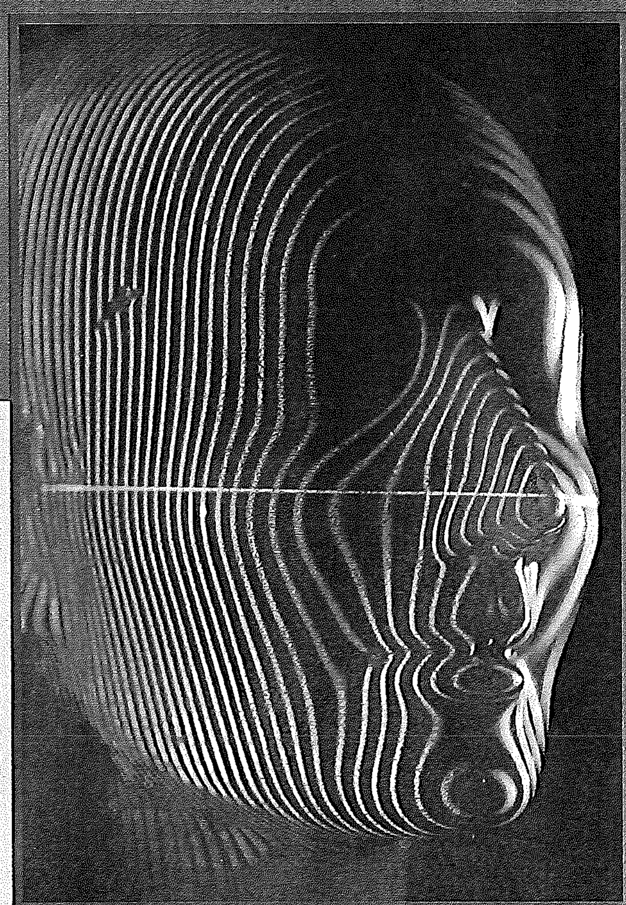
CLINICAL ORTHODONTICS AND RESEARCH



VOLUME 1

No 1

AUG. 1998

MUNKSGAARD • COPENHAGEN

FORUM

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A morphometric analysis of the posed smile

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Dates:
Accepted 1 May 1998

To cite this article:
Clin Orth Res 1, 1998; 2–11
Ackerman JL, Ackerman MB, Brensinger CM, Landis JR:
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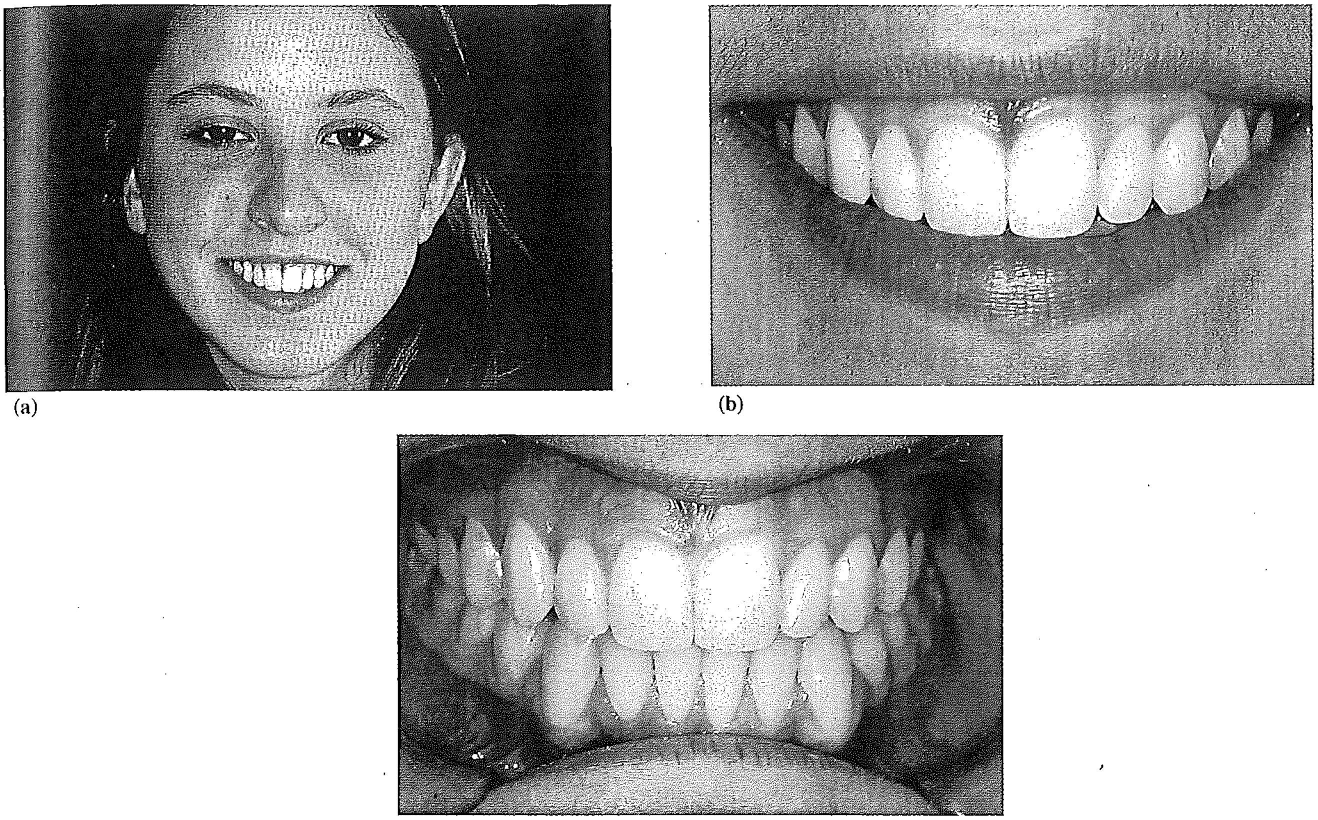
ISSN 1397-5927

Abstract: A fundamental goal of orthodontics is to improve the smile, but no objective criteria exist to assess the lip–teeth relationship, establish objectives of treatment or measure treatment outcome. Here we propose a method to digitally measure the smile characteristics of orthodontic patients. Specifically, the 'posed smile' is measured. By definition the posed smile is voluntary and not elicited by an emotion. It can be a learned greeting or a signal of appeasement and can be sustained. The posed smile is reliably repeatable. The multimedia computer program for smile measurement we developed was based on studies of the utility of the smile photograph and the assessment of the lip–teeth characteristics of the posed smile in treated and untreated patients. On the computer screen a grid, or smile mesh, employs horizontal and vertical lines to measure eleven attributes of a smile. Not all orthodontically 'well-treated' patients with exemplary plaster casts exhibit desirable anterior tooth display while smiling. We suggest that the photographic analysis of an unstrained posed smile might be a standard orthodontic record.

Key words: morphometric analysis; posed smile; smile enhancement

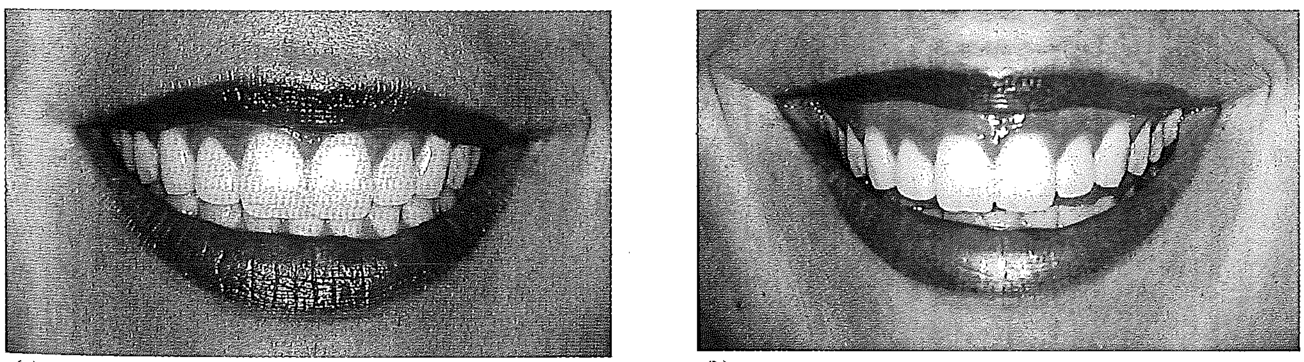
Smile enhancement is a major purpose of orthodontics. However, few objective criteria exist for assessing attributes of a smile, establishing lip–teeth relationship objectives of treatment, or measuring outcomes of therapy. In the absence of a morphometric tool (1) for quantifying smile characteristics, orthodontists will continue to judge this distinctive facial feature, which is so important to the assessment of treatment, wholly subjectively.

In times past, the view of dentofacial esthetics by orthodontists and patients often differed considerably. Orthodontists judging the relationship between lips and



(a) (b) (c)

Fig. 1. Depiction of views seen by the patient (a and b) and the orthodontist (c).



(a) (b)

Fig. 2. Smile classification: a) Unstrained posed smile; b) Unposed spontaneous smile (a 'forced' or strained posed smile can mimic the unposed spontaneous smile).

teeth did that in profile using photographs and lateral X-rays of the head that provided shadows of skeletal and dental structures, as well as the integumental silhouette (2–8). A few orthodontists utilized photographs of the three quarter view of the smiling face (9), whereas others employed photographs of a frontal smiling face (10, 11). Most orthodontists, however, continue to record their results by using lip retractors and intra-oral photographs, profile and frontal photographs with lips in repose, and lateral radiographic cephalographs. When a patient looks in a mirror, the smile that he/she sees is framed by what Lavater (12), 200 years ago, called the lip 'curtain', or what we today call the soft tissue drape (Fig. 1). Peck et al. (13) introduced a classification of smile based on the anatomical studies of Rubin (14, 15). Because facial expressions of smile according to Darwin (16) and Ekman (17) can be either posed or spontaneous, we elected to modify Peck and Peck's classification by designating their Stage 1 the 'posed smile' and Stage 2 the 'unposed (spontaneous) smile'. (Fig. 2). An unposed smile is involuntary, i.e.

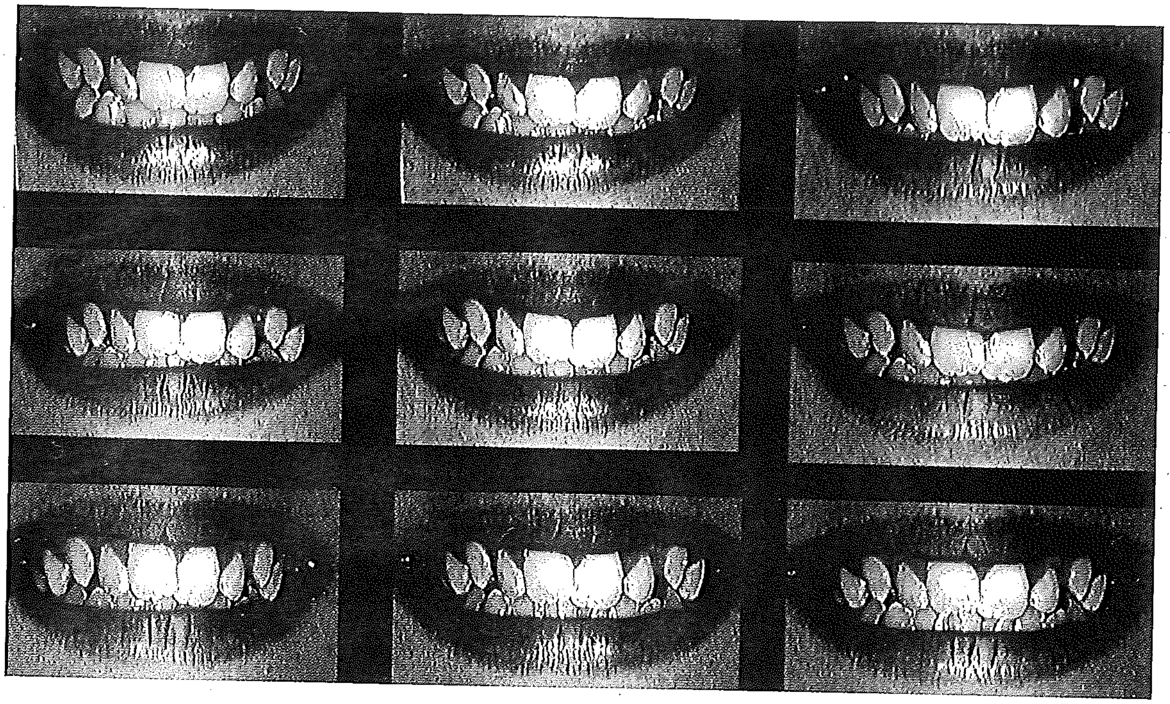


Fig. 3. Typically reproducible posed smiles in pictures taken by multiple assistants.

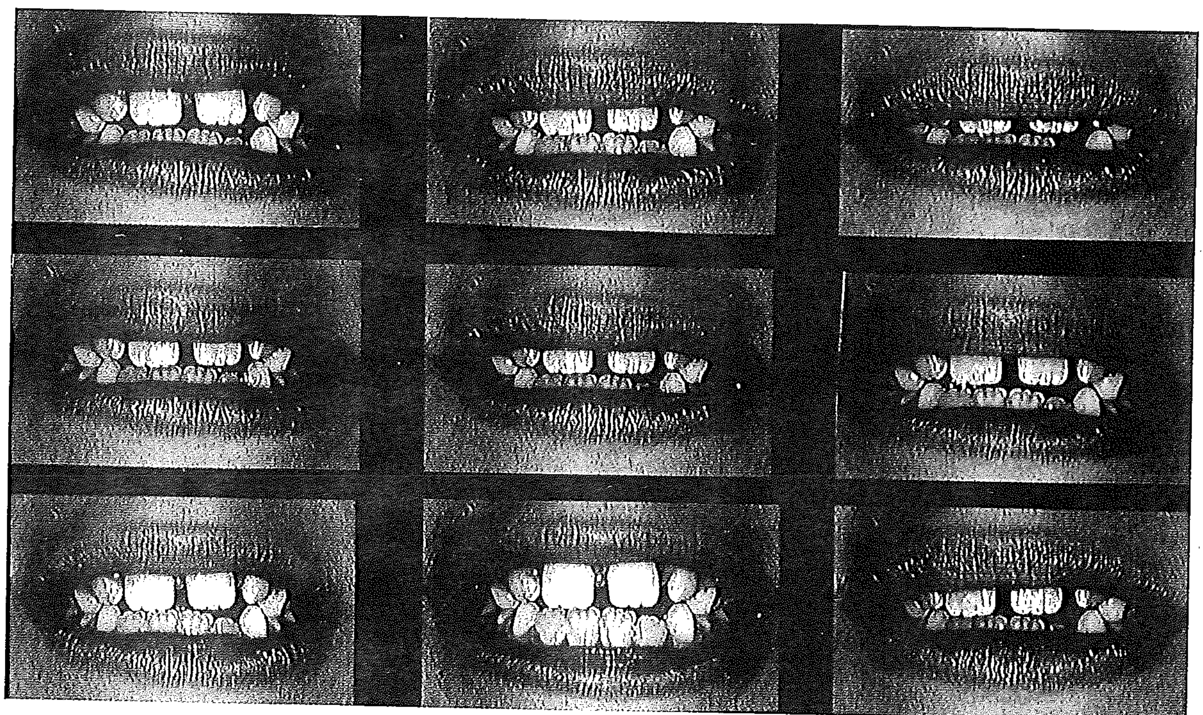


Fig. 4. An outlier: inconsistently produced posed smiles. For example, the upper right and lower middle shots can easily be identified as unnatural posed smiles.

obligatory, and is induced by joy or mirth. It is dynamic in the sense that it bursts forth but is not sustained, all the muscles of facial expression being recruited in the process and causing pronounced deepening of nasolabial folds and squinting of the eyes. An unposed smile is natural in the sense that it expresses authentic human emotion. A posed smile, by contrast, is voluntary and need not be elicited or accompanied by emotion. It can be a learned greeting, a signal of appeasement, or an attempt to indicate self-assurance. A posed smile is static in the sense that it can be sustained. If it is typical for a particular individual, a posed smile will be natural, but it also can be 'forced' to mimic an unposed smile. In the latter circumstance, it cannot be sustained and will seem to be strained and unnatural. In the Peck classification a Stage 2 smile is a 'forced' or strained posed smile resulting in maximum upper lip elevation. Thus, there are two types of posed smiles: *strained* and *unstrained*. When a person is asked to pose for a photograph, the smile that is elicited invariably is a voluntary, unstrained, static, yet natural one. Hulsey (18) took numerous photographs of subjects who were simply asked to smile. Little difference was found between photographs of the *unstrained* posed smile for each individual. Rigsbee (19) studied the reliability of the *strained* posed smile in 101 subjects. Both Hulsey and Rigsbee concluded that reproducibility of the posed smile was great. After a study of denture esthetics, Frush and Fisher, (20) proposed that there should be harmony between the curvature of the incisal edges of upper anterior teeth and the curvature of the upper border of the lower lip. They set forth a definition of the 'buccal corridor' as the space that is created when a patient smiles, between the buccal surface of the posterior teeth and the commissure of the lips. Hulsey (18) assessed standardized photographs of 40 orthodontic subjects, half of them treated and the other half with 'normal occlusion'. He noted that the curvature of the incisal edges of the upper anterior teeth (smile arc) was flatter in those who were treated. A panel judged the smiles characterized by flatter arcs as being less esthetic, therefore confirming the hypothesis of Frush and Fisher. Zachrisson (21) made similar observations in a number of his patients who were treated orthodontically, to wit, some 'treated smiles' are less esthetic.

The purpose of the study conducted by us and reported on here was as follows:

1. To assess the worth of having a photograph of an unstrained posed smile as an orthodontic record for diagnosis
2. To define the lip–teeth characteristics of an unstrained posed smile
3. To develop a reliable computer model for measurement of characteristics of a smile
4. To test the thesis of Hulsey and Rigsbee that a posed smile is reliably repeatable
5. To compare the features of an unstrained posed smile in a matched sample of 30 patients treated orthodontically and 30 patients who were untreated during a 2.5-year period.

The method that we developed to answer the question "To what extent do lip–teeth relationships in a posed smile change in treated and untreated patients?" will now be elaborated on.

Development of the method

Over a 7-year period (1990–1997), 35 mm photographs of a posed smile were taken as part of a patient's routine orthodontic data base. Although orthodontic assistants followed a protocol, the photographs were not standardized; they were not taken at a precise fixed distance, and the head of a patient was not placed in a head holder. Patients were asked to smile in posed fashion, but not to laugh or strain. We preliminarily confirmed the assertion of Hulsey and Rigsbee that a posed smile was reproducible. We did that by having five assistants each take photographs of two smiles of the five subjects. These 10 photographs of each patient were then inspected. Four of five children showed a remarkable ability to produce nearly identical unstrained posed smiles consistently (Fig. 3). One child produced disparate smiles, but it proved easy to determine which of those smiles was natural (Fig. 4).

A multimedia computer program was then developed to analyze photographs of a posed smile and to test further both the reproducibility of the smile and the reliability of office personnel in capturing it. It became necessary to first develop software that could convert measurements taken on photographs of a non-standardized posed smile to actual live size measurements. The photographs of a posed smile were scanned into the computer using cross-hair reference lines as an occlusal plane and dental midline reference in the Quick Ceph Image Pro™ program. On the computer screen the scanned image appeared as approximately twice life size. The width and height of the crown of the maxillary right central incisor were measured on the study casts utilizing a sliding digital caliper, and these measurements were transferred to the computer program. Two vertical lines on the computer screen were dragged with the mouse to indicate the width of the analogous incisor on the scanned photograph. The computer algorithm assigned the tooth dimensions from the cast to the enlarged image of the tooth on the screen and then calculated all other measurements at actual life size. An adjustable grid was constructed that consisted of three horizontal lines and four vertical lines, which could be moved with the cursor and placed on photographs of the smile (Fig. 5). This grid, or Smile Mesh, measures 11 attributes of a smile (Fig. 6). After the landmarks indicated in Fig. 6 had been defined, the reliability for identifying landmarks was tested. Five photographs of smiles that exhibited very different characteristics were scanned twice into the computer by two different people, and the Smile Mesh was applied by both readers to the ten images and intra-class correlation coefficients were calculated. The correlation coefficients were remarkably high, ranging from 0.78 to 0.99 (an indication of the reliability of the Smile Mesh). Nevertheless, the placement of the vertical lines on the mesial and distal surfaces of the upper central incisor requires great precision. The ability to position these lines precisely with the cursor determines the accuracy of the technique. If either of the vertical lines is 1–4 pixels off, an error is created in the other measurements proportional to the number of pixels in the measurement. The margin of error calculated for the measurement of characteristics of a smile range from 0.54 to 4.5%, with the exception of upper lip drape, which is 27%. Because upper lip drape is often less than 1.0 mm, a Smile Mesh measurement of 1.0 mm could actually be as small as 0.73 mm or as large as 1.27 mm.

A more rigorous study was designed to test the reproducibility of an unstrained posed smile and the reliability of the Smile Mesh. A single operator captured five consecutive posed smiles photographically in each of 10 patients. The two readers scanned 50 smile photographs into the computer and applied the Smile Mesh program. The intra-class correlation coefficients, (after additional calibration for identification of landmarks between readers) were remarkably high (Table 1). From this statistical analysis we were able to confirm the findings of both Hulsey and Rigsbee that a posed smile is reproducible. We were also able to confirm the findings of our own preliminary study of intra- and inter-examiner reliability utilizing the Smile Mesh.

Test of the method

Photographs of posed smiles from orthodontic records of 443 patients who had at least two photographs taken, each at different times, were reviewed in order to determine their acceptability for this study, namely, quality

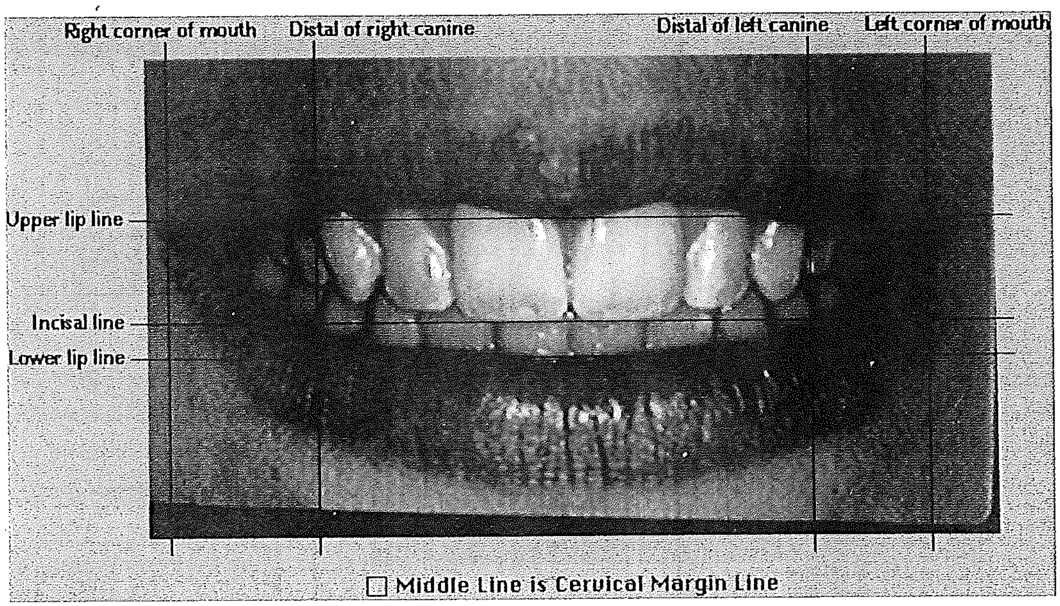


Fig. 5. Smile Mesh placement. Horizontal: 1) upper lip line (smile line), tangent to most inferior point on upper lip; 2) incisal line, tangent to most incisal point of upper right central; 3) lower lip line, tangent to the deepest midline point on superior margin of lower lip. Vertical: 1) distal of upper canines; 2) commissures of lips. Smile arc: description of whether incisal edges of six upper teeth conform more to incisal line (flat) or curvature of lower lip (consonant). Since this study, two additional horizontal lines and one vertical line were incorporated into the 'Smile Mesh' to assess three more smile characteristics; i.e. upper lip thickness, lower lip thickness, and smile symmetry relative to the dental midline.

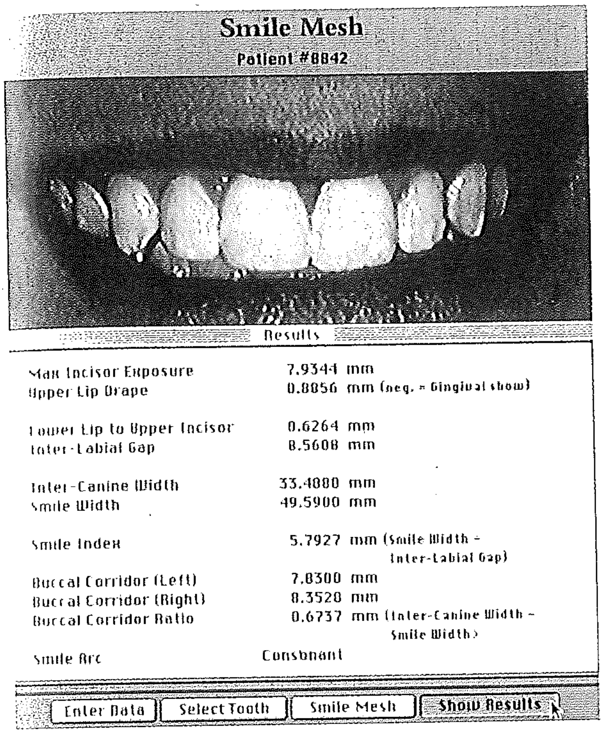


Fig. 6. Measurement of smile characteristics: by measuring the width and height of the upper right central incisor on the study cast, the computer algorithm assigns those dimensions to the approximately twice life size tooth on the screen and then calculates all other measurements at actual life size. The horizontal lines of the 'Smile Mesh' (see previous figure) determine the first four smile characteristics shown in the 'Results' window. The vertical lines determine the next six characteristics (intercanine width–buccal corridor ratio). In the transitional dentition the use of premolars is recommended instead of canines. At this stage of dentition primary canines will be lost and secondly, buccal corridor space appears to be more determined by the premolars rather than canines.

of photograph and authenticity of the unstrained posed smile. The other criteria that were recorded were: 1) gender; 2) date of birth; 3) depth of bite; 4) overjet; and 5) date the photographs were taken. Depth of bite was recorded as either normal, open or deep. Overjet was measured in millimeters. The frequency in percent distribution within the sample was calculated for each variable. One hundred and eighty patients were males and 263 were females. Three hundred and seventy patients had been treated and 73 had not been. It was possible to establish inclusion criteria for a refined sample, which was then matched for the aforementioned variables. The refined sample consisted of 148 treated patients and 30 untreated patients (control group) with a male/female ratio of 53/95 for the treated group, and 14/16 for the control group. All the patients in the control group had malocclusions, which required orthodontic treatment, but treatment was not given for one of two reasons: 1) the optimal time for treatment was later; or 2) the proposed phase I treatment was rejected by a parent. Power calculations based on the 30 untreated patients were performed to estimate the number of treated patients that needed to be studied in order to yield information that would be statistically significant. For the power calculations, it was necessary to make certain assumptions regarding differences that would have to be found in order for the findings to be clinically significant. We assumed that measurements of incisor exposure, lip drape, or change in inter-canine width had to be at least 2.0 mm, where for the inter-labial gap or smile width, we assumed that change of 3.0–5.0 mm would be clinically noticeable. It was determined that only 30 of the treated patients would have to be analyzed, and these 30 patients were selected at random from the matched sample of 148 treated patients. The mean beginning age for the treated group was 11.1 years and for the control group, 9.6 years. The before and after time interval was 2.53 years for the treated group, and 2.46 years for the untreated group. The objective for all treated patients was to alter overbite, overjet, or both of them. The T_1–T_2 changes in a treated and untreated patient are shown in Fig. 7. The changes in smile characteristics in the treated and untreated group are shown in Table 2. Only three of the smile characteristics changed significantly over the course of the 2.5 year interval. Only one of these, i.e. the net difference in change of maxillary inter-canine width between the treated group and the control group of approximately 2.5 mm, was not only highly statistically significant ($p < 0.001$), but it was also clinically important.

***Table 1.* Correlation coefficients for inter-examiner reliability and smile reproducibility**

Variable	Reader 1	Reader 2
Maximum incisor exposure	0.8663	0.8578
Upper lip drape	0.9019	0.9004
Lower lip to incisor	0.8240	0.7972
Inter-labial gap	0.8864	0.8561
Inter-canine width	0.9482	0.9577
Smile width	0.8917	0.6545
Smile index	0.8323	0.8046

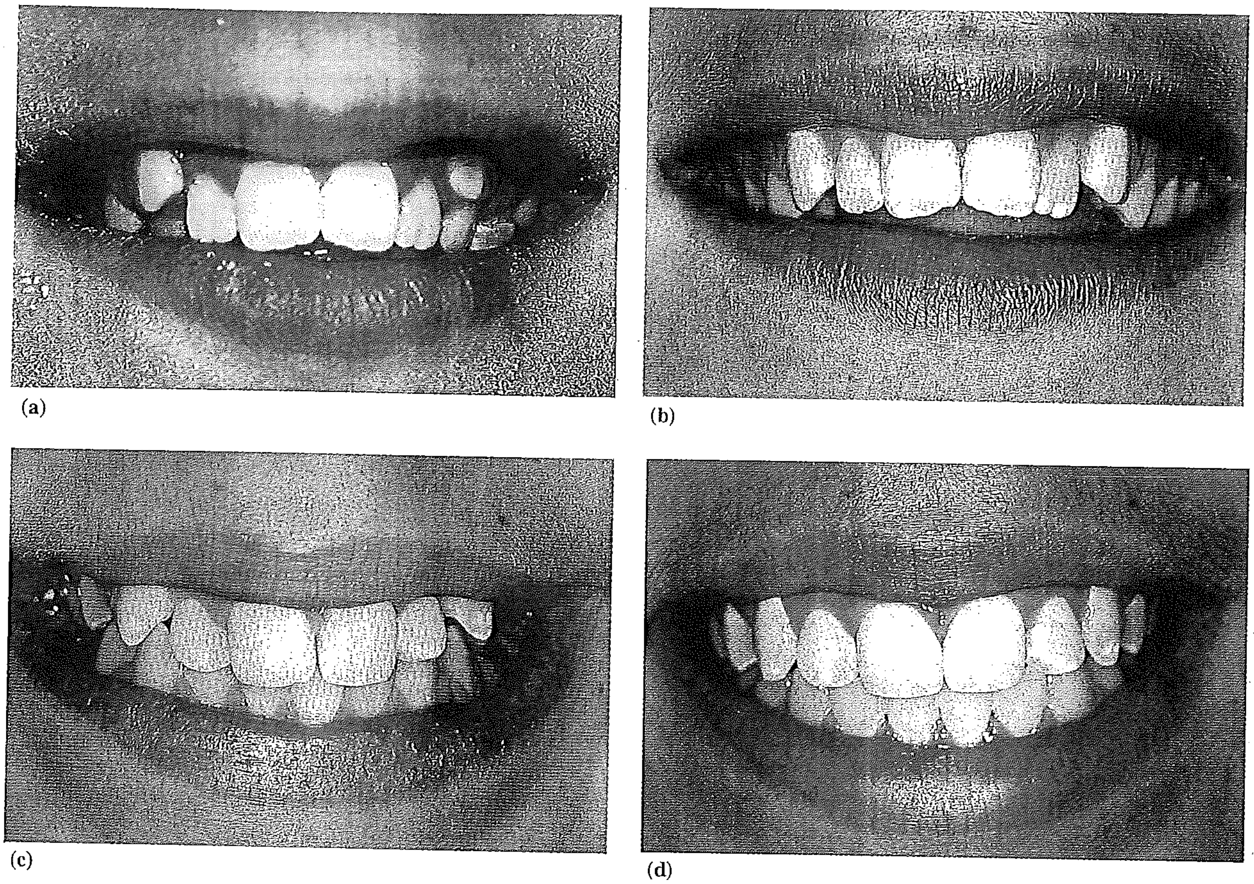


Fig. 7. (a and b) – An untreated subject: a) initial posed smile taken March 15, 1991; b) 2 years and 8 months later November 19, 1993. (c and d) A treated subject – c) pretreatment photos taken February 1, 1994; d) post-treatment records 2 years and 4 months between records May 28, 1996 (Note the change in smile arc from consonant to flat with treatment.)

***Table 2.* Independent two-sample test comparing pre and post study observation period differences (± SD); *p* values are as noted**

Measurement	Untreated			Treated			*p*
	Pre	Post	Diff	Pre	Post	Diff	
Maximum incisor exposure	6.960 ± 1.39	7.078 ± 1.23	0.118 ± 1.28	7.469 ± 1.57	7.845 ± 1.10	0.376 ± 1.25	ns
Upper lip drape	−0.551 ± 1.75	0.300 ± 1.92	0.851 ± 1.49	0.733 ± 2.28	0.570 ± 1.64	−0.163 ± 1.78	0.002
Lower lip to incisor	2.127 ± 1.93	2.082 ± 1.74	−0.045 ± 2.20	2.634 ± 1.93	3.158 ± 1.93	0.524 ± 1.76	ns
Inter-labial gap	10.162 ± 2.50	9.79 ± 2.50	−0.373 ± 2.50	10.704 ± 3.10	11.391 ± 2.81	0.687 ± 2.70	ns
Smile width	50.828 ± 5.04	49.903 ± 4.53	−0.925 ± 4.39	48.580 ± 4.62	49.981 ± 3.76	1.401 ± 4.60	0.05
Smile index	5.308 ± 1.46	5.360 ± 1.174	0.051 ± 1.36	4.903 ± 1.40	4.599 ± 0.97	−0.304 ± 1.26	ns
Inter-canine width	31.548 ± 2.59	31.709 ± 2.57	0.161 ± 2.80	32.270 ± 3.00	34.801 ± 1.82	2.531 ± 2.10	0.001
Buccal corridor (left)	9.806 ± 2.12	9.461 ± 2.21	−0.346 ± 2.33	8.405 ± 2.20	7.586 ± 1.57	−0819 ± 2.67	ns
Buccal corridor (right)	9.474 ± 1.90	8.733 ± 1.85	−0.741 ± 1.856	7.905 ± 2.07	7.594 ± 1.815	−0.312 ± 2.02	ns
Buccal corridor ratio	0.623 ± 0.05	0.638 ± 0.50	0.015 ± 0.05	0.667 ± 0.06	0.699 ± 0.05	0.032 ± 0.065	ns

Changes in smile characteristics during the study period. These results are not adjusted for potential measurement error due to placement of the two vertical lines, which indicate the width of the central incisor in the Smile Mesh program.

***Table 3.* Changes in the smile arc of untreated patients**

	T_2			
T_1	Consonant	Flat	Reverse	Total
Consonant	19	1	0	20
Percent	63.3	3.3	0.0	66.7
Flat	0	5	0	5
Percent	0.0	16.7	0.0	16.7
Reverse	2	1	2	5
Percent	6.7	3.3	6.7	16.7
Total	21	7	2	30
Percent	70.0	23.3	6.7	100

Frequency and percent data are presented. Changes in the smile arc of untreated sample. The smile arc is changed in 13% of the untreated samples. Note: 1 patient out of 20 (5%) who's smile arc was consonant became flat over time.

In regard to smile arc, only 13% of the untreated ample displayed any change during the observation peiod, whereas 40% of treated patients exhibited disernible changes in smile arc. In the treated group, 6 of 19 about 32%) photographs in which the smile arc was rated as being consonant with the lower lip before treatment were judged to be flat after treatment, but in the untreated group, only 1 of 20 smiles (5%) in which the smile arcs were consonant with the lower lip behaved in a fashion in which the smile arc became flat (Tables 3 and 4; Fig. 7). There were no gender differences when smile characteristics of the treated and untreated groups were compared.

***Table 4.* Changes in the smile arc of treated sample**

	T_2			
T_1	Consonant	Flat	Reverse	Total
Consonant	12	6	1	19
Percent	40.0	20.0	3.3	63.3
Flat	2	6	1	9
Percent	6.7	20.0	3.3	30.0
Reverse	1	1	0	2
Percent	3.3	3.3	0.0	6.7
Total	15	13	2	30
Percent	50.0	43.3	6.7	100

Frequency and percent data presented. The smile arc is changed in 40% of the treated sample. Six patients out of 19, who's initial smile arcs were consonant became flat with treatment (32%).

Discussion

This report focuses on discrete morphologic characteristics of the voluntary, static, unstrained reproducible posed smile because of their practical value for diagnosis and assessing treatment in orthodontics. The larger subject of the smile and facial animation as it relates to communication and expression of emotion, although not germane to this article, should also be of interest to orthodontists. Although the English language is replete with words like smirk, insipid smile, wry smile, sardonic smile, ironic smile, inscrutable smile, infectious smile, warm smile, and enigmatic smile, all of which conjure a specific image, those descriptions are entirely subjective. So, too, for signature smiles like that of the Mona Lisa or of Marilyn Monroe. An attractive smile is a requisite for winning elections, and a beautiful smile sells products for companies whose subliminal message in an advertisement is 'look better – feel younger'. The orthodontist who labors diligently to achieve results of treatment that can be shown proudly in plaster casts to board examiners may not grasp fully the significance of changing lip–teeth relationships. For that reason, we propose that a photograph of an unstrained posed smile be a standard orthodontic record.

With the introduction of digital photography it is now easy to ascertain whether a natural and reproducible posed smile has been captured. The measurement of the width and height of the maxillary central incisor can be accomplished intra-orally and those values, along with the smile image, can be transferred digitally to the computer. The Smile Mesh program is extremely user friendly and far less labor intensive than computerized cephalometrics. The time required from capture of an image to reading results takes less than 5 min. Furthermore, the entire task can be assigned to ancillary personnel. Although photographs of the posed smiles utilized in this work were not standardized, there may be merit in the future in comparing the non-standardized technique to a fixed head and camera position. Errors in magnification could still be corrected with the Smile Mesh program. Ours is the first method to be proposed for quantifying smile characteristics in a clinical setting, presumably because new technology that enables it is used widely in orthodontic practice today. This clinical and research tool could be used to develop standards for characteristics of smile in persons with normal occlusion and for esthetics of a smile irrespective of occlusion.

It is interesting to note that in a 2.5-year period of observation during adolescence, the changes in characteristics of a smile in a control group, as well as in patients in a treated group, were remarkably small. If the conventional thinking that lip–teeth relationships change over time is correct, then those changes must occur very gradually or they must happen much later in life. It is likely that these changes are part of aging, rather than part of growth and development. If we had chosen for this study the sample based on specific treatment modalities, would we have seen more significant changes in smile characteristics? Would patients who were treated with palatal expansion have manifested significant reductions in buccal corridor widths? If those patients were compared to persons with normal occlusion, would a panel of judges consider the increased width of the dental arch to be more esthetic? Would their judgment be affected more by the inter-canine or inter-premolar width? The answers to these questions should be sought.

We have introduced here a novel digital morphometric tool to assess the smile of orthodontic patients. In testing this method, we observed that the only statistically significant and clinically important changes that occurred in a matched sample balanced for age, gender, overbite, overjet, and date photographs, were taken of unstrained posed smiles in 30 treated and 30 untreated individuals (150 data sets) taken over a 2.5-year interval, were an increase of 2.5 mm in maxillary inter-canine width and a change in the smile arc. Flattening of the smile arc occurred in approximately 33% of treated patients and only 5% of untreated patients. If the theory of Frush and Fisher is correct and the findings of Hulsey are valid, a smile with a flatter arc is less esthetic.

In the realm of dentofacial esthetics, orthodontists have concentrated so intently on seeking to avoid creating 'flat faces' that they did not recognize the potential of flattening smile arcs. Having paid so much attention to 'Tweed profiles', perhaps the possibility 'straight wire smiles' were being produced was c looked.

Abstrakt

Eines der Grundziele in der Kieferorthopädie ist es, das Lächel verbessern, aber es existieren keine objektiven Kriterien zur Ber sung des Lippen-Zahn-Verhältnisses, der Behandlungsobjektive oc der Beurteilung des Behandlungsergebnisses. Hier schlagen wir ei Methode zur digitalen Bemessung des Lächelns von kieferorthopädischen Patienten vor. Insbesondere wird das "gestellte Lächel bemessen. Das gestellte Lächeln wird als freiwilliges, aber nicht durch eine Emotion verursachtes Lächeln definiert. Es kann eine erlernte Begrüßung, ein Zeichen der Befriedigung und kann anha tend sein. Das von uns entwickelte Computermodell zur Bemess des Lächelns basierte auf Studien zur Beurteilung der Nützlichkei des Lächel-Fotos, der Definition der Lippen-Zahn-Charakteristiken des gestellten Lächelns und des Vergleichens von unbehandelten und behandelten Patienten. Das Multimediacomputerprogramm lä auf dem Quick Ceph Image Pro Image System. Auf dem Bildschirm verwendet wird ein Gitter, oder Lächel-Netz, mit horizontalen und vertikalen Linien, um elf Attribute eines Lächelns z bemessen. Interessanterweise wird bemerkt, daß nicht alle kieferorthopädisch gut behandelten Patienten mit vorbildlichen Gibsmoc ellen die erwünschten Charakteristiken des Lippen-Zahn-Verhältnisses vorweisen. Wir meinen, daß die fotographische Analyse eines unbelasteten, gestellten Lächelns eine wertvolle standardmäßige kieferorthopädische Aufzeichnung sein kann.

Resumen

Uno de los objectivos fundamentales de la ortodoncia es mejorar la sonrisa, pero no existen criterios cuantificables para medir la relación labio–dental, objectivos de los tratamientos y la eficacia del cumplimiento de tales objectivos. Proponemos un mètodo digitalizado para medir la sonrisa de los pacientes ortodónticos. Específicamente se mide la sonrisa de postura. Por definición, la sonrisa de postura es voluntaria y no es provocada por ningún tipo de emoción. Esta puede producirse como un saludo aprendido, un signo de apaciguamiento y puede ser sostenida. El modelo computarizado para la medida de la sonrisa que hemos desarrollado incorpora la utilidad de sonrisas de fotografiás, en la definición existente de características labio–dentales, en la sonrisa de postura, y establece una comparicíon entre pacientes en tratamientos y pacientes no en tratamientos. El programa computarizado multimedia utilizado es el 'Quick Ceph Image Pro'. En la pantalla del monitor una plancha (grid) o malla de sonrisa utiliza las líneas verticales y horizontales para medir once atributos de la sonrisa. Llama la atencíon que no todos los pacientes tratados ortodónticamente con modelos de estudios ejemplares, exhiben las características deseables de una relación labio–dental. Por consiguiente proponemos que una fotografía de sonrisa de postura no forzada sea parte integral de la toma de récords estandarizados para el tratamiento de ortodoncia.

抄録

矯正治療の基本的な目標は、笑顔の改善であるが、口唇ー歯牙の位置関係を測定するための基準や、治療目的あるいは治療結果を評価するための客観的な基準は存在しない。本稿において我々は矯正患者のスマイルの測定をデジタル化する方法を提唱している。特に、ポーズしたスマイルを測定する。ポーズしたスマイルの定義は、自発的であるが、感情によって惹起されたものではない笑顔である。学習された挨拶、宥和の信号であるとも言えるもので、持続可能である。我々は、スマイルの写真の有用性の評価、ポーズしたスマイルの口唇ー歯牙の特徴、治療済み患者と未治療患者の比較に関する研究に基づいて、スマイル測定のコンピュータ・モデルを開発した。開発されたマルチメディアのコンピュータ・プログラムはQuick Ceph Image Programを採用している。コンピュータ画面上に、水平線、垂直線から構成される格子、つまりスマイル・メッシュが表示され、スマイルの１１項目の属性が測定される。興味深いことに、矯正治療を成功裏に完了し、模範的な石膏模型を持つ患者の全てが、口唇ー歯牙の位置関係の望ましい特徴を表している訳ではない。従って我々は、無理のない、ポーズしたスマイルの写真を矯正治療の標準記録として提案する。

Acknowledgements: The authors wish to thank Gregory Cassileth and Jonathan Coopersmith of TDG Consulting for creating the Smile Mesh software and A Bernard Ackerman for his helpful suggestions regarding the manuscript.

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