Changes in Lower Facial Height and Facial Esthetics with Incremental Increases in Occlusal Vertical Dimension in Dentate Subjects

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Purpose: To determine if there are objective changes in lower facial height and subjective changes in facial esthetics with incremental increases in occlusal vertical dimension in dentate subjects. ***Materials and Methods:*** Twenty subjects of four different races and both sexes with a Class I dental occlusion had custom diagnostic occlusal prostheses (mandibular overlays) fabricated on casts mounted on a semi-adjustable articulator. The overlays were fabricated at 2-mm, 3-mm, 4-mm, and 5-mm openings of the anterior guide pin of a semi-adjustable articulator. Direct facial measurements were made between pronasale and menton on each subject while wearing the four different overlays. Thereafter, two digital photographs (frontal and profile) were taken for each subject at maximum intercuspation (baseline) and wearing each of the four mandibular overlays. The photographs of eight subjects were standardized and displayed in a random order to 60 judges comprising 30 laypeople, 15 general dentists, and 15 prosthodontists. Using a visual analog scale, each judge was asked to rate the facial esthetics twice for each of the 80 images. ***Results:*** For objective changes, although an anterior guide pin–lower facial height relationship of 1:0.63 mm was observed, the findings were not correlated ($P > .20$). For subjective changes, the visual analog scale ratings of judges were uncorrelated with increases in anterior guide pin opening up to 5 mm, irrespective of the judge's background status or the sexes of the judges or the subjects ($P > .80$). ***Conclusions:*** Incremental increases in anterior guide pin opening up to 5 mm did not correlate to similar increases in lower facial height. Additionally, it made no difference in a judge's evaluation of facial esthetics irrespective of the judge's background status (layperson, general dentist, or prosthodontist) or sex. *Int J Prosthodont 2015;28:363–370. doi: 10.11607/ijp.4288*

The face has categorically been considered a central feature when making overall esthetic judgments of a person.[1] In the study of facial esthetics, the face is evaluated in transverse, anteroposterior, and vertical dimensions.[2] One of the most important elements in dentistry that affects facial esthetics is occlusal vertical dimension (OVD) (formerly termed vertical dimension of occlusion or VDO). As defined by the Glossary of Prosthodontic Terms, this is the relationship of the mandible and maxilla when the jaw is closed and the teeth are in contact.[3] It can be further understood as the measured vertical distance between any two arbitrary points placed on the face as supported by the occluding members.[3] OVD involves the balance of the entire masticatory system and is an important element in removable and fixed prosthodontics.

A common clinical challenge for prosthodontists is differentiation of patients who naturally lack OVD from patients who have lost their OVD and require prosthodontic means to restore the lost OVD. The clinical assessment of OVD has largely been derived from complete denture principles and can be accomplished using the patient's pre-extraction records, physiologic rest position, measurement of closing forces, tactile

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sense, closest speaking space, force exerted between the teeth on swallowing, and ideal facial dimensions and esthetics.[4] Many of these concepts have been directly applied when determining OVD in fixed dental rehabilitations. While the importance of determining an optimal vertical dimension is clear among dentists, no single method of measuring OVD has been proven to be precise, and most clinicians use a combination of methods and clinical judgment to identify this physiologic zone.[4] The primary reasons for increasing OVD in fixed prosthodontic treatment are to allow for restoration of ideal esthetics, control of occlusal plane and occlusion, to create restorative space, and to potentially eliminate the need for elective endodontics and surgical crown lengthening.[5] Fixed prosthodontic rehabilitation that involves an excessive increase in OVD can affect speech, teeth size, teeth proportions, deglutition, esthetics, and occlusion.

It is widely believed that altering the OVD has the potential to affect a patient's lower facial height (LFH). In removable and fixed prosthodontics, clinicians are routinely asked to make decisions about OVD and its relationship to patients' facial esthetics. Determining the appropriate OVD plays an important role in removable prosthodontics, complete arch fixed prosthodontics, and comprehensive implant-based rehabilitations. In dentate patients, it is presently unknown if there are any differences in facial esthetics in frontal and profile views when the OVD is altered through fixed prosthodontics. Additionally, it is unknown how much increase in LFH occurs with increase in OVD. Since the majority of studies pertaining to LFH are orthodontic reports[6] that have arbitrarily modified LFH without any consideration to OVD, they are of limited clinical relevance to prosthodontics.

Only one study[7] has effectively evaluated the relationship between OVD and LFH from a prosthodontic perspective. This study involved fitting 22 fully dentate subjects with maxillary overlays of 2-mm, 4-mm, 6-mm, and 8-mm thicknesses and investigating the objective and subjective changes in facial height with increases in OVD. The printed photographs of the subjects wearing the overlays were presented to 10 observers. The observers were blinded to the overlay thickness in each photograph and were asked to arrange the photographs of each subject in ascending order of face height. Results of this study showed that the observers could not accurately rank order photographs in a linear manner for overlays of 2-mm, 4-mm, and 6-mm thickness. However, the photographs of the subjects wearing the 8-mm overlay were discernible. The study also showed that there was a linear change in LFH measurements. Though this study was the first to expound on the knowledge related to OVD increase and subjective assessments, some critical issues remained. The study had only 10 observers (judges) and used a rank-ordering method for rating the photographs and LFH as the study endpoint. The rank-ordering method forced the judges to look for changes in the images, leading to a significant observational bias. While LFH is important, it serves only as a surrogate marker for the true endpoint of increasing OVD, which is facial esthetics. The number of judges in this study was unarguably small and the rank-ordering method carries inherent bias and is inapplicable from a clinical standpoint. Finally, this study was conducted on subjects from a single race. It is not known how increasing OVD might influence facial esthetics in people of different races. Although there is an additional body of research on facial height and its relationship to facial esthetics, much of this literature lacks clinical applicability and may be confounded by small judge sample sizes and racial preferences in esthetics.[8]

Given the existing gaps in the current literature, the aim of this study was to determine if there are objective changes in LFH and subjective changes in facial esthetics with incremental increases in OVD in dentate subjects with Class I dental occlusion. The changes in facial esthetics were also analyzed for variations in race, sex, and background of the judge (layperson, prosthodontist, or general dentist).

Materials and Methods

After approval was obtained from the University Institutional Review Board (#12-130-2), 20 dental students with an age range of 20 through 35 years were recruited for this two-part study. The first part of the study was designed as the objective phase of the study and the second part was designed as the subjective phase of the study. A minimum of two subjects from each of the following racial backgrounds were selected for the study: White, Black, Asian (Oriental race), and South Asian. All subjects fulfilled the following predetermined inclusion criteria: *(1)* complete maxillary and mandibular dentition in Class I relationship, *(2)* no previous history of orthognathic or plastic surgery, *(3)* no gross facial asymmetries, and *(4)* no history of any congenital conditions/trauma affecting facial form and appearance. The subjects' racial characteristics were 45% White, 15% Black, 20% Asian, and 15% South Asian. Of these, 35% were women and 65% were men and the average age of subjects was 26.6 years.

After verbal and written consent, each subject had maxillary and mandibular impressions made with medium body polydimethyl siloxane (Algin.X Ultra, Dentsply) and an average axis facebow record (Hanau Spring-Bow, WhipMix) was made with polyvinyl siloxane registration material (Regisil Rigid, Dentsply Caulk). The impressions were poured with type IV gypsum product (CastOne, Dentsply Trubyte) trimmed

Fig 1 Example of four mandibular overlays of different thicknesses that were used to increase OVD before making direct facial measurements and digital photographs.

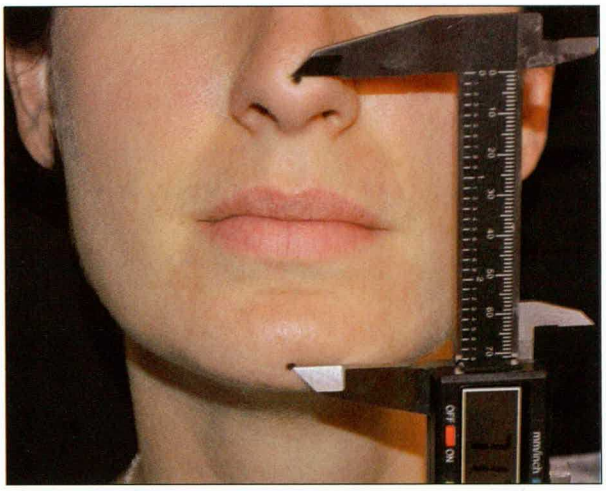

Fig 2 Measurement of LFH from points marked on pronasale to menton.

and mounted on a semi-adjustable articulator (Hanau Wide-Vue, WhipMix) in maximum intercuspation (MIP). In this study, incremental opening of the anterior guide pin (AGP) openings of the articulator was used as a surrogate marker to study increases in OVD. Therefore, both maxillary and mandibular casts were coated with a thin film of petrolatum (Petroleum Jelly, Unilever). At increased AGP measurements of 2 mm, 3 mm, 4 mm, and 5 mm, respectively, diagnostic occlusal prostheses[3] (also known as overlays) were fabricated from mandibular right first premolar to mandibular left first premolar using dental light cured composite resin overlay material (Primosplint, Primotec) (Fig 1). After polymerization, each mandibular overlay was trimmed and adjusted to the corresponding increase in vertical dimension using articulating paper (AccuFilm, Parkell).

At a second visit, the composite resin overlays were inserted in the subject's mouth and minimal adjustments were made to obtain even bilateral contacts. Two points were marked directly on each subject's face with a fine tip dry erase marker (Expo, Sanford Ink) at pronasale (tip of the nose) and soft tissue menton. A digital caliper (Neiko 01407A Stainless Steel 6-Inch Digital Caliper, Neiko Tools) was used to clinically measure the distance between the two points for each evaluated vertical height with different overlays: MIP (0 mm/no overlay), 2 mm, 3 mm, 4 mm, and 5 mm[9] (Fig 2). All of the 100 measurements were made by the same investigator and repeated twice for calibration purposes. This concluded the data collection for part 1 (objective phase) of the study.

Thereafter, 8 of the 20 subjects were chosen based on satisfying the racial and gender prerequisites for part 2 (the subjective phase) of the study. All subjects were asked to remove any cosmetic accessories

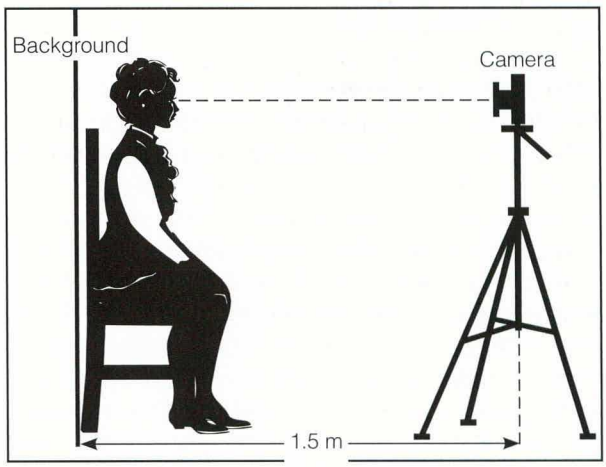

Fig 3 Methodology of obtaining digital images of subjects under standardized conditions.

(hats, earrings, necklaces, lipstick) before presenting themselves to be photographed. A 6.1-megapixel digital camera (D70s, Nikon) with a 105-mm lens and a point flash, as well as an additional flash with a wireless speedlight (SB-R200 Wireless Speedlight, Nikon), was used in the 12 o'clock position. The camera had an aperture setting of F4.5 and was mounted on a tripod (Deluxe Tripod 200, Canon) with a standardized focus and at a standardized distance of 5 feet (1.5 m) from the subject (Fig 3). The lighting conditions remained the same for all photographs. This procedure was similar to the protocol described by Bidra et al.[10] The subjects were then seated in front of a black background, and full-face photographs of each subject were made from the frontal and profile views with the head in natural head position guided to true horizontal.[10] Digital photographs were taken of

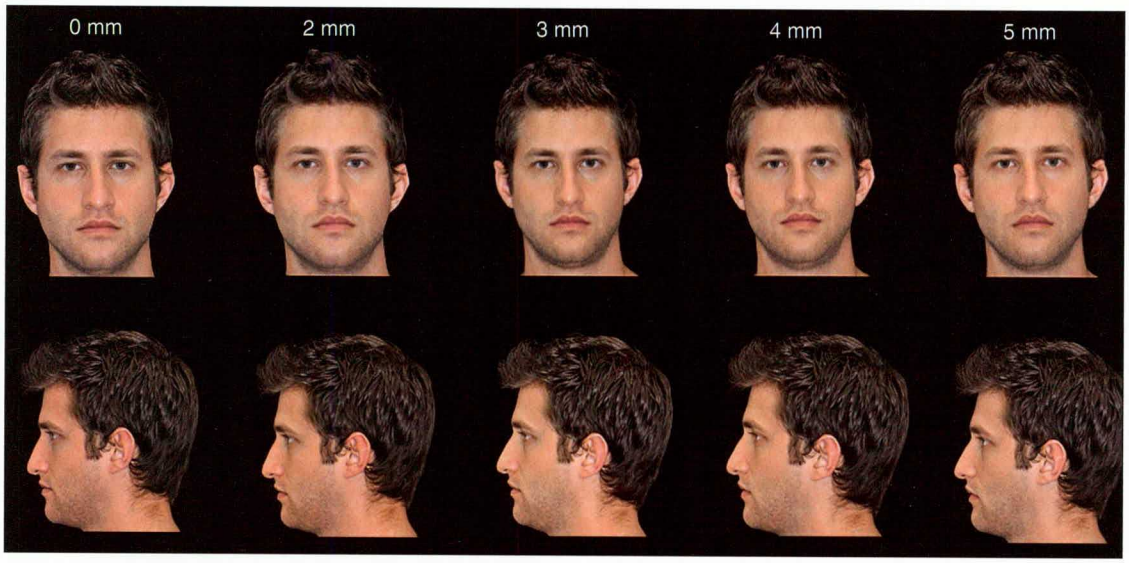

Fig 4 One of the subjects' set of five frontal and profile photographs that included baseline image with no overlay and four additional images with mandibular overlays of different thicknesses. Note that for subjective assessments, only one pair of frontal and profile images of the same OVD was presented in each slide for judges.

each, from frontal and profile views (total 10 images per subject) at MIP (0-mm/no overlay), 2-mm, 3-mm, 4-mm, and 5-mm AGP opening using the same mandibular overlays fabricated previously (Fig 4). Thus ,10 images were produced for each of the 8 subjects.

Each of the 80 digital photographs was saved in a JPEG format. Using a digital photography editing software program (Adobe Photoshop CS4, Adobe Systems), the full-face frontal and profile images were standardized. All photos were cropped to 5.8 × 4.5 inches and evaluated for consistency in head position and picture quality before incorporating them into a digital slide presentation program (PowerPoint 2010, Microsoft). Each slide contained the frontal image and profile image of the same subject at the same OVD. Thus, 5 slides for each of the 8 subjects were collated and used to create a slideshow of 40 total slides in random order.

For assessing changes in facial esthetics of the images, 60 judges comprising 30 laypeople, 15 general dentists, and 15 prosthodontists were recruited. These judges represented various races and age groups (range: 19 to 76 years) and both sexes. The judges' racial characteristics were 70% White, 8.3% Black, 15% Asian, and 6.7% South Asian. Of these, 43.3% were women and, 57.7% were men, 50% were laypeople, 25% were general dentists, and 25% were prosthodontists. The average age of the judges was 44.28 years. After providing written consent, judges were given a brief handout describing selective components of the study and the nature of their participation. In the handout, judges were instructed both on the presentation of the subjects and on how to use a visual analog scale (VAS). Judges were informed that although the same eight subjects were photographed five separate times, no single pair of images had the same facial appearance. The judges were blinded about the nature and purpose of the study and had no knowledge that the study pertained to changes in OVD. Additionally, the judges were required to sign a statement to withdraw from the study if they personally knew or recognized any of the eight subjects who were photographed. After viewing the first round of 40 slides, the judges were asked if they recognized any of the subjects. If an affirmative answer (yes/no format) was provided, the particular judge was excluded from the study.

The collated digital images were presented as a slide show and viewed twice by each judge. The order of photo presentation followed a different randomized sequence for each judge. Judges were provided a printed copy of the VAS scale. Each printout had 80 individual 100-mm VASs corresponding to the order of images and anchored on the left as least esthetic and on the right as most esthetic. Judges were asked the specific question "On a scale of 0 to 100, how do you rate the facial esthetics of this image?" and were asked to draw a line on the scale according to their rating of facial esthetics. Judges were allotted 7 seconds for each slide containing a pair of images before an automatic transition to the next slide.

The data from both parts of the study were analyzed using SPSS 16.0 (IBM). Descriptive statistics were reported as means and standard deviations. The data for part 1 of the study were analyzed using a 5 (mandibular thickness) × 2 (subject sex) × 2 (subject race) × 2 (LFH measurements) mixed model factorial design.

Data were analyzed using the linear mixed subjects procedure in SPSS. The first part of the mixed model examined the data only as a function of measurement opportunity to evaluate reliability of measurement. The next analyses examined main effects attributable to subjects' mandibular overlay thickness, sex, and race. All factors and interactions were entered simultaneously, and type III sums of squares were used to evaluate results. All resulting main effects and interactions were then scrutinized for significance and interpreted at a predetermined α value of .05.

The data for part 2 of the study were analyzed using a mixed model factorial design with 2 (sex of subject) × 4 (race of subject) × 5 (mandibular overlay thickness) × 2 (trials) within-judges factors, and 1 between-judges factor with 3 levels (general dentist versus layperson versus prosthodontist). Data were analyzed using the general linear mixed model procedure in SPSS. The first model examined the data only as a function of trial to evaluate the reliability of the repeated assessments. The next analyses examined main effects attributable to each of the within-judges factors (subject sex, subject race, subject mandibular thickness) and the between-judges effect for these factors. Nonsignificant effects for the within-judges factors or for the between-judges factor (judge professional status) allowed for that factor to be excluded in succeeding analyses. The final model therefore included all possible interactions of those factors that remained significant in prior analyses. All factors and interactions were entered simultaneously, and type III sums of squares were used to evaluate results. All resulting main effects and interactions were then scrutinized for significance and interpreted.

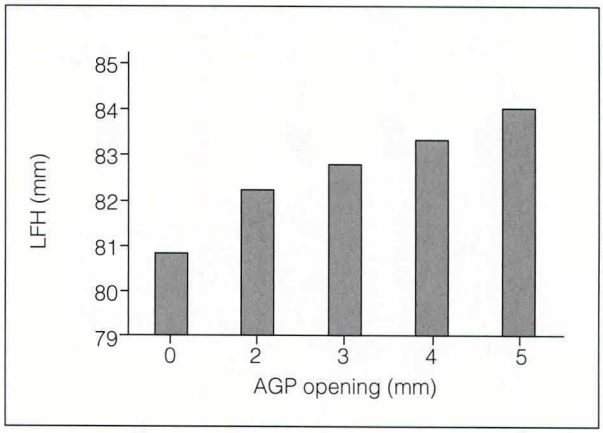

Fig 5 Relationship between overlays made at various AGP openings of the articulator to changes in LFH that was measured directly on subjects' faces. Although an average AGP:LFH relationship of 1 mm:0.63 mm was observed, AGP and LFH were not correlated.

Table 1 Average Measurements and Confidence Intervals of LFH for all 20 Subjects for Overlays Made at Various AGP Openings of the Articulator

			95% confidence interval	
AGP opening (mm)	Mean LFH (mm)	Standard error	Lower bound	Upper bound
0	80.9	2.0	76.9	84.8
2	82.3	2.0	78.3	86.2
3	82.8	2.0	78.9	86.8
4	83.4	2.0	79.4	87.4
5	84.1	2.0	80.1	88.0

Results

In part 1 of the study, LFH measurements were made between pronasale and menton to correlate with each of the five mandibular overlays fabricated at various AGP openings on the articulator (0-mm/no overlay, 2-mm, 3-mm, 4-mm, and 5-mm.). Each measurement was made twice. The inter-rating reliability coefficient ($P < .001$) indicated a high level of consistency between measurements taken twice by the same investigator using the standard procedures ($\alpha = .99$, $r = .99$, $P < .001$). The results for this part of the study indicated that a systematic increase of 1.0 mm in AGP resulted in an average increase of LFH by 0.63 mm (Fig 5). However, the systematic increases in AGP did not reflect similar increases in measured LFH for different AGP openings, different races, and both sexes ($r = .12$, $P > .20$) (Table 1).

In part 2 of the study, all VAS ratings for changes in facial esthetics related to increase in AGP openings on the articulator were performed twice by all 60 judges. The data for overall effect of increase of AGP openings on the articulator and facial esthetic ratings reflected an initial decrease in facial esthetic ratings 0 mm (no overlay) to 2 mm (55.035 to 53.875), then an increase from 2 mm to 3 mm (53.875 to 54.374), then a progressive decrease from 3 mm to 5 mm (54.374 to 54.217 to 54.109). These trends did not indicate any direct correlation between increases in AGP openings on the articulator and facial esthetics ratings ($r = -.01$, $P > .364$). (Fig 6). Nonetheless, ratings of facial esthetics were seen to be affected significantly ($df = 4800$, $P < .000$) by the race of subject and judge, as subjects were ranked higher when judges were of the same race compared to when they were of different races (Table 2).

With regard to sex, the mean values showed that when subjects and judges were of the same sex

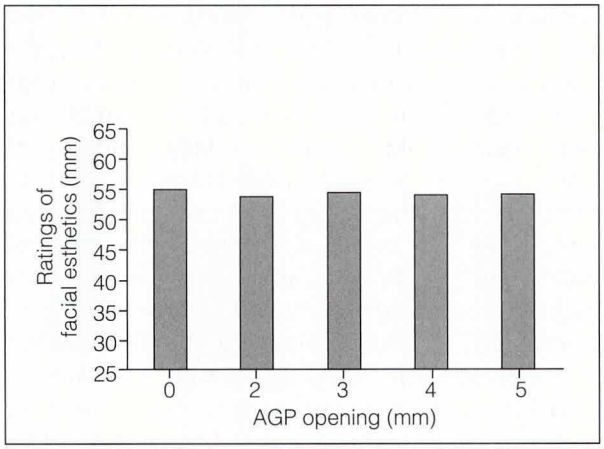

Fig 6 Mean rating for facial esthetics by all judges for overlays made at various AGP openings of the articulator.

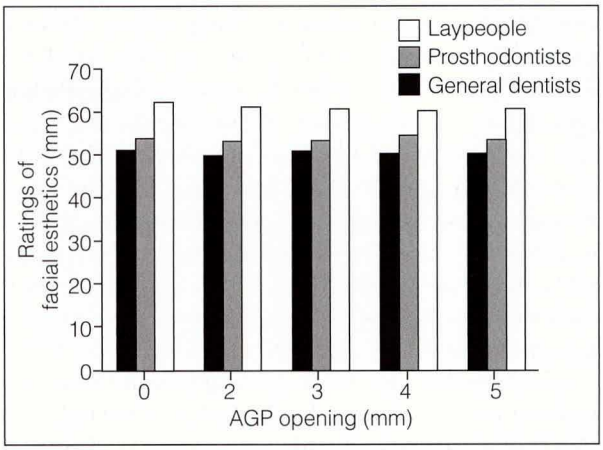

Fig 7 Mean subjective rating for facial esthetics, based on background of judges (layperson, general dentist, prosthodontist) for overlays made at various AGP openings of the articulator.

Table 2 Means and Confidence Intervals for Ratings of Facial Esthetics When Subject and Judges Were of Same Race or Different Races

Judge and subject races	Mean rating on VAS (mm)	Standard error	95% confidence interval	
			Lower bound	Upper bound
Subject and judge of same race	53.6	0.3	53.0	54.3
Subject and judge of different races	56.4	0.6	55.3	57.5

Table 3 Means and Confidence Intervals for Ratings of Facial Esthetics When Subject and Judges Were of Same Sex or Different Sexes

Subject and judge sex	Mean rating on VAS (mm)	Standard error	95% confidence interval	
			Lower bound	Upper bound
Subject and judge of same sex	55.0	0.4	54.1	55.8
Subject and judge of different sexes	55.1	0.4	54.2	55.9

Table 4 Means and Confidence Intervals for Ratings of Facial Esthetics Related to Judge's Background (Layperson, General Dentist, or Prosthodontist)

Background status of the judge	Mean rating on VAS (mm)	Standard error	95% confidence interval	
			Lower bound	Upper bound
Layperson	50.9	0.4	50.1	51.7
General dentist	61.5	0.6	60.4	62.6
Prosthodontist	54.0	0.6	52.9	55.1

the judges reported higher ratings for facial esthetics than when they were of different sexes; however, this difference was not statistically significant (Table 3). Judges also rated subjects as significantly more attractive if they were of the same race, irrespective of AGP openings on the articulator ($F = 18.07$, $df = 4800$, $P < .001$). Finally, ratings of facial esthetics were affected significantly ($df = 4800$, $P < .001$) when judges were of different professional backgrounds (layperson, general dentist, prosthodontist) with general dentists' rating for facial esthetics being the highest, followed by prosthodontists and laypeople (Table 4). Although overall differences were seen, a person's background status (layperson, prosthodontist, general dentist) did not correlate to their ability to detect changes in facial esthetics with increases in AGP openings on the articulator (Fig 7).

Discussion

The null hypotheses of this study were that there would be no objective changes in LFH and no subjective changes in facial esthetics with incremental increases in OVD in dentate subjects with Class I dental occlusion. This study failed to reject both null hypotheses. In this study, incremental opening of the AGP openings of the articulator was used as a surrogate marker to study increases in OVD. The importance of OVD in dentistry has long been understood on a functional level. However, there is minimal scientific understanding about the changes in LFH and facial esthetics as result of increase in OVD. The need to increase or decrease OVD is largely based on requirements for restorative space or to control function and occlusion. Patients in need of prosthodontic treatment involving increases in OVD are commonly

asked to endure extensive treatment with significant psychological and financial investment. This behooves the clinician to have a better understanding of the impact of increase in OVD on facial esthetics.

The methodology of this study called for use of overlays as surrogate markers to represent increases in OVD. This ensured a simple and repeatable method and has been previously reported in the literature.[7,11] The overlays were fabricated on the mandibular arch instead of the maxillary arch to minimize the chance of the overlay affecting lip projection and facial esthetics. The overlays were made using light polymerized resin to provide ease of fabrication, adjustment, and intraoral verification. Overlays were made indirectly on casts of subjects mounted on a semi-adjustable articulator using an average axis facebow record. The overlays were restricted to a maximum thickness afforded by a 5-mm opening of the AGP on the semi-adjustable articulator. This was done to enhance the clinical relevance of the study and to mimic routine clinical procedures. The authors deemed an increase beyond 5-mm opening of the AGP as exaggerated and abnormal for fixed prosthetic rehabilitations. The overlays were extended bilaterally to the mandibular first premolar to allow for sufficient occlusal coverage. Consideration was made to extending the overlay further posterior to the molar regions, but after a pilot analysis in which the overlay was fabricated to the first molar there were excessive prematurities in occlusal contacts and a need for aggressive adjustment of the overlay. Additionally, at AGP increases of 2 mm and 3 mm, the resin overlays were so thin at molar regions that it impeded their use clinically.

In this study, intraclass correlation coefficients of between-trial measurements displayed very high consistency, indicating that the reliability of the individual making the measurements and the method used were acceptable. The results displayed an average increase in LFH of 0.63 mm per 1-mm increase in AGP opening. But this increase in LFH was uncorrelated with AGP openings ($P > .20$). Therefore, systematic increases in AGP opening did not reflect similar increases in measured LFH for all races and both sexes. These results contrast with previous research by Gross et al,[7] who indicated a positive correlation of increase of LFH by 0.5 mm per 1-mm "increase in OVD." It can be argued that the sample size of the present study was higher and more diverse than that used in Gross et al,[7] thus the absence of correlation between OVD and LFH.

All subjects selected for this study had Angle Class I occlusion and were between 20 and 35 years of age and from diverse racial backgrounds (White, Black, Asian, and Asian-Indian.) Use of subjects with Angle Class II or Class III relation may have affected the results, especially in part 2 of this study. However, as this was one of the first studies investigating this topic, the use of Angle Class I subjects allowed for obtaining baseline data for future research. The age range was selected because this was the most common age range found in the literature on facial esthetics.[6,7,8] Using this age group allowed this research to be comparable to other published literature on the same topic. Lastly, this study was one of the first research projects to provide racial and sex diversity between its judges and subjects. Although racial[12] and sex[13] preferences have been validated by previous research in psychology, most previous dental literature in facial esthetics has been conducted regionally and with sizable sex and racial preferences. This affects sample homogeneity and may contribute biases in ratings.

Although this investigation made methodological improvements over many previous studies[6,14] on facial esthetics and explored the topic further, some limitations remained. First, the study involved measuring points placed on movable soft tissues at increased OVD with mandibular overlays placed on the anterior teeth. The combination of these factors made the consistency of measuring soft tissue points difficult in some instances, as some subjects had the tendency to tense their facial muscles, specifically their chin, as the thickness of mandibular overlay increased. Due to the variability in this muscle tonus, it made achieving consistency in the measurements difficult. However, this method is popular in clinical use and has been documented for almost 100 years as the Niswonger technique.[9] Additionally, all measurements were made by one investigator and were repeated twice for consistency. Secondly, the study was primarily conducted in a university setting. Due to the location of this university and the particular demographic represented there, the subject and judge racial and age distributions were not even. Finally, the use of a VAS in ratings for facial esthetics has inherent limitations. Reports on the accuracy of this rating system have been based on the judge's training and familiarity with the assessment instrument.[15] Additionally, prolonged exposures to VASs have shown to result in cognitive fatigue, which may additionally affect results.[16] Despite this drawback, VAS is known to be a widely popular method for evaluating facial esthetics and that has been used significantly in dental literature and sociopsychological literature.[14,17]

One final limitation of the study was that specific vertical facial patterns were not considered for inclusion or exclusion in the sample selection criteria. Thus, the results of the study may not apply to subjects with extreme variation in vertical facial patterns. Facial esthetics in patients with long facial patterns may be affected more readily with an increase in OVD since unfavorable facial characteristics such as a large interlabial gap and

incompetent lips may get accentuated. On the other hand, a patient with a short facial pattern may have a lesser impact or even a benefit with an increase in OVD. A future study segregating the sample based on vertical facial pattern could shed more light on this aspect.

Results from this study can be interpreted in two ways. The first interpretation is that increases in OVD in dentate patients with Class I occlusion by up to 5-mm AGP opening can effect minimal changes in LFH. Additionally, there is minimal change in facial esthetics as rated by general dentists, prosthodontists, and laypeople. This may provide some confidence to clinicians who are concerned that OVD increases in fixed dental rehabilitations may unfavorably affect LFH and facial esthetics. The second interpretation of the results is that clinicians should not increase a patient's OVD in fixed prosthetic rehabilitations, based solely on the objective of favorably improving LFH and facial esthetics. Decisions to increase a patient's OVD in fixed prosthodontics should be based on an eclectic approach that incorporates the patient's restorative needs, esthetics, occlusion, facial form, and ability of the jaw muscles to tolerate the increase. To the authors' best knowledge, this was the first study to make direct correlations between OVD and facial esthetics.

This research can provide the clinician with guidelines for making treatment decisions regarding increases in OVD and its effect on LFH and facial esthetics of a given patient.

Conclusions

Based on the findings of the study, the following conclusions were drawn:

1. There was an average increase in LFH of 0.63 mm for every 1-mm increase in AGP opening on the articulator using mandibular overlays (diagnostic occlusal prosthesis). However, LFH was uncorrelated to incremental increases in AGP opening. Systematic increases in AGP openings were not reflected in similar increase in measured facial height for all races and both sexes.
2. The relationship between ratings for facial esthetics and incremental increase in AGP opening of the articulator using mandibular overlays was not significant up to a 5-mm increase.
3. When the subject and judges were of the same race, there was a statistically significant impact on overall ratings of facial esthetics. Judges rated subjects of the same race slightly higher than subjects of other races. Though statistically significant, the magnitude of difference between the two values is very small, as the VAS was recorded on a scale of 1 to 100. These differences in facial esthetics ratings occurred irrespective of subjects' mandibular thickness.
4. When subject and judge sex were the same there was no statistically significant impact on ratings for facial esthetics ($P < .86$).
5. The ability of a judge to detect changes in facial esthetics with increases in AGP using mandibular overlays did not relate to a judge's background status (layperson, prosthodontist, or general dentist).

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