

## Association between Esthetic Parameter and Patient Satisfaction Level with Implant-Supported Dental Prosthesis in Anterior Region

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### Abstract

The increasing popularity of dental implants has resulted in rising expectations towards anterior dental implants. The self-evaluation Orofacial Esthetic Scale (OES) measures an individual's satisfaction level towards his/her appearance, meanwhile Pink Esthetic Score and White Esthetic Score (PES/WES) evaluates soft tissue and restoration aspects of anterior dental implants. The yet-undefined association between esthetic parameter and patient satisfaction level causes some difficulties for dentists to produce esthetic restorations that suit every patient's wishes.

We examined the association between esthetic parameters and patient satisfaction level with anterior dental implants. Thirty-three individuals ( $\geq 17$  years old) with anterior dental implants evaluated their satisfaction level using OES questionnaire. Intraoral photographs of six anterior teeth from each subject were assessed using PES/WES index. Pearson correlation was used to analyze the association between esthetic parameter and satisfaction level, and effect of sex, implant location, and age  $>35$  years. Spearman correlation was used to analyze the effect of age 17–35 years. A medium-strength ( $r=0.501$ ) positive correlation existed between esthetic parameter and satisfaction level ( $P=0.03$ ), and this had the greatest impact on female ( $P=0.03$ ), age  $>35$  years ( $P=0.01$ ), and maxillary central incisor ( $P=0.01$ ) groups. A significant correlation exists between esthetic parameter and patient satisfaction level.

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### Introduction

Technological advancement in recent years has caused increased popularity of dental implants. The high success rate (up to 97%) of implant-supported dental prostheses (ISDPs) generates an increase in patient interest to restore their lost tooth. This automatically leads to another increase in patient expectations towards ISDPs regarding their functional and esthetic aspects.<sup>1-3</sup>

An esthetic single ISDP in the anterior region depends on harmonious integration of the ISDP regarding the patient's overall appearance, particularly in the soft tissue area.<sup>4</sup> However, esthetic evaluation is objective and tends to vary

between individuals.<sup>5</sup> Various studies regarding subjective and objective evaluation of anterior ISDPs were conducted to evaluate the association between patients' and dentists' esthetic perceptions.<sup>6-10</sup> However, those studies have not reached a conclusive result.<sup>11</sup> The yet-undefined association between esthetic parameter and patient satisfaction level causes some difficulties for dentists to produce esthetic restorations that suit every patient's wishes.

In 2009, the Pink Esthetic Score and White Esthetic Score (PES/WES) was developed to evaluate soft tissue and restoration aspects of a single anterior region ISDP. These esthetic indices have had a high reproducibility rate and are user-friendly in a clinical setting.<sup>6,7</sup> Meanwhile, in 2010, Larsson et al.<sup>13</sup> developed the Orofacial Esthetic Scale (OES) questionnaire to specifically evaluate patient's orofacial esthetic perception after prosthodontic treatment. The OES questionnaire has excellent psychometric properties<sup>12-14</sup> and has been validated in Indonesia by Seftiana.<sup>15</sup>

We studied the association between

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esthetic parameter (using the PES/WES index) and satisfaction level (using the OES questionnaire) in subjects with an anterior region ISDP. Use of these indices and questionnaires is highly recommended to Indonesian dentists so as to improve the quality of esthetic restorations produced and, hence, patient's satisfaction level.

### Materials and methods

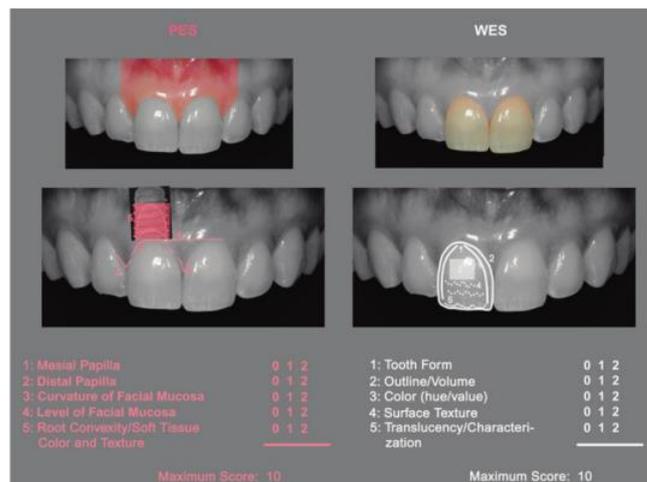
This cross-sectional study was approved by the ethical committee of the Faculty of Dentistry Universitas Indonesia (No.78/Ethical Approval/FKGUI/XII/2015), and was conducted at a privately-owned dental clinic Indo Dental Centre from August 2016 to July 2017. Inclusion criteria were age  $\geq 17$  years, presence of a single anterior region ISDP with a natural tooth in the contralateral area still intact, no history of diabetes mellitus, and that the ISDP had been restored for a minimum of 6 months.<sup>16</sup> Materials used were the OES questionnaire, PES/WES index, a contrastrer, digital single lens reflex (DSLR) camera (Nikon D90, AF micro Nikkor 105 mm 1:2.8 D; Nikon, Tokyo, Japan) with a twin flash, lip retractor, gloves, and masks.

Before obtaining data, the camera was calibrated to establish basic camera settings (aperture f22, shutter speed 1/125 seconds, ISO 100). The procedures by which the intraoral photographs of the six anterior teeth would be taken required use of a lip retractor and contrastrer as background. The operator ensured that the patient's Frankfurt horizontal plane was parallel to the DSLR camera. The camera lens was directed perpendicular to the cervical tooth margin to be photographed. Lastly, the operator confirmed that the single ISDP and natural tooth at the contralateral area were depicted clearly in one frame.

A total of 33 subjects matched the inclusion criteria and signed the provided informed consent. Intraoral photographs of six anterior teeth were obtained according to the aforementioned procedures (Figs. 1a, 1b).

**Figure 1.** Intraoral photographs. (a) Single ISDP tooth #22. (b) Single ISDP tooth #21

The subject then filled out the OES questionnaire based on the current perception of his/her orofacial esthetic, while the intraoral photograph was evaluated using PES/WES index guidelines (Fig. 2). An example of the PES/WES evaluation is shown in Table 1.



**Figure 2.** PES/WES index evaluation guideline.

| Parameter                                  | Absent            | Incomplete        | Complete       |
|--|-------------------|-------------------|----------------|
| Mesial papilla                             |                   | 1                 |                |
| Distal papilla                             |                   |                   | 2              |
|  | Major Discrepancy | Minor Discrepancy | No Discrepancy |
| Curvature of facial mucosa                 |                   | 1                 |                |
| Level of facial mucosa                     |                   |                   | 2              |
| Root Convexity/color & soft tissue texture |                   |                   | 2              |
| Total PES                                  |                   |                   | 8              |
| Parameter                                  | Major Discrepancy | Minor Discrepancy | No Discrepancy |
| Tooth form                                 |                   | 1                 |                |
| Volume/tooth outline                       |                   | 1                 |                |
| Color (hue/value)                          |                   | 1                 |                |
| Surface texture                            |                   | 1                 |                |
| Translucency                               |                   |                   | 2              |
| Total WES                                  |                   |                   | 6              |

**Table 1.** Example of PES/WES evaluation for Figure 1a, single ISDP tooth #22.

### Results

The Pearson correlation test showed a significant correlation between PES/WES and OES scores (correlation coefficient,  $r = 0.501$  and



$P = 0.03$  [ $< 0.05$ ], with a medium-strength positive correlation (Pearson correlation = 0.50; Table 2). However, in male subjects Pearson correlation analysis indicated no significant correlation between PES/WES and OES scores ( $r = 0.44$  and  $P = 0.07$  [ $> 0.05$ ]), indicating no significant correlation between esthetic parameter and patient satisfaction. Conversely, the same analysis in female subjects showed a significant correlation between esthetic parameter and patient satisfaction ( $r = 0.58$  and  $P = 0.03$  [ $< 0.05$ ]; Table 3).

|         | Range (Min.–Max.) | Median | Mean  | SD   | Correlation Coefficient (r) | P    |
|---------|-------------------|--------|-------|------|-----------------------------|------|
| OES     | 36–70             | 60     | 58.39 | 6.92 | 0.50                        | 0.03 |
| PES/WES | 9–20              | 15     | 14.09 | 2.42 |                             |      |

Note: SD = standard deviation.

**Table 2.** Correlation between PES/WES and OES scores.

|        |         | N (%)     | Range (Min.–Max.) | Mean  | SD   | Correlation Coefficient (r) | P    |
|--------|---------|-----------|-------------------|-------|------|-----------------------------|------|
| Male   | OES     | 18 (54.5) | 48–64             | 57.06 | 4.76 | 0.44                        | 0.07 |
|        | PES/WES | 18 (54.5) | 10–17             | 14.11 | 2.27 |                             |      |
| Female | OES     | 15 (45.5) | 36–70             | 60.00 | 8.77 | 0.58                        | 0.03 |
|        | PES/WES | 15 (45.5) | 9–20              | 14.07 | 2.66 |                             |      |

**Table 3.** Correlation of PES/WES and OES scores according to sex.

Correlation analysis according to age groups was performed using two different tests. Normality testing of the 17–35-year age group showed  $P = 0.041$  ( $< 0.05$ ), indicating that the data distribution for this group was abnormal and, therefore, a nonparametric test (Spearman correlation) was used, while the  $> 35$ -year age group remained with the Pearson correlation. There was no significant correlation between esthetic parameter and satisfaction level in the 17–35-year age group (Spearman correlation coefficient,  $r = 0.05$  and  $P = 0.86$  [ $> 0.05$ ]). The  $> 35$ -year age group, however, showed a significant correlation ( $r = 0.69$  and  $P = 0.001$  [ $< 0.05$ ]; Table 4).

|          |         | N (%)     | Range (Min.–Max.) | Mean  | SD   | Correlation Coefficient (r) | P    |
|----------|---------|-----------|-------------------|-------|------|-----------------------------|------|
| 17–35 y  | OES     | 13 (39.4) | 52–69             | 61.00 | 5.61 | 0.05                        | 0.86 |
|          | PES/WES | 13 (39.4) | 11–16             | 14.00 | 1.73 |                             |      |
| $> 35$ y | OES     | 20 (60.6) | 36–70             | 56.70 | 7.28 | 0.69                        | 0.00 |
|          | PES/WES | 20 (60.6) | 9–20              | 14.15 | 2.81 |                             |      |

**Table 4.** Correlation of PES/WES and OES scores according to age group

Correlation analysis according to implant location excluded two cases in the canine single ISDP subgroup because too few data were available in this subgroup to be analyzed statistically. Subjects with a central incisor single ISDP showed a significant correlation between esthetic parameter and patient satisfaction ( $r = 0.60$  and  $P = 0.01$ ). Meanwhile, subjects with a lateral incisor single ISDP showed no significant correlation ( $r = 0.29$  and  $P = 0.33$ ; Table 5).

|                 |         | N (%)     | Range (Min.–Max.) | Mean  | SD   | Correlation Coefficient (r) | P    |
|-----------------|---------|-----------|-------------------|-------|------|-----------------------------|------|
| Central Incisor | OES     | 18 (54.5) | 36–70             | 58.61 | 8.48 | 0.60                        | 0.01 |
|                 | PES/WES | 18 (54.5) | 9–20              | 14.56 | 2.53 |                             |      |
| Lateral Incisor | OES     | 13 (39.4) | 50–69             | 58.15 | 4.99 | 0.29                        | 0.33 |
|                 | PES/WES | 13 (39.4) | 12–15             | 13.54 | 2.33 |                             |      |
| Canine          | OES     | 2 (6.1)   | 56–60             | 58.00 | 2.83 | –                           | –    |
|                 | PES/WES | 2 (6.1)   | 12–15             | 13.50 | 2.12 |                             |      |

**Table 5.** Correlation of PES/WES and OES scores according to implant location.

## Discussion

The PES/WES and OES scores indicated a significant correlation between esthetic parameter and patient satisfaction. This finding agrees with the results of Cho et al.<sup>10</sup> and Al-Dosari et al.,<sup>17</sup> who reported a significant correlation between patients' and dentists' esthetic perception in terms of anterior teeth evaluation. This finding was unique because the OES questionnaire tends to evaluate orofacial esthetic as a whole, while PES/WES evaluates specifically the esthetic parameter of only one ISDP in the anterior region. The significant

correlation found between these two indices showed that patients tend to evaluate their anterior teeth as an integral part of their facial esthetic, and facial parts (such as, smile, lips, and nose) also may influence patient satisfaction.<sup>19</sup> The correlation between PES/WES and OES also may be explained by the tendencies of respondents to choose the middle value in a numeric rating scale, which is the type of scale used for OES. Sangster et al.<sup>20</sup> discovered that, in a self-evaluation situation, respondents tend to avoid negative values because they do not want to give a bad evaluation for themselves. Moreover, if the respondent filled out the questionnaire directly before any individual involved in the evaluation, he/she will tend to provide a better review than what he/she actually feels.<sup>20</sup>

We found a medium correlation strength between esthetic parameter and patient satisfaction level, indicating that even though patients' and dentists' esthetic perception as a whole were similar, they were not always in agreement.<sup>7,13</sup> Dentists tended to be more detailed in identifying esthetic changes in the teeth, but not all of these minor details are considered to be of importance for the patients.<sup>21</sup> Therefore, it is recommended to all dentists to continually involve the patients in generating and choosing the treatment plan needed for their oral rehabilitation. Patient expectations should be reviewed and adjusted to the plausible dental treatment in every case.<sup>11,17</sup> Mehl et al.<sup>22</sup> also emphasized the importance of patient education throughout the esthetic rehabilitation process. Dental education may act as a bridge that resolves the discrepancy between patient expectations and the actual clinical condition, which often causes miscommunication between dentists and patients.

The next step in data analysis revealed that the correlation between esthetic parameter and patient satisfaction level was significant in female subjects, subjects who were >35 years old, and those with a central incisor single ISDP. This means that esthetic changes caused by a single anterior region ISDP generate the highest satisfaction level in these three groups. Mehl et al.<sup>22</sup> explained this phenomenon by stating that female subjects tend to evaluate their appearance more critically than males. Therefore, esthetic changes in female subjects tend to generate higher statistical impacts

because females often are more expressive and emotional in their responses.<sup>19,22,23</sup>

The significant correlation found in the >35-year age group was parallel to the theory described by Tole et al.<sup>18</sup> and Luo et al.,<sup>24</sup> which stated that older patients tend to give higher satisfaction scores than younger patients, because older adults are not overly critical in their esthetic evaluation and generally have accepted aging as a physiologic process that they must go through. The difference in significance in these two age groups also may be caused by the difference in the way young and older adults evaluate smile esthetic, particularly the maxillary gingival display and black triangle in the embrasure of central incisors. Older adults are more tolerant towards the black triangle and prefer no gingiva to be present when smiling. This is because as an individual gets older, he/she tends to have more dental problems. Therefore, excessive tooth exposure that comes with the gingival display when smiling might highlight those problems and lessen his/her confidence.<sup>25</sup>

In the analysis regarding implant location, a significant correlation was found between esthetic parameter and patient satisfaction in subjects with a central incisor single ISDP ( $P = 0.01$ ). This finding was parallel to the result obtained by Cho et al.,<sup>10</sup> who stated that patient esthetic perception differed significantly based on the tooth being restored. This finding also was similar to the opinions of some esthetic experts who generally believe that the maxillary central incisor is the determining key factor in evaluation of the anterior teeth.<sup>26-28</sup> Wolfart<sup>23</sup> posited that the maxillary central incisor may affect someone's subconscious when he/she was asked to give an esthetic dental evaluation. Hasanreisoglu et al.<sup>29</sup> also reported similar results, stating that the maxillary central incisor was the most dominant tooth in determining the esthetic aspect of anterior teeth. They reasoned that this was due to the central incisors' position in the dental arch that allows these teeth to be viewed clearly without obstruction by any part of the lips.

Limitation of this study was the evaluation of PES/WES that was performed by 1 researcher only, which may cause bias in evaluation. Furthermore, photographs of the anterior teeth were taken only from the frontal side which may cause some parts of the teeth not to be displayed

clearly, such as the distal side of canine.

## Conclusions

There was a correlation between esthetic parameter and satisfaction level for patients with an anterior region ISDP. This correlation was medium-strength and positive in value. The correlation between esthetic parameter and patient satisfaction was influenced by age, sex, and implant location.

## Declaration of Interest

The authors report no conflict of interest.

## References

1. Luciano AA, Felipe J, Werlang G, Pavelski MD. A Retrospective Clinical Trial of the Early Success Rate of Osseointegrated Implants. *Dent Press Implantol* 2013;7(3):76-83.
2. Goodacre CJ, Bernal G, Rungcharassaeng K, Kan JYK. Clinical Complications with Implants and Implant Prostheses. *J Prosthet Dent* 2003;90(2):121-32.
3. Fugazzotto PA. Success and Failure Rates of Osseointegrated Implants in Function in Regenerated Bone for 72 to 133 Months. *Int J Oral Maxillofac Implant* 2005;20(1):77-83.
4. Hof M, Tepper G, Koller B, Krainhöfner M, Watzek G, Pommer B. Esthetic Evaluation of Single-Tooth Implants in the Anterior Mandible. *Clin Oral Implants Res* 2014;25(9):1022-6.
5. Wong A, Cheung C, McGrath C. Developing a Short Form of Oral Health Impact Profile(OHIP) for Dental Aesthetics: OHIP-Aesthetic. *Community Dent Oral Epidemiol* 2007;35(1):64-72.
6. Fürhauser R, Florescu D, Benesch T, Haas R, Mailath G, Watzek G. Evaluation of Soft Tissue Around Single-Tooth Implant Crowns: The Pink Esthetic Score. *Clin Oral Implants Res* 2005;16(6):639-44.
7. Belser UC, Grütter L, Vailati F, Bornstein MM, Weber H-P, Buser D. Outcome Evaluation of Early Placed Maxillary Anterior Single-Tooth Implants Using Objective Esthetic Criteria: A Cross-Sectional, Retrospective Study in 45 Patients with a 2- to 4-Year Follow-Up Using Pink and White Esthetic Scores. *J Periodontol* 2009;80(1):140-51.
8. Belser UC, Schmid B, Higginbottom F, Buser D. Outcome Analysis of Implant Restorations Located in the Anterior Maxilla: A Review of the Recent Literature. *Int J Oral Maxillofac Implants* 2004;19:30-42.
9. Tettamanti S, Millen C, Gavric J, et al. Esthetic Evaluation of Implant Crowns and Peri-Implant Soft Tissue in the Anterior Maxilla: Comparison and Reproducibility of Three Different Indices. *Clin Implant Dent Relat Res* 2016;18(3):517-26.
10. Cho H, Lee J, Um H, Chang B. Esthetic Evaluation of Maxillary Single-Tooth Implants in the Esthetic Zone. *J Periodontal Implant Sci* 2010;40(4):188-93.
11. Burgueño-Barris G, Cortés-Acha B, Figueiredo R, Valmaseda-Castellón E. Aesthetic Perception of Single Implants Placed in the Anterior Zone. A Cross-Sectional Study. *Med Oral Patol Oral Cir Bucal* 2016;21(4):e488-93.
12. John MT, Larsson P, Nilner K, Bandyopadhyay D, List T. Validation of the Orofacial Esthetic Scale in the General Population. *Health Qual Life Outcomes* 2012;10(1):1.
13. Larsson P, Nilner K. Reliability and Validity of the Orofacial Esthetic Scale in Prosthodontic Patients. *Int J Prosthodont* 2010;23(3):257-63.
14. Persic S, Celebic A. Psychometric Properties of the Croatian Version of the Orofacial Esthetic Scale and Suggestions for Modification. *Int J Prosthodont* 2011;24(6):523-34.
15. Seftiana E, Iratanti. The Relationship Between Width Height Ratio of Upper Anterior Teeth with Esthetic Perception (Based on Validated Orofacial Esthetic Scale). 2016.
16. Si M, Zhuang L, Huang X, Gu Y, Chou C, Lai H. Papillae Alterations Around Single-Implant Restorations in the Anterior Maxillae: Thick Versus Thin Mucosa. *Int J Oral Sci* 2012;4(2):94-100.
17. Al-dosari A, Al-rowis R, Moslem F, Alshehri F, Ballo AM. Esthetic Outcome for Maxillary Anterior Single Implants Assessed by Different Dental Specialists. *J Adv Prosthodont* 2016;8(5):345-53.
18. Luo Z, Zeng R, Luo Z, Chen Z. Single Implants in the Esthetic Zone: Analysis of Recent Peri-implant Soft Tissue Alterations and Patient Satisfaction. A Photographic Study. *Int J Oral Maxillofac Implants* 2011;26(3):578-86.
19. Flores-Mir C, Silva E, Barriga MI, Lagravère MO, Major PW. Lay person's perception of smile aesthetics in dental and facial views. *J Orthod* 2004;31(3):204-9.
20. Sangster RL, Willits FK, Saltiel J, Lorenz FO, Rockwood TH. The Effects of Numerical Labels on Response Scales. 1995. <https://www.bls.gov/ore/pdf/st010120.pdf>.
21. Shulman JD, Maupome G, Clark CD, Levy SM. Perceptions of Desirable Tooth Color Among Parents, Dentists and Children. *J Am Dent Assoc* 2004;135(5):595-604.
22. Mehl CJ, Harder S, Wolfart S, et al. Influence of Dental Education on Esthetic Perception. *Int J Esthet Dent* 2016;10(3):486-500.
23. Wolfart S, Quaas AC, Freitag S, Kropp P, Gerber WD, Kern M. Subjective and Objective Perception of Upper Incisors. *J Oral Rehabil* 2006;33(10):489-95.
24. Tole N, Lajnert V, Pavicic DK, Spalj S. Sex, Age, and Psychosocial Context of the Perception of Facial Esthetics. *J Esthet Restor Dent* 2014;26(2):119-31.
25. Sriphadungporn C, Chamnannididha N. Perception of Smile Esthetics by Laypeople of Different Ages. *Prog Orthod* 2017;18(8):1-8.
26. Rosenstiel SF, Ward DH, Rashid RG. Dentists' Preferences of Anterior Tooth Proportion - A Web-based Study. *J Prosthodont* 2000;9(3):123-36.
27. Goldstein R. Change Your Smile. In: Goldstein R, ed. Third Edit. Chicago: Quintessence; 1997:25-27.
28. GJ C, Pinault A. Esthetics of Anterior Fixed Prosthodontics. In: First Edit. Chicago: Quintessence; 1994:38-41.
29. Hasanreisoglu U, Berksun S, Aras K, Arslan I. An analysis of maxillary anterior teeth: Facial and dental proportions. *J Prosthet Dent* 2005;94(6):530-8.