Short Communication

Smile Arcs of Caucasian and Korean Youth

Jin-Keun Dong, DDS, MSD, PhDª/Robert G. Rashid, DDS, MAS^b/Stephen F. Rosenstiel, BDS, MSD^c

This study was designed to measure and compare the smile arcs (tooth and lip arcs) of young Caucasian and Korean subjects. Two hundred subjects (100 male and 100 female) were selected from Caucasian and Korean students. Class photographs taken with a digital camera showing the subjects with a posed smile were used for this study. Curves were rendered as semitransparent overlays, which were manipulated over the images using Adobe Photoshop to determine the best fit for tooth and lip arcs. There were statistically significant differences due to ethnicity and gender. Mean lip arcs had greater curvature than mean tooth arcs. *Int J Prosthodont 2009;22:290–292.*

Though it has been difficult to examine and quantify precisely what represents facial attractiveness, presenting an attractive appearance has been a sought-after goal throughout history. The development of computer graphics has enabled the quantification of facial features with much greater facility and accuracy than was previously possible. The measurement of average facial values, facial symmetry, and sexual dimorphism are good candidates for biologically based standards of facial beauty.

Frush and Fisher¹ have previously brought attention to the importance of the smile line—the harmony between the curvatures of the incisal edges of the maxillary anterior teeth (the tooth arc) and the superior border of the lower lip (the lip arc). Parekh et al² evaluated computerized variations of smile arcs with a webbased study and reported that smiles with ideal and excessive smile arcs were significantly more acceptable than those with flat smile arcs.

There have been efforts to geometrically determine the tooth arc. Dong et al³ studied maxillary anterior incisal curves of young Korean subjects and reported that the mean radius of the maxillary anterior incisal curve was 102 mm. There were no significant differences between male (113 mm) and female (92 mm) subjects. This study was designed to measure and compare the tooth and lip arcs of young Caucasian and Korean subjects.

Materials and Methods

One hundred Caucasian subjects (50 male and 50 female) were selected from students attending the Ohio State University College of Dentistry. One hundred Korean subjects were selected from Wonkwang University Dental College. Their ages ranged from 18 to 30 years.

Class photographs were used for this study. These photographs were taken with a digital camera and showed the subjects with a posed smile. From a larger number of available pictures, images were selected that fully displayed the maxillary anterior incisal edges and in which the subject was facing directly toward the camera (Fig 1). Curves were generated with Math GV

^aProfessor, Department of Prosthodontics, Wonkwang University, School of Dentistry, Iksan, South Korea.

^bClinical Professor, Section of Restorative and Prosthetic Dentistry, Ohio State University, College of Dentistry, Columbus, Ohio, USA. ^cProfessor and Chairman, Section of Restorative and Prosthetic Dentistry, Ohio State University, College of Dentistry, Columbus, Ohio, USA.

Correspondence to: Dr Jin-Keun Dong, Department of Prosthodontics, Wonkwang University, School of Dentistry, 344-2, Sinyong-dong, Iksan, South Korea. Fax: 82-63-857-4824. Email: dong@wku.ac.kr

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Fig 2 Parabolas from the formula f(x) =nx² superimposed on a representative photograph to determine smile arc. The blue curves are n = 0, 0.05, 0.10, 0.15 and

Class photographs used for this study show a posed smile. Fia 1



Fig 3 Tooth arcs of Caucasian and Korean students.

FREEWARE Version 3.1 (Greg VanMullem) as parabolas of the formula $f(x) = nx^2$, where n ranged from 0.025 to 0.350 in increments of 0.025. The curves were rendered as semitransparent overlays, which were manipulated over the images using Adobe Photoshop to determine the best fit for tooth and lip arcs (Fig 2).²

Means for gender and ethnic group were calculated, and differences between the means were tested for statistical significance with JMP 6.03 (SAS) using factorial analysis of variance (ANOVA) with a post-hoc Tukey honestly significant difference (HSD) test to determine which categories were statistically significantly different ($\alpha = 0.05$).

Results

Tooth Arc

Mean tooth arcs of Caucasian male and female subjects were $f(x) = 0.084x^2$ and $f(x) = 0.118x^2$, respectively. Mean tooth arcs of Korean male and female subjects were $f(x) = 0.070x^2$ and $f(x) = 0.078x^2$, respectively (Fig 3).



Fig 4 Lip arcs of Caucasian and Korean students.

Factorial ANOVA for tooth arcs revealed a statistically significant interaction. The post-hoc Tukey HSD test revealed that Caucasian females had a significantly greater tooth arc than Caucasian males, Korean females, or Korean males ($P \le .001$). The other groups did not differ statistically.

Lip Arc

Mean lip arcs of Caucasian male and female subjects were $f(x) = 0.175x^2$ and $f(x) = 0.176x^2$, respectively. Mean lip arcs of Korean male and female subjects were $f(x) = 0.118x^2$ and $f(x) = 0.117x^2$, respectively (Fig 4).

Factorial ANOVA for lip arcs showed no statistically significant interactions, allowing for analysis of the main effects of race and gender. Only race had a significant effect on lip arc, with the lip arc for Caucasians being significantly greater than that for Koreans (P <.001). Lip arcs were greater than tooth arcs in both races and genders (P < .001).

Discussion

The photographs for the two ethnic groups were taken under somewhat different conditions and with different equipment. However, standardization was achieved by adjusting the enlargement and resolution of the images using the Photoshop software.

Facial morphologic differences by ethnic group reveal that the Koreans had horizontally wider and smaller anteroposterior facial dimensions than Caucasians. The dolichocephalic head form is commonly seen among Caucasians, whereas Koreans are mostly brachycephalic.⁴

In the present study, it was found that the mean lip arcs of Korean subjects were statistically significantly less curved than their Caucasian counterparts, as were the tooth arcs of female Koreans.

Hulsey⁵ reported that the most attractive smiles displayed a smile line ratio of 1.00 to 1.25. In the present study, the lip arcs were found to be steeper than the tooth arcs in both genders and ethnic groups. The mean values of tooth and lip arcs were 0.088 and 0.147, respectively. The mean tooth arcs of females had greater curvature than males. However, the mean lip arcs of females were not significantly different than those of males. This result suggests that while the skeletal structure is different between males and females, the muscular structure may not be.

These study results provide useful guidance for evaluating anterior teeth and planning treatment for esthetic restorative care. Clinicians should consider racial and gender differences when developing an esthetic treatment plan.

Conclusions

Within the limitations of this study, it was concluded that the mean lip arcs had greater curvature than the tooth arcs. There were statistically significant differences due to ethnicity and gender.

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Literature Abstract

Measurement of implant stability by resonance frequency analysis and damping capacity assessment: Comparison of both techniques in a clinical trial

There are many available implant success criteria in the literature. However, there are currently no objective means of predicting implant treatment outcomes. Most practices rely heavily on clinical and radiographic findings but these are of limited value. A quantitative measurement technique that evaluates implant stability has been explored to provide a more reliable prognostication tool. The objective of this study was to evaluate the presumed correlation of the resonance frequency analysis (RFA) technique and the damping capacity assessment of Periotest equipment in a clinical trial. A total of 65 edentulous patients were included in the clinical trial; 45 were patients with loaded implants while 20 had the implants placed and measured immediately postsurgery. Solid screw Straumann implants were used in this clinical trial from June 2004 to April 2005. All measurement of implant stability was performed in triplicate by an experienced clinician with Periotest and Osstell equipment. In total, 105 implants were measured in the maxilla and 108 implants in the mandible. Results showed that the overall mean implant stability quotient was 57.66 ± 8.19 and the Periotest result mean was -5.08 ± 2.02 . The correlation of RFA and Pertiotest values with implant diameter was statistically significant. However, no significant correlation was found with that of implant length. In conclusion, it was suggested that Osstell seems to be a more precise instrument for measurement of implant stability compared to Periotest, which displayed a relatively larger standard deviation. The reason for this deviation was attributed to various clinical conditions, such as handpiece angulation and point of measurement, when using the Periotest device.

Zix J, Hug S, Kessler-Liecht G, Mericske-Stern R. Int J Oral Maxillofac Implants 2008;23:525–530. References: 21. Reprints: Prof Dr Mericske-Stern, Department of Prosthodontics, School of Dental Medicine, University of Bern, Freiburgstr 7, CH-3010 Bern, Switzerland. Fax: +41 31 632 49 33. Email: regina.mericske@zmk.unibe.ch—S. K. Lim, Singapore

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