# EVALUATION OF ANTERIOR TOOTH DISPLAY IN REST POSITION & SMILE, AND SMILE CHARACTERISTICS IN DRAVIDIAN TAMIL LINGUISTIC POPULATION

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**MASTER OF DENTAL SURGERY**

**BRANCH V**

**ORTHODONTICS AND DENTOFACIAL ORTHOPAEDICS**

**APRIL 2011**

# CERTIFICATE

This is to certify that the dissertation entitled "**Evaluation of Anterior Tooth Display in Rest Position & Smile, and Smile Characteristics in Dravidian Tamil linguistic population**" done by **Dr. JAYARAMAN P.** Post graduate student (M.D.S), Orthodontics **(Branch V),** Tamil Nadu Govt. Dental College and Hospital, Chennai, submitted to the Tamil Nadu Dr.M.G.R.Medical University in partial fulfilment for the M.D.S. degree examination **(April 2011)** is a bonafide research work carried out by him under my supervision and guidance.

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# DECLARATION

I, **Dr. JAYARAMAN P.,** do hereby declare that the dissertation titled **"Evaluation of Anterior Tooth Display in Rest Position & Smile, and Smile Characteristics in Dravidian Tamil linguistic population"** was done in the Department of Orthodontics, Tamil Nadu Government Dental College & Hospital, Chennai 600 003. I have utilized the facilities provided in the Government Dental College for the study in partial fulfilment of the requirements for the degree of **Master of Dental Surgery** in the specialty of Orthodontics and Dentofacial Orthopaedics **(Branch V)** during the course period **2008-2011** under the conceptualization and guidance of my dissertation guide, **Professor Dr. M.C. SAINATH, MDS.**

I declare that no part of the dissertation will be utilized for gaining financial assistance, for research, or other promotions without obtaining prior permission from the Tamil Nadu Government Dental College & Hospital.

I also declare that no part of this work will be published either in the print or electronic media except with those who have been actively involved in this dissertation work, and I firmly affirm that the right to preserve or publish this work rests solely with the prior permission of the Principal, Tamil Nadu Government Dental College & Hospital, Chennai 600 003, but with the vested right that I shall be cited as the author(s).

*Signature of the PG student* *Signature of the HOD*

*Signature of the Head of the Institution*

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Title of the Work : Evaluation of Anterior Tooth Display in Rest position & Smile and Smile Characteristics in Dravidian Population ( Tamil linquisttic)

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The request for an approval from the Institutional Ethical Committee (IEC) was considered for the following on the IEC meeting held on 18.10.2010 at the Principal's Chamber, Tamil Nadu Government Dental College & Hospital, Chennai-3 and it was advised to mention the Exclusion Criteria such as short upper lip, thumbsucking, Lip biting and other Exclusion Criteria and the amount of gingival also shown at the time of laughing.

**" Subsequent to the addition of Exclusion Criteria, Provision of Information sheet and Consent form it was Advised to Proceed with the Study "**

The Members of the Committee, the Secretary and the Chairman are pleased to approve the proposed work mentioned above, submitted by the Principal Investigator.

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5. You should inform the IEC immediately in case of any adverse events or serious adverse reactions. You should abide to the rules and regulations of the Institution.
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# ABBREVIATIONS

| | | |
|---|---|---|
| ICW | - | Inter Commissure Width |
| IICW | - | Inner Inter Commissure Width |
| ILG | - | Inter Labial Gap |
| MID | - | Maxillary Incisal Display |
| OICW | - | Outer Inter Commissure Width |
| R | - | Rest |
| S | - | Smile |
| ULL | - | Upper Lip Length |
| ULT | - | Upper Lip Thickness |

# CONTENTS

# INTRODUCTION

Esthetics or the study of beauty is an essential component in the practice of orthodontics. Esthetics is a Greek word which means perception of beauty. The facial esthetics embodied in classic Greek sculpture had a strong influence on many of the early orthodontists.

It has been said that “beauty is power; and smile is its sword”. For appreciation of beauty, it is said that the human mind functions at the limbic level in the subconscious or the primitive part of the brain.

Facial expression and physical attractiveness in general, form essential parts of social interaction. The smile is even more important because of its increasing role in the esthetic ideal. The smile and facial display as related to communication and expression of emotion must be taken into account in the context of dento-facial problems. Few objective criteria exist for assessing attributes of smile, establishing tooth-lip relationship for best esthetics.

An esthetically pleasing smile depends not only on components such as tooth size, shape, color, and position, but also on the amount of visible gingivae and the framing of the lips. All these components should form a harmonic and symmetric entity.

Ricketts[39] proved that a normal well balanced face exhibited a progressive mathematical relationship between its proportions and that similar relationships existed between dental components of an ideal occlusion.

An application of basic mathematical and geometrical principles to the normal morphology of structure involved in orthodontics will help devise the proportions in the practice of orthodontics. This would help esthetics be made a Scientific, rather than a mere subjective phenomenon as was in the past.

In the dental literature, 3 approaches are suggested to determine the height of the smile line: the qualitative, the semi-quantitative, and the quantitative approaches. In the qualitative approach, the orthodontist observes the patient.

As soon as the patient smiles, a qualitative statement about the height of the smile line is made. In the semi-quantitative approach, a patient is asked to smile, and the smile is recorded by a photograph. With this photograph, the height of the smileline is visually classified. In the quantitative approach, the smile line height is determined with a measuring instrument. The methods in this approach range from simple to sophisticated.

Ackerman et al[29] and Sarver and Ackerman[14] used computer software programs for measuring smile line height and tooth display. At first, digitized smiling photographs from orthodontic records were measured. Later, they used digital video cameras for smile registration. The smile is not a singular category of facial behavior; structural differences do exist between posed and spontaneous smile. Hence, development of less interfering methods of smile registration and precise measurements are needed for smile analysis. The scientific and clinical relevance of digital videographic method is found to be high.

The Dravidians have been found to be different from other ethnic groups by many earlier workers. Therefore, it was thought relevant to conduct a study on smile characteristics and tooth- lip relationship in Tamil linguistic population through digital videography. Thus far no study has been undertaken to study the smile and tooth-lip relationships for best esthetics on them.

This study therefore, endeavors to determine:

1. Anterior tooth display in rest position and smile
2. Smile characteristics and
3. Extend its application to the practice of orthodontics

# AIM AND OBJECTIVES

## Aim:

The aim of this study is to evaluate the anterior tooth display in rest position and smile, and smile characteristics in Dravidian Tamil linguistic population.

## Objectives:

To analyse the factors that contribute to aesthetic smile through digital videographic measurement, that include

- Maxillary Incisal Display
- Upper Lip Length
- Upper Lip Thickness
- Interlabial gap
- Outercommissure Width
- Innercommissure Width
- Smile Height
- Smile Arc, and
- Smile Line

# REVIEW OF LITERATURE

The subject of facial aesthetics is predominantly important to Orthodontists. Before attempting to identify a present day concept of facial and dental aesthetics, it is imperative to develop a historical perspective of the subject.

A perusal of literature pertaining to the soft tissue profile indicates that researchers have investigated profiles utilizing several methods such as sculpture, photographs in black and white, photographs in color; in frontal, lateral view, silhoutte photographs and lateral cephalometric radiographs.

## Anterior Tooth Display

**Vig, R.G. and Brundo, G.C. 1978**[46] in their study of maxillary incisor exposure, reported a gradual decreasing maxillary incisor exposure for each increase in age group from under 30 to over 60 and further stated that mandibular incisor display after age 60 was approximately equal to the amount of maxillary incisor display before the age of 30.

Under the age of 30, the mean tooth exposure in rest position for maxillary central incisor was found to be 3.4 mm, and 0.5mm for mandibular central incisor. Over 60, maxillary central incisor it was 0.0mm, and for mandibular central incisor 3.0mm.They also found that the men displayed 1.2mm-0.5mm more of mandibular incisor than females.

**Tjan AHL and miller 1984**[3] conducted a visual evaluation of full smiles of 454 dental and dental hygiene students in the age limit of 20-30 and found that 11% had high smiles revealing complete cervico incisal length of maxillary incisors and a continuous band of gingiva. An average smile was found in 69 % revealing 75–100% of maxillary incisor and low smile in 20% displaying less than 75 % of maxillary incisors.

**Sheldon Peck, Leena Peck**[42] **1992** in their study found maxillary incisor exposure in males to be 4.7 mm with the SD of 2.0, and for females 5.3mm with SD of 1.8. The maxillary incisor exposure in maximum smile was 9.8mm

for male with 2.2 mm of SD and for females 10.5mm with SD 2.1

**Bjorn U Zachrisson 1998**[48] has emphasized the following clinical criteria. Study the patient from the front to make a reliable esthetic evaluation. Routinely take extraoral photographs that record the pre- and post-treatment tooth display with the lips at rest. Be careful not to over-intrude the maxillary incisors in a patient with average or low smile type. Establish an age-appropriate vertical anterior tooth display in rest position and normal conversation. Provide a curve of the maxillary incisors that is parallel to the inner contour of the lower lip in smiling. Reduce excessive gingival exposure in a long-faced patient by active maxillary incisor intrusion coupled, if necessary, with labial gingivectomies.

**Edward A. McLaren, and Robert Rifkin, 2002**[17] quoting published reports of tooth display when the lips are at rest, have shown that the average 30-year-old female displays 3.5 mm of tooth structure. The prosthodontic literature has generally recommended setting denture teeth

so that 2 mm of tooth structure is displayed at rest. Thus, between 2 mm and 4 mm displayed at rest will be esthetically ideal for most female patients.

Tooth size and position and lip length and mobility greatly affect maxillary tooth display both statically and dynamically. The average length for maxillary central incisors has been measured at between 10 and 11mm.The average lip length has been measured at between 20 to 22 mm measured from the base of the nose to the edge of the upper lip. Average lip mobility in a normal smile is between 7 and 8 mm. When a person smiles in an esthetic composition, the tips of the maxillary canines come very close or touch the lower lip, while the maxillary incisors come about 2 to 4 mm short from touching the lower lip. This is affected by the curvature of the lower lip and the incisal plane. Also, all of the maxillary anterior teeth are displayed, cuspid to cuspid, and up to 3 mm of gingiva is exposed.

**Al Wazzan KA in 2004**[2] examined 473 adults who had maxillary and mandibular anterior teeth with no caries,

restorations, severe attrition, mobility, extrusion, or obvious deformities. The portions of anterior teeth that were visible were measured vertically using a Boley gauge from the border of the lip to the incisal edge for the incisors and to the cusp tip for the canines. The measurement was taken at the midpoint of the tooth when the lips and lower jaw were at the rest position. The length of the upper lip was measured from the base of the columella to the tip of the philtrum at the midline of the face. He concluded that males showed more of the maxillary lateral, canine, and mandibular anterior teeth than females. With increasing age, the amount of maxillary anterior teeth that was visible at rest decreased. The subjects with shorter upper lips displayed more maxillary central incisor structure than those with longer upper lips. Racial differences were not found.

**Shyam Desai et al in an article 2009**[16] showed that Maxillary incisor display differed significantly as a function of age. Post-hoc analysis confirmed that 15-19yr olds had higher maxillary incisor display than either 40-49yr olds (P 5 0.029) or 50 yrs old and above (P 5 0.004);

the 20-30 yrs group was higher than (P 5 0.007) or (P 5 0.001), and (30-40yrs) was higher than 40-50 yr group (P 5 0.005) and 50-60 yr group (P 5 0.001). There was no difference among persons aged between 15-30 yrs, and they did not differ significantly from each other either (P \0.05). The difference between 40-50yrs and 50-60yrs group was not significant.

**Smile characteristics**

**Frush and Fisher 1958**[24] in their study of BCS discussed the relationship between the curvature of the incisal edges of the upper anterior teeth and the curvature of the upper border of the lower lip. They defined the buccal corridor as the space developed when a patient smiles between the buccal surfaces of the posterior teeth and the commissure of the lips.

**Hulsey 1970**[20] **and Rigsbee et al 1988**[40] in their study of smile measuring concluded that both the unstrained and strained smile are reproducible.

**Choi et al 1995**[10] pointed out the effect of age and concluded that as a person ages gravity exerts its inevitable effects. Upper incisor exposure becomes less, and lower incisor exposure becomes greater.

**Sarver and Ackerman 2003**[13] suggests a more detailed analysis of the morphology of the upper lip and its relationship to the upper incisor which includes height of the philtrum, height of the commissures, inter labial gap at rest and smile

**Sheldon Peck,Leena Peck, and MattiKataja in 1992**[42]**,** performed a comparative study to examine the nature of the gingival smile (GSL).They found that a there existed a specific dento-labial configuration characterized by the exposure of maxillary anterior gingiva during a full smile. The results indicated that the capacity to project a gingival smile was related to: anterior vertical maxillary excess and the muscular ability to raise the upper lip significantly higher than average when smiling. Other variables significantly associated with GSL were greater overjet, greater interlabial gap at rest and greater overbite.

Factors that did not appear associated with GSL phenomenon were upper lip length, incisor clinical crown height, mandibular plane angle and palatal plane angle.

**Edward Philips 1999**[18] in an article on 'Classification of Smile Pattern', stated that there are 4 stages in smile cycle. Stage I: lips closed. Stage II: resting display. Stage III: natural smile (three-quarters). Stage IV: expanded smile (full). Of course, smiles vary and are unique to each individual. Many smiles do not differ much from a natural smile to an expanded smile. In these cases, treatment can often be restricted to the maxillary or mandibular anterior front six teeth. Other smiles have a very apparent discrepancy in display between these two stages, in which case, the treatment plan to esthetically improve the smile must be extended. Further he describes types of smiles in which there are 5 variations based on anterior tooth display: Type 1 maxillary only, Type 2 maxillary and over 3 mm gingival, Type 3 mandibular only, Type 4 maxillary and mandibular, and Type 5 neither maxillary nor mandibular.

**David M. Sarver,** in **2001**[12]**,** presented the concept of the smile arc and how it relates to orthodontics-from the recognition of its importance, to its impact on orthodontic treatment planning, to how procedures and mechanics are adapted to optimize the appearance of the smile.

**Marc B. Ackerman, James L. Ackerman, 2002**[29,30] have called the curve formed by the incisal edges of the maxillary anterior teeth the “smile arc”. They suggested that the two factors that contribute to the appearance of the smile arc are the sagittal cant of the maxillary occlusal plane and the arch form. Increasing the cant of the maxillary occlusal plane to Frankfort horizontal in natural head position will increase maxillary anterior tooth display and improve the consonance of the smile arc. The patient’s arch form-and particularly the configuration of the anterior segment-will greatly influence the degree of curvature of the smile arc. The broader the arch form, the lesser the curvature of the anterior segment and the greater the likelihood of a flat smile arc.

**Puppin 2002**[37] in his studies of smile height showed that there is a greater tendency for woman to show medium (55.9%) and high ( 37.5%) smile lines, while men feature medium (54%) and low (23.8%) smile lines. These findings were similar to the work of Peck and Peck.

**Wong NKC, Kassim AA, Foong KWC.**[47] **in 2005** through 3-dimensional dental models and visualization techniques, including curve-fitting and image-processing algorithms analyzed smile arcs with respect to different parameters and showed that smile consonance depends greatly on the conversational distance and the angle of elevation between the viewer and the smile.

**McNamara L, McNamara Jr JA, Ackerman MB, Baccetti T in 2008**[31] took up a study to broaden the understanding of how various skeletal, dental, and soft-tissue relationships are related to the esthetics of the smile in patients with malocclusions before orthodontic treatment. Vertical lip thickness proved to be the most influential variable in smile esthetics. The significant relationship of incisor protrusion with the vertical thickness of the

vermilion border of the upper lip must be considered when planning orthodontic treatment.

**VinodKrishnan, Sunish T. Daniel, Don Lazar, and AbinAsok in 2008**[25] attempted a comprehensive evaluation of smile characteristics with the aims of (1) evaluation of perception differences, if any, between dental specialists and laypersons; and (2) quantification of smile characteristics with the smile arc, buccal corridor measurements, and a modified smile index (MSI).Their study indicated that (a). Smile analysis should be an important aspect of orthodontic diagnosis and treatment planning. (b). Orthodontists should not disturb consonant smiles but create them with proper bracket positioning. (c). The MSI, with negative correlation with the mandibular width-facial height index, warrants further evaluation with a larger sample to validate its clinical use and to develop a predictive approach of its relationship.

**Manshaee K, Changizi S, Mojaver YN**[27]**. in 2008** compared arch form parameters in consonant and non-consonant smiles. The frontal posed smile photographs and

study models of 30 females with consonant smile and 30 females with non-consonant smile were obtained from the students of dentistry in the University of Rafsanjan (age between 20 and 25). Intermolar width (IMW) and intercanine width; molar arch depth (MAD) and canine arch depth (CAD); ratio of sum of 6 anterior tooth material (SUM) to canine arch depth (CAD) and that's ratio to intercanine width (ICW); distance between the incisal edges of the central incisors (CI) and lateral incisors (LI) and cusp tips of canines (CT) to the tangent line to the superior border of lower lip curvature (LLC) during smile were measured and compared between two groups. Result only the distance between the incisal edges of the central incisors and lateral incisors to the curvature of lower lip during smile show significant differences between two groups

**Murakami Y, Deguchi S, Kageyama T, Miyazawa H, Foong KWC[33]. in 2008** in a study conducted to evaluate an esthetic smile in young Japanese women, found out that the average smile, smile curve arch line without touching the lower lip, parallelism of the upper incisal curve with the

inner curvature of the lower lip, no display of the 1st molar, 1:1 ratio of the widths of nose and upper cuspid, a minimum buccal corridor with no significant relation in widths of the upper dental arch all corresponded to ideal smile.

**Suh YJ, Nahm DS, Choi JY, Baek SH.[43] in 2009**in a study to find which soft tissue and underlying hard tissue factors contributed to the amount of UID during posed smile (PS) and at rest posture (RP). They suggested that the diverse causes of inappropriate UID according to the soft and hard tissue factors need different treatment approaches such as orthodontic treatment, periodontal treatment, orthognathic surgery, botulinum toxin, or myectomy. The clinician, they recommended, can use these variables as a guideline for differential diagnosis of inappropriate UID.

**Rafiqul Islam Toru Kitahara, Lutfun Naher, Atshusi Hara and Akihiko Nakasima[38] 2009** in a study of lip morphological changes in orthodontic treatment in class2 division 1 patients concluded that both upper and lower lips in the smile of the class 2 division 1 pretreatment group moved to an inferior position and upward movement

of the upper lip and mouth corners was smaller in comparision with the control group the characteristics of the class 2 smile were improved by orthodontic treatment but the differences in comparison with the control group remained immediately after treatment.

**Carlos Alexandre Câmara[9] 2010** presented the concept of six horizontal smile lines viz., Cervical line-gingival zenith, Papillary line-papillary tips, Contact points line–contact points, Incisal line-incisal edges (incisal line), the upper lip line and lower lip line, which facilitate the understanding of the intrinsic characteristics that interfere in the aesthetics of the mouth. According to the author, a harmonization of these lines gives each professional a higher possibility of success in their treatments that include aesthetic objectives.

**Panossian AJ, Block MS in 2010[35]** in an article to establish an evidence-based evaluation of the esthetic region of the mouth by reviewing normal values for the face, the smile line, and the teeth, performed a Medline search to find evidence-based data on accepted normal

ranges of facial and dental proportions. The information found was organized following a sequence of physical examinations, which then was used to develop a decision tree for diagnosis and treatment planning. They concluded that, following this evaluation algorithm, clinicians will be able to document a standard set of data that will reveal skeletal and dental dysmorphia, which can then follow a well-organized sequence of treatment to re-establish facial and dental harmony.

**Smile Analysis through Digital Videography**

**Burstone's** data **1967**[8] suggested that, while standardizing the extraoral photography, potential errors are immense. His data on interlabial gap in adolescents showed, in centric occlusion the lip gap was 1.8mm (S.D. 1.2mm), but in rest position the gap was 3.7mm (S.D. 1.6mm)

**Sheldon Peck, Leena Peck, and MattiKataja**[42] **in 1992,** introduced a standardized procedure for recording tooth display in rest position and full smile. In conjunction with the standard full-face, three-quarter, and profile views, this will help the clinician avoid undesirable treatment

effects on the smiles of older patients. Estimates of method errors using double determinations show mean differences and standard deviations consistent with expectations. Towards this, they performed a comparative study to examine the nature of the gingival smile (GSL), a specific dento-labial configuration characterized by the exposure of maxillary anterior gingiva during a full smile. The results indicated that the capacity to project a gingival smile was related to: anterior vertical maxillary excess and the muscular ability to raise the upper lip significantly higher than average when smiling. Other variables significantly associated with GSL were greater overjet, greater interlabial gap at rest and greater overbite. Factors that did not appear associated with GSL phenomenon were upper lip length, incisor clinical crown height, mandibular plane angle and palatal plane angle.

**David m Sarver 1993**[12] conducted a study on the impact of pros and cons of video imaging and concluded that the use of integrated and facial images allowed him to visualize primarily in profile. He suggested that frontal

view can be useful when evaluated particular aspect and pattern of treatment option.

**Marc B. Ackerman, and James L. Ackerman 2002[29,30],** the pioneers who introduced Digital Videography for smile analysis suggested that, using digital video and computer technology, the clinician can evaluate the patient's dynamic anterior tooth display and incorporate smile analysis into routine treatment planning; for, aesthetic smile design is a multi-factorial decision-making process that allows the clinician to treat patients with an individualized, interdisciplinary approach.

**David M. Sarver, DMD, and Marc B. Ackerman, 2003[13,14]** stated, "the 'art of the smile' lies in the clinician's ability to recognize the positive elements of beauty in each patient and to create a strategy to enhance the attributes that fall outside the parameters of the prevailing esthetic concept. New technologies have enhanced our ability to see our patients more dynamically and facilitated the quantification and communication of newer concepts of function and appearance."They presented a comprehensive

methodology for recording, assessing, and planning treatment of the smile in 4dimensions.

**Marc B. Ackerman, Colleen Brensinger, J. Richard Landis, 2004**[28] conducted a retrospective study to measure lip-tooth characteristics of adolescent's pretreatment video clips of 50 patients (27 boys, 23 girls) with a mean age of 12.5 years, measured the smile index, intercommissure width(mm), interlabial gap(mm), percent incisor below the intercommissure line, and maximum incisor exposure (mm). The results suggest that anterior tooth display at speech and smile should be recorded independently but evaluated as part of a dynamic range. Asking patients to say ''cheese'' and then smile is no longer a valid method to elicit the parameters of anterior tooth display. When planning the vertical positions of incisors during orthodontic treatment, the orthodontist should view the dynamics of anterior tooth display as a continuum delineated by the time points of rest, speech, posed social smile, and a Duchenne smile.

**Vicky V. Tarantili, Demetrios J. Halazonetis[45], and Meropi N in 2005** conducted a study to record and analyze the dynamic nature of spontaneous smiles. Their results of facial measurements showed that the upper lip elevated by 28%, relative to the rest position, and the mouth increased in width by 27%. The corners of the mouth moved laterally and superiorly at an angle of approximately 47°. Time analysis showed that the smiles developed in a staged fashion. The first stage (attack phase) was the shortest, lasting an average 500ms. It was followed by a sustaining phase that included waxing and waning. The smile ended with a fade-out stage. The second and third stages were of variable duration and could be interrupted by the attack phase of a subsequent smile. The dynamics of the spontaneous smile and the findings of this study raised concerns about the validity of a single photographic capture for esthetic assessment and treatment planning.

**Pieter A. A. M. van der Geld, Paul Oosterveld, Marinus A. J. van Waas in 2007[36]** concluded that videographic method is reliable for measurement of tooth display and lip position in spontaneous and posed smiling,

speaking, and the application of this method is warranted especially when obtaining an emotional smile is difficult, such as cleft lip and palate or disfigured patients.

**Christopher Maulika and Ravindra Nanda in 2007**[11] argued that, with video (about 30frames per second) rather than static photographs, one can attain a much more predictable, standardized smile, and the use of computer software to extract the frame of the widest smile can reduce measurement error and allow for relative ease in analysis and measurements.

**Brian J. Schabel, Lorenzo Franchi, Tiziano Baccetti, and James A. McNamara, Jr 2009**[6] analyzed the relationships between subjective evaluations of post-treatment smiles captured with clinical photography and rated by a panel of orthodontists and parents of orthodontic patients, and objective evaluations of the same smiles from the Smile Mesh program (TDG Computing, Philadelphia, Pa) and concluded that no objective measure of the smile could predict attractive or unattractive smiles as judged subjectively.

**Brian J. Schabel; Tiziano Baccetti; Lorenzo Franchi; James A. McNamara, Jr 2010[6],** with the objective of testing the null hypothesis that there is no clinically significant difference between the post–orthodontic treatment images of smiles of 48 subjects captured by clinical photography and the smiles of the same subjects obtained from digital video clips captured by PANASONIC PV-GS200 digital camera in the same location under standard fluorescent light conducted a study and concluded that a significant positive correlation existed between Smile Mesh measurements obtained from smiles captured by clinical photography and those captured with digital video clips.

# MATERIALS AND METHODS

A Sample size of 100 participants-comprising equal numbers of boys and girls, who are Students, and Patients of the Tamil Nadu Govt. Dental College and Hospital, and Students of other Educational Institutions of Chennai were involved in this study.Prior permission was applied for, and clearance from the Institutional Ethical Committee was obtained; the comprehensive procedure was explained to the participants, and informed consent obtained for conducting this study.

**Inclusion Criteria:**

Tamil linguistic subjects of Dravidian ancestry-based on family tree, aged between 16-19years with natural dentition, full Maxillary and Mandibular arches up to and including first molars, without caries and/or periodontal diseases, possessing ideal Dental and Facial proportions with Class I dental and skeletal features confirmed by lateral cephalometric radiographs were included for the study.

**Exclusion Criteria:**

Subjects of Interlinguistic parentage, lip incompetency, subjects who have undergone restorative, orthodontic, prosthodontic or surgical and or other cosmetic dental therapy; those with lip abnormalities like short upper lip, cleft lip etc., persons with the clinical features of abnormal oral habits like thumb sucking, tongue thrusting, mouth breathing; subjects with sagittal, vertical and transverse skeletal or dental discrepancies were excluded from the study.

**Study Design**

**Photographing for Accurate Measurements:**

For any image to be accurately sized it is essential that a few general rules are followed

- The object should be photographed with a ruler in the image
- The object and ruler should be on same plane
- The plane of object and the focal plane of camera should be parallel.

- Or, more simply, the ruler and subject should be on the same flat surface and at the same angle as the camera.

The subjects were seated in natural head position with the help of cephalostat, facing a 'Sony-DCR-DVD201E Digital Camera Video Recorder' mounted on an adjustable tripod set at a distance of 50cm.The camera lens was adjusted to be parallel to the apparent occlusal plane and the camera focused only on the mouth (from nose to chin) so that the person could not be identified. Included in the capture area (frame) were 2 rulers with millimeter markings. The rulers were secured in a cross configuration so that if the subject accidentally rotated 1 ruler, the other could be used to analyze the frame. The subjects were instructed to hold the ruler to their chin, say ''Subject number. 'Cheese', relax, and then smile. Recording started about 1 second before the subject began speaking and ended after the smile. The sequence lasted for 5seconds.The procedure was repeated for authenticity. To standardize the

technique, the same camera and location were used under standard fluorescent lighting.

The video clip was downloaded to a computer (Windows 7Intel Core2Duo) and uploaded to Cyberlink Power Director-a video-editing software program. Each frame was analyzed, and 2 frames were captured for the study. The first frame represented the subjects' lips at rest, and the second showed the subjects' widest commissure-to-commissure posed smile. These frames were converted into a JPEG file in Adobe Photoshop CS4 and renamed in Windows 7(Microsoft, Redmond, Wash) with the subject's number and the rest and smile frames. Each file was opened in Adobe Photoshop CS4 (Adobe Systems, San Jimageose, Calif) and adjusted by using the millimeter ruler in the frame.

**Calibrating Image Size**

To calibrate an image, a known distance is measured within the image and the data entered from this measurement into the image size dialog box. For this image a length of one cm on the ruler is measured .This length is

zoomed in tightly with the zoom tool. Zoom-in provides more accurate placement of Measure tool providing a more precise tool. The zoom magnification percentage is set in multiples of 100s e.g., 200, 300, 400.to prevent frequency interference artifacts in the image. Then the measure tool is selected, clicked and a line of 1cm length along the ruler in the photo is drawn.

If the line drawn with the measure tool begins on the right edge of the ruler mark, the end of the line is also on the right side of the ruler mark. The distance, in pixels, is displayed in the measure tool options bar as L1 in CS3 Photoshop. In CS3 the Use Measurement Scale Box unchecked so that the value in L1 will be based on the unit set for Photoshop's ruler.

The distance displayed as L1 is entered in the Image Size Dialog Box in the Pixel/centimeter field. To assess the Image Size Dialog Box, Image >Image size is chosen. Among the 3 settings the Resample Box is unchecked first; this retains the full image quality by not changing the number of pixels in the image. Next, the resolution unit of

measurement pop-up menu is set to pixels/cm on the units of the ruler in the photo. Lastly, the L1 value in the resolution text box is entered and clicked OK. If calibration has been correct the image will print 1:1.

The accuracy of calibration is verified either by printing the image and measuring the ruler or by aligning the ruler with the Photoshop's ruler by comparison. This is done by scrolling the image so that the lines of the ruler in the photograph are aligned with Photoshop's rulers. If everything was done correctly there will be an exact correspondence between them (although the lines in the rulers may not be in the same places, the relationship and spacing should be the same).

In the rest frame, (1) upper lip length (2) upper lip thickness, and (3) intercommissural width.

In the smile frame, (1) upper lip length, (2) upper lip thickness, (3) maxillary incisor display, (4) interlabial gap at smile, (5) outer intercommissural width, (6) inner intercommissural width (7) the anterior smile height -

entered as high, average, low, or n/a (no dental display) (8) the smile line - entered as parallel, flat, reverse, or n/a (lower lip covering the maxillary incisor edge).

# RESULTS

The mean and standard deviation of various parameters of smiles were calculated of which the Upper Lip Length at rest (ULL/R) was found to be 20.09mm and Upper Lip Thickness at rest (ULT/R) was found to be 7.4mm.

Inter Labial Gap at Rest (ILG/R) was found to be 0.26mm and Inter Commisure Width at Rest (ICW/R) was found to be 51.4mm.

The mean and standard deviation of various parameters of smiles were calculated of which the Upper Lip Length at smile (ULL/S) was found to be 14.95mm and Upper Lip Thickness at smile (ULT/S) was found to be 6.33mm.

Smile height was found to be 11mm and Outer Inter Commisure Width at Smile (OICW/S) was found to be 65.7mm and Inner Inter Commisure Width at Smile (IICW/S) was found to be 59.9mm.

According to t test, the mean value for ULL/R in males was 22.2mm, SD 2.48mm and P value <0.001 suggestive of statistically significant. In females, the mean value for ULL/R was 19.63mm, SD 2.42mm and P value <0.001 suggestive of statistically significant.

The mean value for ULT/R in males was 7.67mm, SD 1.70mm and P value 0.176. In females, the same were, i.e. mean 7.22mm, SD 1.59mm and P value 0.176, both of which suggest that they are statistically insignificant.

The mean value for ILG/R in males was 0.364mm, standard deviation was 0.748mm and P value 0.151. For females, the mean value for ILG/R was 0.166mm, standard deviation was 0.6107mm and P value 0.0151. Both of these are statistically insignificant.

The mean value for ICW/R in males was 52.71mm, standard deviation was 3.5mm and P value 0.001. The same for females were i.e. mean, standard deviation and P value,

50.2mm, 3.72mm and <0.001 respectively. These values are statistically significant at 1% level.

According to t test, the mean value for ULL/S in males was 15.9mm, SD 2.71mm and P value <0.001 suggestive of statistically significant. In females, the mean value for ULL/S was 13.98mm, SD 2.14mm and P value <0.001 suggestive of statistically significant.

The mean value for ULT/S in males was 6.33mm, SD 1.92mm and P value <0.98 In females, the same were, i.e. mean 6.33mm, SD 1.71mm and P value <0.98, both of which suggest that they are statistically insignificant.

The mean value for ILG/S in males was 11.56mm, standard deviation was 1.93mm and P value 0.039. For females, the mean value for ILG/S was 10.57mm, standard deviation was 2.71mm and P value 0.039. Both of these are statistically insignificant.

The mean value for OICW/S in males was 66.58mm, standard deviation was 4.80mm and P value 0.084. The

same for females were i.e. mean, standard deviation and P value, 65mm, 4.22mm and 0.084 respectively. These values are statistically not significant.

The mean value for IICW/S in males was 60.98mm, standard deviation was 3.47mm and P value 0.014. The same for females were i.e. mean, standard deviation and P value, 58.98mm, 4.44mm and 0.014 respectively. These values are statistically significant for males and females.

The mean value for smile height in males was 11.42mm, SD 2.02mm and P value 0.080. In females, the mean was 10.57mm, SD 2.71 and P value 0.080. These values of both males and females are not significant.

Maxillary Incisal Display (MID) in males had a mean of 8.25mm, SD 1.55mm and P value 0.568. In females, the mean was 8.40mm, SD 1.08mm and P value 0.568. These values are not significant.

**Smile Arc and Gender Difference:**

The frequency of parallel smile arc was 52 (52%), whereas flat smile arc 43 (43%). 2% of the subjects analyzed had reverse smile arc while it was not available for 3%. The Crosstab test for smile arc among males and females shows that in a sample of 50 females, 63.5% (33 girls) showed a parallel smile arc with a P value of 0.001 which is statistically significant. In males, the percentage of smile arc was found to be 72.1% and the P value was 0.001 which was statistically significant at 1%. The results revealed that the males have statistically significant flat smile arc. The Chi square test was used for the range values and found that P value was 0.001 which was significant.

**Smile Height and Gender Difference:**

64% of the subjects had average smile height. A decreasing trend was noted with 27% exhibiting low smile height and 9% had high smile height. The low smile line was found to be 66.7% in males whereas it was 33.3% in females. 48% of the males exhibited average smile line. 51.6% of the female sported average smile height. The high smile height was noted in 11.1% in males and 88.9% in

females. These results showed that the P value was 0.014 which was slightly significant at 5% level. The low smile height was statistically significant in males and the high smile height was statistically significant in females. This parameter was analyzed using Chi square test.

## Descriptives

### Overall Descriptive Statistics

| | N | Mean (mm) | Std. Deviation (mm) |
|---|---|---|---|
| ULL_rest | 100 | 20.916 | 2.7621 |
| ULT_rest | 100 | 7.445 | 1.6574 |
| ILG_rest | 100 | .265 | .6870 |
| ICW_rest | 100 | 51.485 | 3.8219 |

## Descriptives

### Descriptive Statistics

| | N | Mean (mm) | Std. Deviation (mm) |
|---|---|---|---|
| ULL_smile | 100 | 14.952 | 2.6224 |
| ULT_smile | 100 | 6.334 | 1.8145 |
| ILG_s | 100 | 11.072 | 2.3983 |
| outICW_s | 100 | 65.797 | 4.5729 |
| InICW_s | 100 | 59.986 | 4.0985 |
| Smile ht | 100 | 11.003 | 2.4233 |
| Max Inc Dis | 100 | 8.3328 | 1.33609 |

**Smile Arc**

| | | Frequency | Percent |
|---|---|---|---|
| Valid | NA | 3 | 3.0 |
| | Parallel | 52 | 52.0 |
| | Flat | 43 | 43.0 |
| | Reverse | 2 | 2.0 |
| | Total | 100 | 100.0 |

**Smile line**

| | | **Frequency** | **Percent** |
|---|---|---|---|
| Valid | Low | 27 | 27.0 |
| | Average | 64 | 64.0 |
| | High | 9 | 9.0 |
| | Total | 100 | 100.0 |

**t-Test**

**Group Statistics for Rest Position Parameters**

| | **Gender** | **N** | **Mean (mm)** | **Std. Deviation(mm)** | **P value** |
|---|---|---|---|---|---|
| ULL_rest | Male | 50 | 22.202 | 2.4869 | <0.001** |
| | Female | 50 | 19.631 | 2.4200 | |
| ULT_rest | Male | 50 | 7.670 | 1.7028 | 0.176 |
| | Female | 50 | 7.220 | 1.5959 | |
| ILG_rest | Male | 50 | .364 | .7488 | 0.151 |
| | Female | 50 | .166 | .6107 | |
| ICW_rest | Male | 50 | 52.712 | 3.5477 | 0.001** |
| | Female | 50 | 50.259 | 3.7222 | |

NOTE: **denotes significance at 1% level

**t-Test**

**Group Statistics for Smile Parameters**

| | **Gender** | **N** | **Mean (mm)** | **Std. Deviation (mm)** | **P value** |
|---|---|---|---|---|---|
| ULL_smile | Male | 50 | 15.920 | 2.7176 | 0.000** |
| | Female | 50 | 13.984 | 2.1440 | |
| ULT_smile | Male | 50 | 6.334 | 1.9246 | 0.998* |
| | Female | 50 | 6.335 | 1.7171 | |
| ILG_s | Male | 50 | 11.566 | 1.9311 | 0.039* |
| | Female | 50 | 10.578 | 2.7191 | |
| outICW_s | Male | 50 | 66.588 | 4.8084 | 0.084* |
| | Female | 50 | 65.006 | 4.2251 | |
| InICW_s | Male | 50 | 60.988 | 3.4778 | 0.014* |
| | Female | 50 | 58.984 | 4.4490 | |
| Smile ht | Male | 50 | 11.428 | 2.0270 | 0.080* |
| | Female | 50 | 10.579 | 2.7181 | |
| Max Inc Dis | Male | 50 | 8.2560 | 1.55408 | 0.568* |
| | Female | 50 | 8.4096 | 1.08606 | |

NOTE: **denotes significance less than 1%

**Smile Arc * Gender**

**Crosstab**

| | | | **Gender** | | **Total** | **P value** |
|---|---|---|---|---|---|---|
| | | | Male | Female | | |
| Smile Arc | NA | Count | 0 | 3 | 3 | |
| | | % within Smile Arc | .0% | 100.0% | 100.0% | |
| | Parallel | Count | 19 | 33 | 52 | |
| | | % within Smile Arc | 36.5% | 63.5% | 100.0% | |
| | | Count | 31 | 12 | 43 | 0.001** |
| | Flat | % within Smile Arc | 72.1% | 27.9% | 100.0% | |
| | | Count | 0 | 2 | 2 | |
| | | % within Smile Arc | .0% | 100.0% | 100.0% | |
| | Reverse | 50 | 50 | 100 | | |
| | | 50.0% | 50.0% | 100.0% | | |
| | | 100.0% | 100.0% | 100.0% | | |

**Smile line/Height * Gender**

**Crosstab**

| | | | Gender | | Total | P value |
|---|---|---|---|---|---|---|
| | | | Male | Female | | |
| Smile height | Low | Count | 18 | 9 | 27 | 0.014* |
| | | % within Smile height | 66.7% | 33.3% | 100.0% | |
| | Average | Count | 31 | 33 | 64 | |
| | | % within Smile height | 48.4% | 51.6% | 100.0% | |
| | High | Count | 1 | 8 | 9 | |
| | | % within Smile height | 11.1% | 88.9% | 100.0% | |
| Total | Count | 50 | 50 | 100 | | |
| | % within Smile height | 50.0% | 50.0% | 100.0% | | |

**T-Test**

**Paired Samples Statistics**

| | | Mean (mm) | N | Std. Deviation (mm) | Std. Error Mean |
|---|---|---|---|---|---|
| Pair 1 | ICW_rest | 51.485 | 100 | 3.8219 | .3822 |
| | outICW_s | 65.797 | 100 | 4.5729 | .4573 |

**T-Test**

**Paired Samples Statistics**

| | | Mean (mm) | N | Std. Deviation(mm) | Std. Error Mean |
|---|---|---|---|---|---|
| Pair 1 | ILG_rest | .265 | 100 | .6870 | .0687 |
| | Smile Line | 11.003 | 100 | 2.4233 | .2423 |

**Chi-Square Tests**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 17.165(a) | 3 | .001** |
| Likelihood Ratio | 19.440 | 3 | .000 |
| Linear-by-Linear Association | 9.260 | 1 | .002 |
| N of Valid Cases | 100 | | |

**t-Test**

**Group Statistics**

| | **Measurement** | **N** | **Mean (mm)** | **Std. Deviation(mm)** | **Prb** |
|---|---|---|---|---|---|
| ULT_rest | Direct | 10 | 7.370 | 1.2139 | 0.890 |
| | Adobe | 100 | 7.445 | 1.6574 | |
| ULL_smile | Direct | 10 | 14.610 | 2.5031 | 0.694 |
| | Adobe | 100 | 14.952 | 2.6224 | |

# DISCUSSION

The orthodontist's interest in facial appearance has increased in recent years. As it has been realized that soft tissues are important diagnostic features and represent boundaries in treatment, it remains a more challenging boundary than hard tissues. It makes sense therefore to concentrate more on soft tissues and to develop more sophisticated methods of measuring and analyzing them at the diagnostic stage and at the end of treatment.

The concept of standards of facial attractiveness based on classical values have remained --unchanged over several centuries. Several authors like **Farkas** et al 1984[19], have suggested that changes in standards on facial esthetics have taken place. **Auger and Turley** 1999[4] studied profile photographs of adult Caucasians females from fashion magazine and found that standards of facial attractiveness had changed with a trend towards more protrusive lip and increased vermillon display. A smilar study on male facial profile done by **Nguyen** and **Turley** 1998[34], showed, as in

female profiles, a tendency toward lip protrusion, lip curve and vermillon display existed.

Racial studying to determine how males judged female beauty according to racial group membership was done by Malvin 1964 and concluded that American white and American black share a common esthetic standards that of a Caucasian facial model. The African blacks rated Caucasian features less attractive. Thus for only few studies have been done to determine the beauty of the Dravidian population and no study so far has been done on Tamil linguistic subjects. With ancestry based on family tree, subjects were selected for this study for evaluation of Maxillary Incisal Display, smile characteristics like Upper Lip Length, Upper Lip Thickness, Interlabial gap, Outercommissure Width, Innercommissure Width, Smile Height, Smile Arc, and Smile Line.

**Smile characteristics**

Smile involves development of prominent naso labial folds, flaring of nostrils, inferior movement of nasal tip, display of teeth, pronounced lip movement, squinting of

eyes which denote final part of smiling process in natural and spontaneous smile.

**Characteristics of normal smiles are**

- Normal incisal show
  - Almost all cervico incisal length of tooth of maxillary anterior teeth display
  - Only interproximal gingival display
- Upper incisors do not touch the lower lip
- Incisal edges are parallel to the lower lip
- Smiles display at least the first premolars or $1^{st}$ and $2^{nd}$ premolars
- The upper incisors are approximately the width of the philtrum
- The upper central incisor, lateral incisors and canines are in the golden proportions (1:0.618) (Levin 1978)
- Midline coincides with harmonious and balanced smile

  Measuring of smile have been done by different methods by different peoples at different point of time.

**Ackerman et al 1998**[1] have described a reliable and repeatable method of recording the unstrained posed smile. They stated that the posed smile can be subdivided into strained- forced and unnatural, or unstrained which looks natural and can be sustained. The method of smile requirement recommended by Ackerman scaling can be achieved by measuring vertical and horizontal tooth size and applying vertical and horizontal scaling factors. On a photograph of an unstrained posed smile, the vertical lines correspond to the commissures of the lips. The distal embrasures of the upper canines established a second method of defining the buccal corridors originally described by **Hulsey** 1970 and the dental midline. The horizontal lines correspond to the upper border of the upper lip, the lower border of the upper lip, the incisal edge of the right central incisor, the upper border of the lower lip and the lower border of the lower lip. In this method the following measurements can be obtained: maximum upper incisor exposure, upper lip drape, lower lip to upper incisor parallelism, inter labial gap at rest and smiling, and intercommissural width during smile. In our present study, unstrained posed smile of both girls and boys in an age

group of 16-19 yrs with natural dentition possessing ideal dental and facial proportions with class 1 dental and skeletal features were included.

**Marc B. Ackerman, Colleen Brensinger, J. Richard Landis, in 2003**[28] in a study to evaluate Dynamic Lip-Tooth Characteristics During Speech and Smile in adolescents which consisted a final sample of 50 patients, the raw digital video stream of each patient was edited to select a single image frame representing the patient saying the syllable ‘‘chee’’ and a second single image representing the patient’s posed social smile and saved as part of a 12-frame image sequence. Each animation image was analyzed using a SmileMesh computer application to measure the smile index .They concluded that anterior tooth display at speech and smile should be recorded independently but evaluated as part of a dynamic range. Asking patients to say ‘‘cheese’’ and then smile is no longer a valid method to elicit the parameters of anterior tooth display.

**Theodore Moore et al in 2005**[32] in a study to assess influence of buccal corridors on smile attractiveness when judged by lay persons, they selected 10 randomly smiling subjects (5 women, 5 men) were digitized. They concluded that Having minimal buccal corridors is a preferred esthetic feature in both men and women, and large buccal corridors should be included in the problem list during orthodontic diagnosis and treatment planning. (Am J Orthod Dentofacial Orthop 2005;127:208-13) in this study 100 both boys and girls 16 – 19 years who are students of dental and other institutions of Chennai were selected.

**Pieter A.A. M. van der geld Paul Ooserveld Marinus A. J. Van Waas, 2007**[36] in the study of reliability and clinical application of digital videographic measurements of tooth display and lip position in smiling and speech, they studied 20 subjects who are individually filmed, spontaneous smiles were captured twice with a digital video camera, transferred to a computer and analysed on video frame level. 2 raters were involved. They concluded that digital videogaphic method is reliable for measurement of tooth display and lip position in

spontaneous and posed smile. They also stated that this method is suitable for clinical practice.

**Shyam desai et al** in an article ajodo **2009** 136: 310 e1-310 e10[16] conducted the dynamic smile analysis and defined age related changes in the smile of students, residents, staffs, patients and guardians at the university of Connecticut health centre. The inclusion criteria were: patients who were over 15 years of age with no orthodontic treatment. No history of lip surgery enhanced. A mini DVD Camera GL-2, Canon, Tokyo, Japan was used on a tripod approximately 4 feet from the standing subject. Subject's heads were held in the natural head position by looking straight into an imaginary mirror. The camera lens was adjusted to be parallel to the apparent occlusal plane and the camera focused only on the mouth. The video clip was downloaded to a computer and uploaded to Scenalyzerlive version 4.0 - a video editing software program. Each frame was analyzed and 2 frames were captured for the study. 1$^{st}$ frame was represented at the rest and the 2$^{nd}$ frame was on posed smile. The frames are converted into a JPEG file in scenalyzer live and renamed in Windows XP Professional.

They concluded that as a person ages the smile gets narrower vertically and wider transversely. The dynamic measures indicate that the muscles' ability to create a smile decreases with increasing age. A significant decrease of 1.5 – 2 mm in maxillary incisor display at smile was found. Smile index was significantly increased which indicated smile gets narrower vertically and wider transversely.

**Brian J. Schabel; Tiziano Baccetti; Lorenzo Franchi; James A. McNamara, Jr. in 2010**[6] in a study used Clinical photography vs digital video clips to asses smile esthetics. The extra oral photographic series included photographs of the subject in repose, during smiling, and in profile. For this purpose only the extra oral smiling photographs were used. A Canon H EF 35 mm SLR camera was set at a fixed distance of 36 inches between the lens and the subject. All photographs were taken by one of two dental school staff photographers. A digital video camera Panasonic H PV-GS200 was used to record the dynamic range of each subject's smile, with slight modifications to the protocol reported by Ackerman and Ackerman. The video camera was adjusted vertically to be directly in line

with the subject's mouth, and the zoom feature was used to focus only on the mouth and adjacent soft tissues to protect the anonymity of the subject. They concluded that Digital video clips offer a tremendous amount of information for analyzing the dynamic character of the smile, but a standard digital photograph allows for immediate viewing, and is a valid tool for analysis of the post treatment smile.

In this study, the subjects were seated in natural head position held with the help of cephalostat, facing a SONY DCR-DVD201E Digital Camera Video Recorder, mounted on an adjustable tripod, set at a distance of 50cm.The camera lens was adjusted to be parallel to the apparent occlusal plane and the camera focused only on the mouth (from nose to chin) so that the person could not be identified. Included in the capture area (frame) were 2 rulers with millimeter markings. The subjects were instructed to hold the ruler to their chin, say ‘‘Subject number. ‘Cheese’, relax, and then smile. Recording started about 1 second before the subject began speaking and ended after the smile. The sequence lasted for 5seconds.The procedure was repeated for authenticity. The video clip was

downloaded to a computer (Windows 7Intel Core2Duo) and uploaded to Cyberlink Power Director-a video-editing software program. Each frame was analyzed, and 2 frames were captured for the study. The first frame represented the subjects' lips at rest, and the second showed the subjects' widest commissure-to-commissure posed smile. These frames were converted into a JPEG file in Adobe Photoshop CS4 and renamed in Windows 7(Microsoft, Redmond, Wash) with the subject's number and the rest and smile frames.

To calibrate an image, a known distance is measured within the image and the data entered from this measurement into the image size dialog box. Zoom magnification percentage is set in 300 to prevent frequency interference artifacts in the image. Then the measure tool is selected, clicked and a line of 1cm length along the ruler in the photo is drawn.

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A good review of smile in orthodontics is given by Sarver in 2001. Rigsbee et al 1988 studied the influence of animation on smile characteristics and observed that during smiling 20% showing of upper lip and 130% increase in the original width; upper lip length was greater for males than females by 2.6mm at rest and 3.2 mm while smiling; upper incisal exposure was 9.7 mm; inter labial gap was 11.8mm. After orthodontic treatment, patients tended to have more upper incisal exposure on smiling.

In this study the smile parameters were evaluated using Adobe Photoshop CS4 software. The mean and standard deviation of various parameters of smiles were calculated of which the overall mean of Upper Lip Length at rest (ULL/R) was found to be 20.09mm and Upper Lip Thickness at rest (ULT/R) was found to be 7.4 mm Inter Labial Gap at Rest (ILG/R) was found to be 0.26mm and Inter Commisure Width at Rest (ICW/R) was found to be 51.4 mm. The Upper Lip Length at smile (ULL/S) was found to be 14.95mm and Upper Lip Thickness at smile (ULT/S) was found to be 6.33 mm. Smile height was found to be 11 mm and Outer Inter Commisure Width at Smile (OICW/S) was found to be 65.7 mm and Inner Inter Commisure Width at Smile (IICW/S) was found to be 59.9 mm.

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**Smile Arc and Gender Difference:**

The frequency of parallel smile arc was 52 (52%), whereas flat smile arc 43 (43%). 2% of the subjects analyzed had reverse smile arc while it was not available for 3%. The Crosstab test for smile arc among males and females shows that in a sample of 50 females, 63.5% (33 girls) showed a parallel smile arc with a P value of 0.001 which is statistically significant. In males, the percentage of smile arc was found to be 72.1% and the P value was 0.001 which was statistically significant at 1%. The results revealed that the males have statistically significant flat

smile arc. The Chi square test was used for the range values and found that P value was 0.001 which was significant.

**Smile height and Gender Difference:**

64% of the subjects had average smile height. A decreasing trend was noted with 27% exhibiting low smile height and 9% had high smile height. The low smile height was found to be 66.7% in males whereas it was 33.3% in females. 48% of the males exhibited average smile height. 51.6% of the female sported average smile height . The high smile height was noted in 11.1% in males and 88.9% in females. These results showed that the P value was 0.014 which was slightly significant at 5% level. The low smile height was statistically significant in males and the high smile height was statistically significant in females. This parameter was analyzed using Chi square test.

**Inter Labial Gap:**

ILG/R was about 0.26mm and the P value was <0.001 which was significant at 1% level.

**Upper Lip Thickness at Rest:**

The ULT/R was analyzed through direct and Adobe methods where the P value was 0.890 (P value > 0.01) suggestive of insignificant difference. Both the methods were similar stating that Adobe method can be used as a substitute for direct bio-metric method for its faster data processing.

**Upper Lip Length at Smile:**

The ULL/S when compared with direct and Adobe methods, the P value was 0.694 (P value > 0.01) suggestive of statistically insignificant value.

**Reliability Statistics:**

**Smile at Rest Reliability:**

According to Cronbach's Alpha, the correlation coefficient value was 0.999 (P value >0.01) suggestive of insignificant difference. This test proves to be reliable. It may be summarized that soft tissue findings of this study can aid the clinician in the practice of orthodontics in determining the best approaches to achieve aesthetic harmony.

# SUMMARY AND CONCLUSION

1. Smile aesthetics is an essential component in orthodontics due to the re-emergence of the soft tissue paradigm. An aesthetically pleasing smile depends not only on the components such as tooth size, shape, colour and position, but also on the amount of the visible gingivae and the framing of the lips.
2. The digital videographic method is advantageous over direct biometric measurements for it is easy to use in a clinical setup.
3. The result showed that the males were found to have more ULL/R, ULT/R, ILG/R and ICW/R than females.
4. During smile, males were found to have more ULL, ILG, OICW, IICW, smile height and same ULT.
5. In view of MID, males were found to have lesser incisor exposure than females.
6. The study evaluated that the females exhibited parallel smile arc whereas males exhibited flat smile arc.
7. Average smile height was exhibited by 64% of the subjects of the study.

Evaluation of the anterior tooth display and smile characteristic study was undertaken to determine the applicability of these findings in Tamil linguistic population to the normal morphology of structure regularly involved in orthodontic practice.

**Future Trends:**

It opens an avenue for a long term prospective longitudinal study with large samples and evaluation of other soft tissue analyses in various Dravidian population.

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# INFORMATION SHEET

**STUDY TITLE**

***Evaluation of Anterior Tooth Display in Rest Position & Smile and Smile Characteristics in Dravidian (Tamil Linguistic) Population.***

The aim of this study is to evaluate the factors responsible for pleasant smile through digital videography, obtain a data pool and arriving at a mean value which will be used as the standard that would be helpful in Orthodontic diagnosis and treatment planning. The factors to be analyzed are as follows

- Upper front teeth display
- Upper Lip Length
- Upper Lip Thickness
- Gap between the upper & lower lips
- Outer corner width of the mouth
- Inner corner width of the mouth
- Smile Height and
- Smile Arc and
- Smile Line

**Image Capture**:

A digital video camera is used for recording the subject's smile. Standardize the technique, a 'Sony-DCR-DVD201E Digital Camera Video Recorder' mounted on an adjustable tripod fixed at a distance of 50cm is used in the same location under standard fluorescent lighting. The subject is seated in natural head position such that his/ her mouth is parallel to the camera. The zoom is adjusted to obtain a sharp image, focusing only the mouth, to protect the anonymity of the subject.

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# தகவல் அறிக்கை

## ஆய்வின் நோக்கம்:

பல் சீரமைப்பு நோய் குறியறிதல்/ சிகிச்சை திட்டமிடுதலில் திராவிட இன தமிழ் மக்களின் புன்னகையை நிர்ணயிக்கும் காரணிகளின் சராசரியை வீடியோ படம் மூலம் தொகுத்து கண்டறிதல்

## காரணிகள்:

- முன் வரிசை பற்களின் வெளிப்பாடு
- மேல் உதட்டு நீளம்
- மேல் உதட்டு தடிமன்
- ஈரிதழ் இடைவெளி
- வாய் வெளி மூலை அளவு
- வாய் உள் மூலை அளவு
- புன்னகை உயரம்
- புன்னகை வில்
- புன்னகை உயர எல்லை

## படப்பிடிப்பு முறை

பங்கேற்பவரின் காது-கண் கிடைக் கோடு தரைக்கு இணையாகவும் அவரது வாய், படக்கருவியின் ஆடிக்கு இணையாகவும் இருக்குமாறு அமர்த்தப்பட்டு, உயரத்தை மாற்றவல்ல முக்காலியின்மீது பொருத்தப்பட்ட படப்பிடிப்பு கருவியின் மூலம் அவரது வாய்ப்பகுதி மட்டும் படம் பிடிக்கப்படுகிறது

தரப் பராமரிப்புக்காக, சூழ்நிலையும், ஒளி அளவும் மாறாவண்ணம் படப்பிடிப்பு ஒரே அறையில், ஒரே கருவியால் நடத்தப்படுகிறது.

# INFORMED CONSENT FORM

**STUDY TITLE:**

Evaluation of Anterior Tooth Display in Rest Position & Smile and Smile Characteristics in Dravidian (Tamil Linguistic) Population.

Participant's Name: Age/Sex: Id No:

Address:

Telephone no:

I, _____

exercising my free will, hereby consent to be included as a participant in the above mentioned study.

- I have been informed to my satisfaction about the purpose of the study and that my smile will be videographed and an X ray of my head will be taken.
- I agree to co –operate fully with the Investigator for the procedure.
- I am aware that my smile images may be used for research purposes.
- I am convinced that my smile photographs, video and X Ray images will not be used for any other purposes or misused
- I agree to report to the Investigator as and when required for the research.
- I have given my consent to use my personal and ancestral details for research purpose by the Investigator.

- I am told that the investigator and the Institution will keep my identity confidential.

Signature Signature

Name of the Participant Name of the Investigator

Dr Jayaraman. P

Chennai-3

Date

# ஒப்புதல் படிவம்

ஆய்வின் தலைப்பு: சென்னை திராவிட இன தமிழ் மக்களின் புன்னகை மற்றும் முன்வரிசை பற்களின் அழகை நிர்ணயிக்கும் காரணிகள் பற்றிய ஆய்வு

பெயர்: வயது: ஆண் / பெண்

முகவரி:

தொலைபேசி எண் :

பங்கேற்பவரின் எண்: குறியீடு எண்::

_____ஆகிய நான்

என்னை இந்த ஆய்வுக்கு உட்படுத்துவதற்கு முழுமையாக சம்மதிக்கிறேன்

- எனக்கு ஆய்வின் அவசியமும் ஆய்வின் முறைகளும் புரியும்படி முழுமையாக தெரிவிக்கப் பட்டுள்ளது.
- ஆய்வில் முழுமையாக ஒத்துழைக்க நான் சம்மதிக்கிறேன்.
- எனது புன்னகையை வீடியோ படம் எடுத்துக்கொள்ளவும் எனது தலையை நுண்கதிர் படம் எடுத்துக்கொள்ளவும் மருத்துவரை அனுமதிக்கிறேன்.
- இந்த ப்படத்தை மருத்துவரின் ஆய்வுக்கு பயன்படுத்திக்கொள்ள சம்மதிக்கிறேன்..
- என்னைப் பற்றிய சுய விவரங்களை மருத்துவரின் ஆய்வுக்கு பயன்படுத்திக்கொள்ள சம்மதிக்கிறேன். என்னைப் பற்றிய சுய விவரங்கள் மருத்துவராலும் இம்மருத்துவமனையாலும் இரகசியமாக வைக்கப்படும் என்று உறுதி அளிக்கப்பட்டுள்ளது.
- இந்த ஆய்வு சம்மந்தமாக எதிர்காலத்தில் தேவைப்படும்போது மருத்துவருடன் ஒத்துழைக்க சம்மதிக்கிறேன்

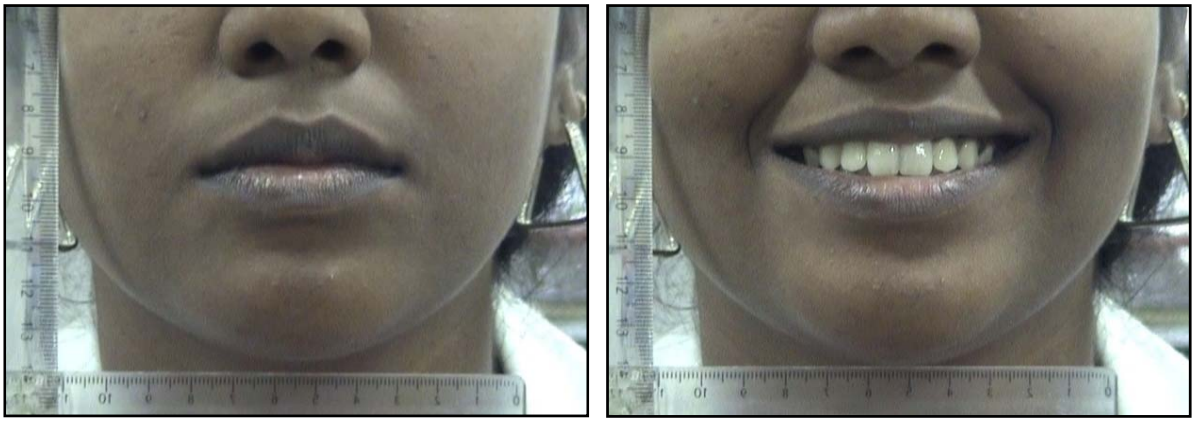
பங்கேற்பவரின் பெயர்: ஆய்வாளரின் பெயர்::

மரு.பெ. ஜெயராமன்

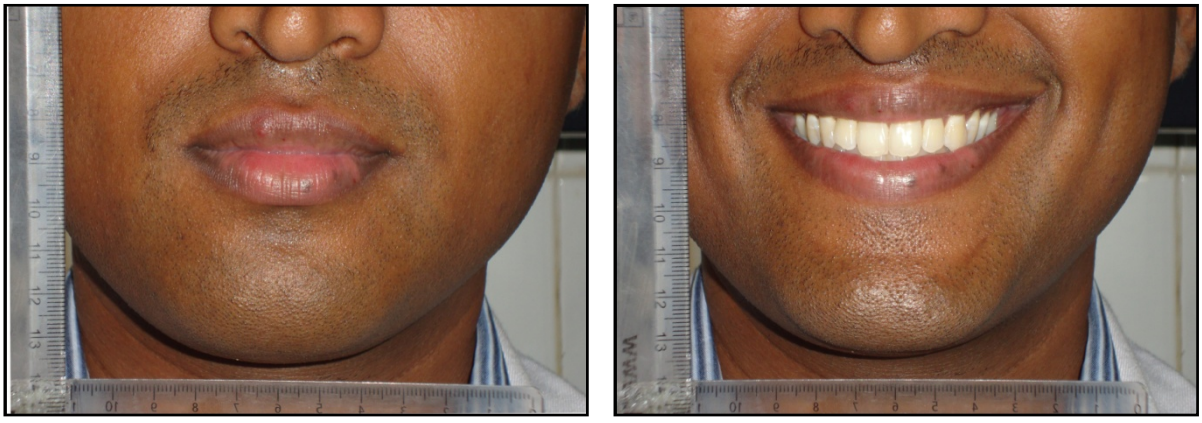
கையொப்பம்/ பெருவிரல் ரேகை

கையொப்பம்

தேதி



***Parallel Smile Arc - Female***



***Parallel Smile Arc - Male***

*Flat Smile Arch – Male*

*High Smile Line - Female*

*Average Smile Height –Female*

*Low Smile Height -Male*

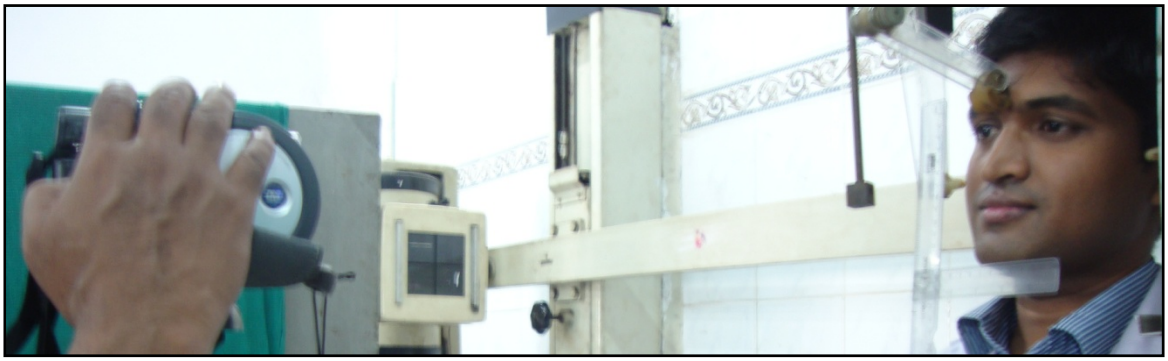
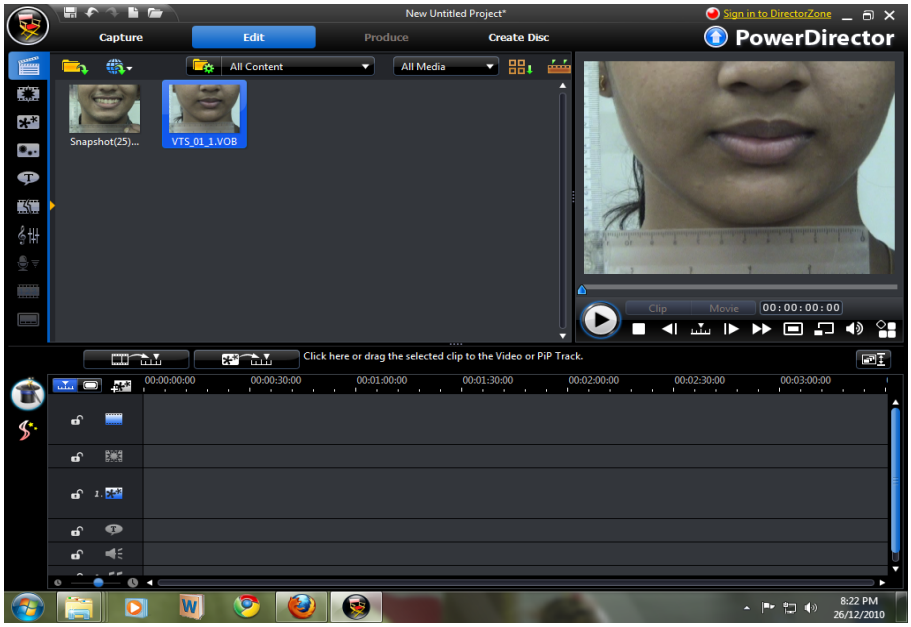


*Image Capture*

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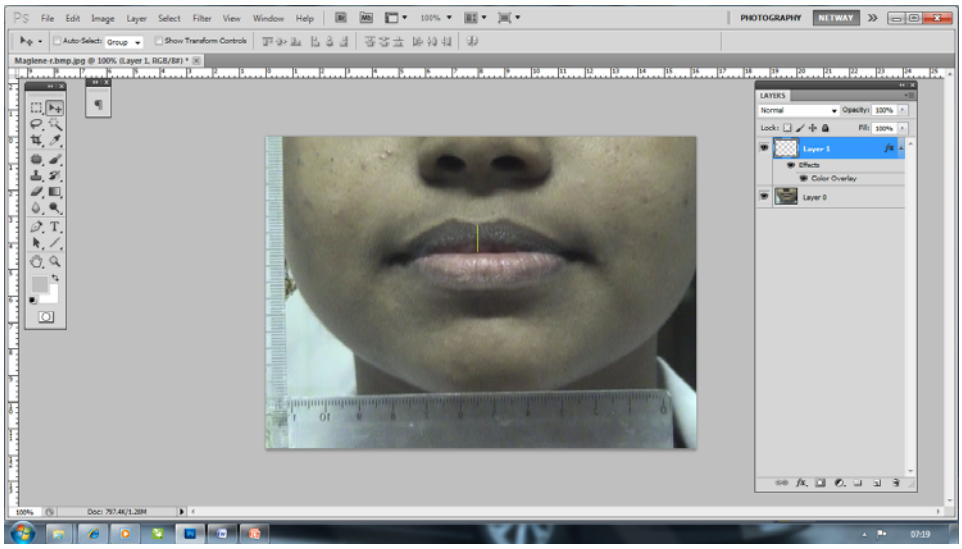

***Analysis on computer***

***Lateral Cephalometric Radiographs***