.A. Malki, M.S. Al-Zahrani, Y.M. Alkhiary."Effect of lip position and gingival display on smile and aesthetics as perceived by college students with different educational backgrounds" ClinCosmetInvestig Dent, vol. 5, pp. 77-80, 2013.
- [38]. R.M. Ricketts.Facial art. In Ricketts R.M. Provocations and perceptions in craniofacial orthopaedics Boulder, CO: RMO; 1989, pp. 149-212.
- [39]. G. Chiche, A. Pinault."Aesthetics of anterior fixed prosthodontics" Chicago: quintessence.
- [40]. V.G. Kokich, V.O. Kokich, H.A. Kiyak. "Perception of dental professionals and laypersons to altered dental aesthetics: asymmetric and symmetric situations"Am J OrthodDentofacialOrthop, vol. 130, pp. 141-51, 2006.
- [41]. R.W. McAlister, E.M. Harkness, J.J. Nicoll. "An ultrasound investigation of the lip levator musculature" Eur J Orthod, vol. 20, pp. 713-20, 1998.
- [42]. D.A. Garber, M.A. Salama."The aesthetic smile. Diagnosis and treatment"Periodontology, vol. 11, pp. 18-28, 2000.
- [43]. W.S. Hwang, M.S. Hur, K.S. Hu, W.C. Song, K.S. Koh, H.S. Baik. "Surface anatomy of the lip elevator muscles for the treatment of gummy smile using botulinum toxin"Angle Orthod, vol. 79, pp. 70-7, 2009.
- [44]. D.M. Sarver. "The importance of incisor positioning in the aesthetic smile: the smile arc" Am J OrthodDentofacialOrthop, vol.120, pp. 98-111, 2001.

- [45]. H.W. Austin. "Correction of gummy smile- a plastic surgeon's view" *Dent today*, vol. 9, pp. 25, 1990.
- [46]. H. Miron, S. Calderon, D. Allon. "Upper lip changes and gingival exposure on smiling: vertical dimension analysis" *Am J Orthod Dentofacial Orthop*, vol. 141, pp. 87-93, 2012.

Monica Adekoya "Incisal Display and Smile Line During Posed Smile In a Young Nigerian Population". *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, vol. 17, no. 5, 2018, pp 45-52.