

# The psychosocial impacts of implantation on the dental aesthetics of missing anterior teeth patients

P. Chen,<sup>1</sup> S. Yu<sup>2</sup> and G. Zhu<sup>3</sup>

## IN BRIEF

- Highlights that anterior implant-supported prostheses significantly improve adverse psychological effects precipitated by missing anterior teeth.
- Reports that the 'psychosocial impact of dental aesthetics questionnaire' (PIDAQ) could be used as an important tool for assessing the treatment effects of implantation in patients with missing anterior teeth.

**Objective** The aim of the current study was to investigate the psychosocial impact of dental aesthetics among patients who received anterior implant-supported prostheses. **Methods** The current study is a cross-sectional evaluation involving 115 individuals who had gone through treatment at the dental clinics of general hospitals. Participants completed the Chinese version of the psychosocial impact of dental aesthetics questionnaire (PIDAQ) before implantation and six months after crown restoration. Basic demographic information was recorded. Six months after implant crown restoration, participants were asked to self-assess their own oral aesthetics compared to before implantation. **Results** A total of 106 patients completed the study. PIDAQ scores correlated significantly with the self-assessment of the degree of oral aesthetics. Six months after crown restoration, the two factors (social impact and aesthetic attitude) decreased and the dental self-confidence score increased significantly compared to pre-implantation scores. Gender and education level significantly affected PIDAQ. **Conclusions** Anterior implant-supported prostheses significantly affected the patients' psychosocial perception. Implantation of missing anterior teeth can significantly improve patients' negative psychosocial impact of dental aesthetics. Gender and education level are correlated with the degree of improvement. The PIDAQ can be used in assessing the psychosocial effects of implantation in missing anterior teeth.

## INTRODUCTION

Unlike the posterior teeth, anterior teeth play a primary important role in the maintenance of an intact arch.<sup>1</sup> Although rarely life threatening, anterior teeth loss affects the quality of life in aspects of speech, chewing, aesthetics, self-esteem, psychological and social impacts for individuals.<sup>2,3</sup> It was noted that many patients who would accept edentulous spaces in posterior regions, found the anterior teeth indispensable. The leading cause of anterior teeth loss is trauma and upper incisors are the most frequently lost teeth involved in such cases because of their prominent anatomical location in the maxillary bone.<sup>4</sup> Apart from injury, anterior teeth loss is also associated with chronic periodontitis<sup>5</sup> and its

sequelae, as well as caries and congenital absence, making it a nidus for common disease in dental clinics.

The demand for anterior aesthetic restoration is increasing and presents clinical challenges.<sup>6,7</sup> Dental implant therapy is currently one of the most commonly used methods of replacing missing dentition. In comparison to conventional prostheses, implant-supported prostheses have a more natural feeling, stability, optimal aesthetics, phonetics and hygiene access with a minimally absorbed residual ridge.<sup>8,9</sup> Moreover, they can achieve a positive effect on social rehabilitation of an affected patient.<sup>10,11</sup> A previous study revealed that demand for dentures will most likely be requested if the upper or anterior tooth is missing.<sup>12</sup> Peck *et al.* reported that aesthetic, rather than functional factors, may determine a patient's subjective need to replace the missing teeth.<sup>13</sup> Anterior aesthetic appeal can help the whole body establish attractiveness and build self-esteem and happiness.<sup>14-16</sup> On the contrary, decayed anterior teeth were shown to have negative impact on perceptions of facial attractiveness.<sup>17</sup>

Although it is assumed that there are negative consequences for individuals with missing anterior teeth, little attention has been paid to the psychosocial impact of such treatment. This impact may have varying effects on peoples' daily life; for example, some patients are content with their unfavorable dentition because of their high level of psychosocial tolerance, while others may experience significant barriers to personal and social success.<sup>18-20</sup> The psychosocial impact of dental aesthetics questionnaire (PIDAQ) is an instrument that assesses the psychosocial impact of dental aesthetics and quality of life (QoL). Previously, this questionnaire has not been used in the study of implantation of anterior teeth.<sup>21</sup> PIDAQ contains 23 items, which are established based on the study of dental aesthetic and oral-health-related quality of life.<sup>22-24</sup> The reliability, validity and applicability of the PIDAQ for young adults in Brazil has been assessed.<sup>25</sup> Prior work has also shown that the translated Chinese version of PIDAQ demonstrates good reliability, validity and responsiveness.<sup>26</sup> The use of PIDAQ to assess the implant effects of missing anterior teeth

<sup>1</sup>Institute of Stomatology, the General Hospital of PLA, Beijing, 100853, China; <sup>2,3\*</sup>Department of Stomatology, the General Hospital of Jinan Military Command of PLA, Jinan, 250031, China

<sup>†</sup>Co-first author

\*Correspondence to: Guo-Xiong Zhu  
Email: zhuguoxiongkq@163.com;  
Tel: +86 531 5166 6423

may provide a tool to promote exchange between patients and dentists, and may help dentists to better meet patients' requirements.

Thus, the present study was performed to address the psychosocial impact of placing impact-supported prostheses in anterior teeth loss patients using valid and reliable sociodental and psychological measurement. The association between implant and psychosocial traits of dental aesthetics was compared before implant therapy and six months after implant-supported prosthodontic rehabilitation.

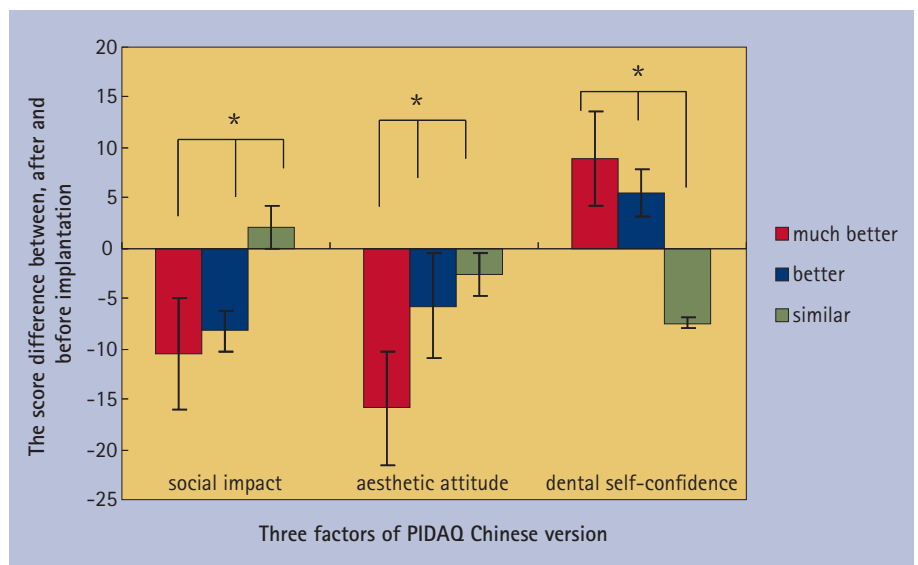
**MATERIAL AND METHODS**

**Patients**

Patients seeking anterior teeth implant therapy to replace their missing teeth were recruited for this study. All clinical procedures were approved by the Ethics Committee of the Jinan Military General Hospital of PLA. An invitation to participate in the study was extended to eligible patients. Each participant was given a detailed explanation of the study, and informed consent was obtained from each participant before inclusion. Patients with cleft lip, cleft palate, cognitive impairment and other serious congenital malformations were excluded from this study, as they may have scoring bias in the PIQAD. Also, participants were excluded if they had had previous implant therapy history or any local or systemic contra-indications to dental implant therapy. Inclusion criteria specified that the overall implant therapy of participants must be successful throughout the entire study period. Patients were excluded if any signs of failure occurred during any stage of the treatment.

**Assessment**

The assessment of the psychosocial impact of dental aesthetics was surveyed using the Chinese version of PIDAQ. One investigator, trained in PIDAQ, conducted all clinical and radiographic examinations and thoroughly assessed each patient before and after implant therapy. Questionnaires were completed between May 2011 and January 2012, before implant placement, and six months after the completion of implant crown restoration treatment. Age, gender and education level of the patients were recorded before implantation surgery.



**Fig. 1** The relationship of self-assessment of the oral aesthetic degree after implantation compared with pre-implantation, and scores of the differences between after and before implantation. The asterisk represents  $p < 0.05$  comparing different self-assessment of oral aesthetic degree. The correlation coefficient of the score differences and social impact, aesthetic attitude and dental self-confidence was  $-0.629$ ,  $-0.753$  and  $0.617$  respectively

Scales	Before implantation			After implantation			Paired differences	
	Mean (SD)	Median	Range	Mean (SD)	Median	Range	Mean (SD)	p value
Social impact	19.4 (3.74)	20	13-25	11.0 (6.09)	11.5	4-28	-8.3 (6.17)	<0.001
Aesthetic attitude	21.5 (5.79)	21.5	9-33	11.2 (6.11)	10.5	3-27	-10.3 (7.97)	<0.001
Dental self-confidence	3.8 (5.44)	1.5	0-19	10.6 (4.48)	11.0	2-17	6.0 (6.19)	<0.001

Patients were requested to fill out questionnaires in the department of stomatology.

The PIDAQ Chinese version consisted of 23 items, grouped into three dimensions: social impact, aesthetic attitude and dental self-confidence. The impact of each item was scored based on the importance of each dimension to the patient. Factor 1 (items 1-8) focused on the social impact of dental aesthetics (social impact). Factor 2 contained items 9-17, which reflected the aesthetic impact of individual attitudes (aesthetic attitude). Factor 3 contained items 18-23 and reflected the individual degree of confidence in dental aesthetics (dental self-confidence). A weight for each dimension was calculated on an individual basis by dividing the summed responses of that dimension by the total possible scale score. To construct an overall score, scores within each dimension were first calculated by multiplying the summed dimension response by the dimension weight. Patients responded to each item by selecting one of three response categories

in the form of a Likert response format that included (0, 'never'; 1, 'hardly ever'; 2, 'occasionally'; 3, 'fairly often' and 4, 'very often'). The PIDAQ was used to evaluate how frequently, before and after treatment, each patient had experienced any of the problems mentioned in the three dimensions. All participants completed the questionnaires before implant insertion and again six months after rehabilitation with implant-supported prostheses. The six-month time point following prosthetic rehabilitation has been shown to be an adequate period for the patients to adapt to new prostheses and provide a reliable assessment.<sup>27,28</sup> Higher scores of social impact and aesthetic attitude indicate that adverse effects of these two were greater, whereas the dental self-confidence score is proportional to the degree of confidence.

**Sample size**

In our pilot data of 20 patients, we found a 6.3 point average reduction on the social impact (standard deviation of 5.9)

**Table 2** The proportion of 'often' and 'very often' in social impact in PIDAQ before and after implantation (%)

Items in brief	Before implantation	After implantation	Ratio of before/after
1. Hold back when I smile	45.3	9.3	4.87
2. What others think	37.2	24.5	1.52
3. Offensive remarks	65.1	45.3	1.44
4. Inhibited in social contacts	52.3	4.7	11.12
5. Hide my teeth	54.7	9.3	5.88
6. People stare	24.4	4.6	5.30
7. Irritated on remarks	43.0	14.0	3.07
8. Worry about opposite sex	70.9	38.4	1.85
1-8	49.1	18.7	2.72

**Table 3** The proportion of 'often' and 'very often' in aesthetic attitude in PIDAQ before and after implantation (%)

Items	Before implantation	After implantation	Ratio of before/after
9. Envy	80.2	36.0	2.23
10. Somewhat distressed	33.7	10.5	3.21
11. Somewhat unhappy	14.0	15.2	0.92
12. Others have nicer teeth	38.4	16.3	2.36
13. Feel bad	39.6	2.3	17.22
14. Wish teeth looked better	100	51.2	1.95
15. Don't like teeth in mirror	40.7	10.5	3.88
16. Don't like teeth in photo	46.5	14.0	3.32
17. Don't like teeth on video	39.6	9.3	4.26
9-17	48.1	18.1	2.66

**Table 4** The proportion of 'often' and 'very often' in dental self-confidence in PIDAQ before and after implantation (%)

Items	Before implantation	After implantation	Ratio of after / before
18. Proud of teeth	4.7	23.3	4.96
19. Like to show teeth	10.6	24.5	2.31
20. Pleased to see teeth in mirror	13.9	29.1	2.09
21. Teeth are attractive	4.7	10.4	2.21
22. Satisfied with appearance	4.7	33.7	7.17
23. Find tooth position nice	14.0	24.4	1.74
18-23	8.8	24.3	2.76

at six months after rehabilitation with implant-supported prostheses. To reach a withdrawal rate of 40%,<sup>29</sup> a sample size of 102 patients was required ( $\alpha = 0.05$ ,  $\beta = 0.10$ ), which indicated that our current sample size was appropriate to provide sufficient statistical power.

### Statistical analysis

Participants who had two or more missing PIDAQ items or 'don't know' responses

were excluded from analysis according to an invalid scale, and for participants with one missing item or 'don't know' response, the value was replaced with the sample mean for the group. All the data were analysed using the statistic software SPSS 15.0 (SPSS Inc. Chicago, IL, United States). All numeric values were presented as median and mean  $\pm$ SD. We used multivariate analysis to examine the difference of all factor's scores of PIDAQ between

before implantation and after implantation. Differences in mean social impact, aesthetic attitude and dental self-confidence scores between the baseline and six-month interval were assessed with the paired t-test or Wilcoxon signed rank test. Comparisons (for example, changes in social impact score from before implantation to after implantation) between males and females, college education and high school education were evaluated using independent sample t-test and Mann-Whitney test. Pearson tests were used to analyse the relation of the scores of PIDAQ and self-assessment of patients. Statistical tests were two-tailed ( $\alpha = 0.05$ ). A p value less than 0.05 was considered as statistically significant.

### RESULTS

Of 115 patients, 9 patients were eliminated from follow-up due to changing resident city (five cases) or contact information (four cases). Hence they were excluded from the analysis. One hundred and six patients (64 females and 42 males) completed the scale and clinical examination. The mean participant age was  $43.5 \pm 11.5$  years (range from 31-56 years old). The majority of participants (72.6%) held a college degree (or higher) and the remaining 27.4% completed high school education. At six months after implant crown restoration, 24.5% patients thought the aesthetic degree was much better, 70.8% patients felt it was better, 4.7% patients considered it to be similar and no patient chose worse or much worse, compared with before implantation.

Upon clinical examination, the practising dentist did not find any implant or upper structure loose; crown loose, porcelain crack, gingival swelling, food impaction or significant dental calculus and debris.

The PIDAQ score variation between pre- and post-implantation was related to the self-assessment of the aesthetic degree of implant restoration. The correlation coefficients of social impact, aesthetic attitude and dental self-confidence were  $-0.629$ ,  $-0.753$  and  $0.617$  respectively. There were significant differences between different self-assessments of the aesthetic degree. The score of dental self-confidence was higher, the score of social impact and aesthetic attitude was lower, and the aesthetic degree of self-assessment was higher (Fig. 1).

Compared with pre-implantation, at six months after implant crown restoration,

the scores of social impact and aesthetic attitude decreased significantly, and the score of dental self-confidence increased significantly. The differences between before implantation and at six months after implant crown restoration were significant (Table 1).

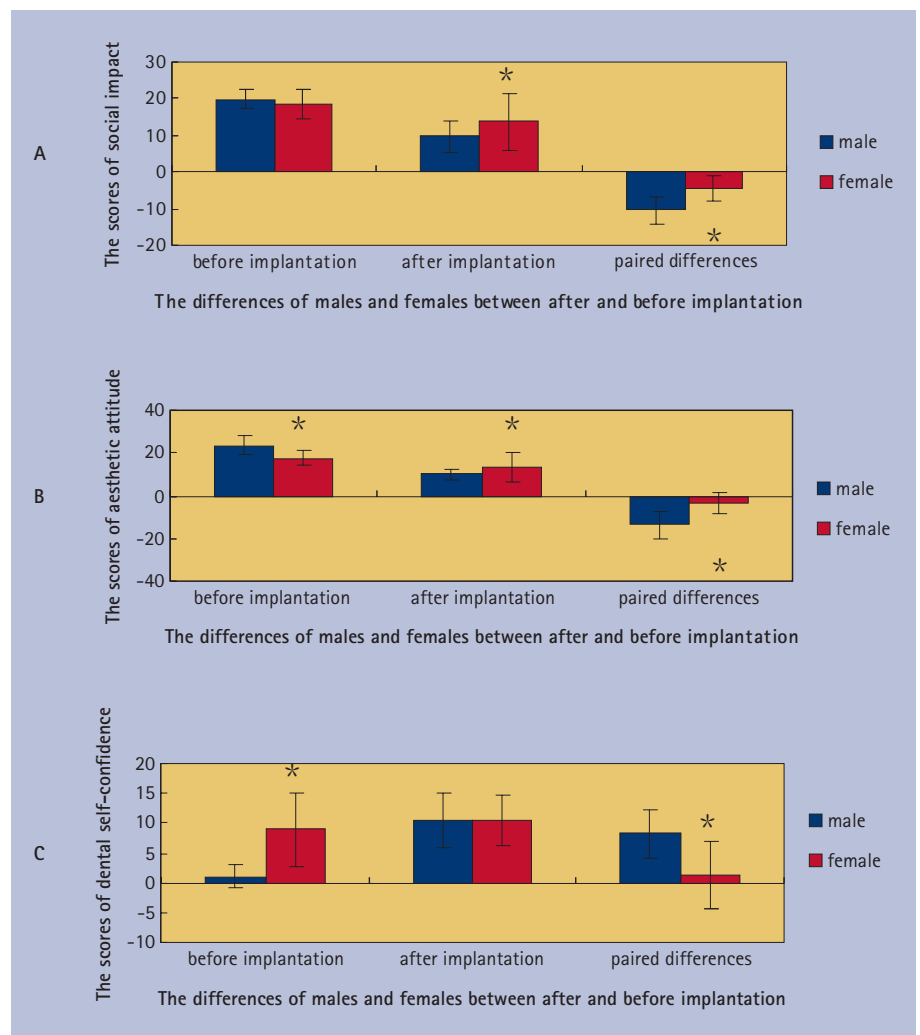
When considering social impact, aesthetic attitude and dental self-confidence from a specific item, when compared with before implantation, the proportion of 'fairly often' and 'very often' in item 4 (inhibited in social contacts), item 13 (feel bad), and item 22 (satisfied with appearance) showed the largest improvement. In short, implantation of missing anterior teeth may decrease the adverse social impact and aesthetic attitude. Additionally, dental self-confidence appeared to be improved (Tables 2-4).

Before implantation, the score of aesthetic attitude and dental self-confidence was significantly different between genders. The adverse aesthetic attitude in males was more obvious than in females, but the dental self-confidence in males was not stronger than females. After implantation, the adverse social impact and aesthetic attitude in males was significantly lower than in females, and still there was no significant difference between males and females in dental self-confidence. Compared between pre- and post-implantation, the improvement degree of PIDAQ in males was significantly greater than in females (Fig. 2).

Before implantation, the patients of a higher education level group obtained higher scores of social impacts and aesthetic attitude than the lower education level group. However, the higher education level group's score of dental self-confidence was lower. After implantation, the score of aesthetic attitude in lower education level was significantly decreased, compared with higher education level. Compared between pre- and post-implantation, the change degree of the score in social impact and aesthetic attitude in lower education level was significantly lower than the higher education level group (Fig. 3).

## DISCUSSION

Missing anterior teeth is fairly common<sup>30</sup> and the anterior zone is most demanding from an aesthetic, functional,



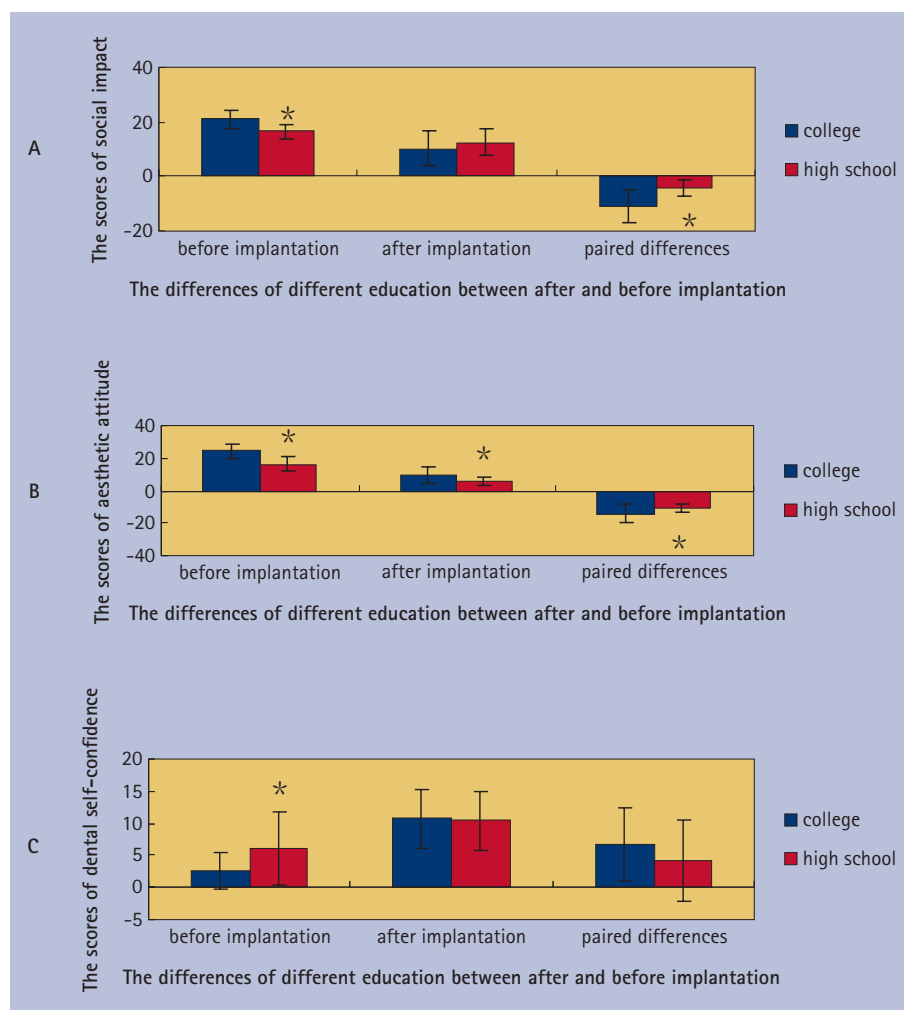
**Fig. 2** The scores of PIDAQ before and after implantation between males and females. The asterisk represents  $p < 0.05$  comparing males and females. a = the scores of social impact with different genders; b = the scores of aesthetic attitude with different genders; c = the scores of dental self-confidence with different genders

psychosocial and phonetic perspective.<sup>31</sup> Oral implantation of missing anterior teeth benefits not only dental health but also the overall and psychological well-being of the patient,<sup>32</sup> including confidence and self-esteem.<sup>33</sup> Implantation of missing anterior teeth has changed from focusing on a tooth as a unit to a patient as a unit. This paradigm shift is responsible for concern not only about the functional recovery of the tooth, but also the psychological health of the patient.<sup>34</sup>

Investigations of psychological impact of dental implant therapy are still insufficient. Patel *et al.* reported that edentulous patients experienced severe psychological complications that can be reduced by implant-supported prostheses.<sup>35</sup> Meanwhile, Al-Omiri MK *et al.* carried out a similar investigation of the psychological influence of dental implant treatment and reported that implant treatments had a

favourable effect on patients.<sup>36</sup> In another study, Torres *et al.* suggested that dental implant therapy has a significant effect on psychological effects when compared with conventional prostheses.<sup>37</sup>

As a valid and reliable test, the PIDAQ was used to measure the aesthetic profile of subjects before and after implant treatment, as there was no other test regarding oral aesthetic psychology that has been used in oral medicine. This questionnaire was validated for a Chinese population in previous studies and was judged valid and reliable.<sup>26</sup> The PIDAQ test measures three dimensions of psychosocial impacts, and is, simply, a reproducible, statistically easy test to use and can be completed in a short time. Studies about PIDAQ should be undertaken in patients undergoing oral restorative treatment in the anterior region<sup>38</sup> and implantation of missing anterior teeth is a very important restorative



**Fig. 3** The scores of PIDAQ before implantation and after crown restoration between different education levels. The asterisk represents  $p < 0.05$  comparing the college and high school education levels. a = the scores of social impact with different education levels; b = the scores of aesthetic attitude with different education levels; c = the scores of dental self-confidence with different education levels

procedure. In this study, each patient was set up as his/her own control. A within-subject control study design promoted the reliability of the current protocol. Our findings demonstrated that implant-supported prostheses improved patients' psychosocial ratings. Additionally, a relationship was established between psychosocial traits and impacts of implant therapy on patient with anterior teeth missing.

Our study showed that the self-assessment of the aesthetic degree after anterior teeth implantation had a relationship with the PIDAQ scores, judged by correlation coefficients of the three factors. The scores from pre- and post-implantation, showed that implantation impacted the adverse effects caused by missing anterior teeth by leading to significant improvements in social impact, aesthetic attitude and dental self-confidence. Changes in the proportion of 'fairly often' and 'very often' after

implantation also suggested that restoration of missing anterior teeth can improve the patients' quality of life.

In considering social impact, the treatment of implantation had the best improvement in 'inhibited in social contacts', which can increase the patients' self-esteem and social interaction capabilities. Before implantation, most people in the aesthetic attitude 'wished teeth looked better', which was a direct response of the impact from missing anterior teeth. And the biggest improvement of 'satisfied with appearance' in dental self-confidence showed that implantation in anterior teeth had a close relation with the improvement of patients' appearance.

The patient sample contained a higher percentage of females than males. A common preconception is that females have more critical oral demands and are more concerned about their dental status.<sup>39,40</sup>

Meanwhile, males are less demanding with regard to appearance and performance because of the nature of their social life.<sup>41</sup> In contrast, a prior study found that men regarded dental appearance as more important than women<sup>42</sup> and other studies found that the differences were not significant.<sup>43,44</sup> In the current study, the adverse aesthetic attitude and dental self-confidence of males was more obvious than females when anterior teeth were missing before implantation. This can be explained by the opinion that females are typically more stable psychologically and lead a less stressful social life than males.<sup>45</sup> After implantation, the results showed the same tendency: that social impact, aesthetic attitude and dental self-confidence were more improved in males than females, which suggested that males expressed greater satisfaction with implantation treatment in anterior teeth. Females were more critical regarding their dental appearance and function.<sup>46-49</sup>

There was a relationship between education level and dental aesthetic satisfaction. With an increase in education level, the dissatisfaction with dental aesthetics decreased.<sup>50</sup> In this study, the higher education level population chose implantation when anterior teeth were missing more than the lower education level. These results suggested that a higher education level population had knowledge that there is some link between dental appearance and social status expressed by better jobs and social acceptability.<sup>51</sup>

After implant treatment, the social impact and aesthetic attitude of patients with higher education had improved more than patients with lower education, but there were no significant differences in dental self-confidence. This suggested that the higher education level population paid more attention to adverse social impact and aesthetic attitude resulting from missing anterior teeth than the lower education level population. However, the change in the degree of dental self-confidence had no relation to education level.

Our current study has some limitations. Firstly, the current sample size is relatively small, although it can provide sufficient power. Once stratified, the sample size is even smaller, which further reduces the statistical efficacy. Secondly, the current study lacks long-term follow-ups, such

as one year or longer after implantation. What's more, our study analysed only limited social factors such as gender and education level. Other factors, such as skill of the operating dentist, degree of missing teeth (single loss, multiple loss, partial loss etc), implanting materials, health condition, income, etc, are also very important to the psychological impact. Hence, additional studies with larger sample sizes, longer follow-up time, diverse impact factors, and comparison of implantation to traditional restorative treatment protocols are needed to further investigate the potential psychological effects of implantation on dental aesthetics.

## CONCLUSION

PIDAAQ is an instrument that assesses the psychosocial impact of dental aesthetics and quality of life. The aesthetic degree following implantation correlated negatively with the scores of social impact and aesthetic attitude, but positively with the scores of dental self-confidence. Implantation of anterior teeth significantly improved adverse psychological and quality-of-life effects precipitated by missing anterior teeth. Gender and education level both significantly affected PIDAAQ before implantation and after crown restoration. This study showed that PIDAAQ could be used as an important tool for assessing the treatment effects of implantation in patients with missing anterior teeth.

*The significant statistical contributions to this research by L. L. Yu, Medical Records Department, General Hospital of Jinan Military Region of PLA, are greatly appreciated. None of the authors had conflicts of interest.*

- Oh W S, Basho S. Esthetic removable partial denture design in replacing maxillary anterior teeth. *Gen Dent* 2010; **58**: e252–e256.
- Heinlein W D. Anterior teeth: esthetics and function. *J Prosthet Dent* 1980; **44**: 389–393.
- Schwartz H. Anterior guidance and aesthetics in prosthodontics. *Dent Clin North Am* 1987; **31**: 323–332.
- Osagbemiro B B, Akadir O A, Arigbede A O. Patients' attitude towards anterior teeth extraction and prosthetic replacement at the UPTH Dental Center, Port Harcourt. *Niger J Med* 2011; **20**: 52–56.
- Byahatti S M, Ingafou M S. Reasons for extraction in a group of Libyan patients. *Int Dent J* 2011; **61**: 199–203.
- Van der Geld P, Oosterveld P, Van Heck G, Kuijpers-Jagtman A M. Smile attractiveness. Self-perception and influence on personality. *Angle Orthod* 2007; **77**: 759–765.
- Sackstein M. Display of mandibular and maxillary anterior teeth during smiling and speech: age and sex correlations. *Int J Prosthodont* 2008; **21**: 149–151.
- el Salam el Askary A. A multidisciplinary approach to enhance implant esthetics: case report. *Implant Dent* 2003; **12**: 18–23.
- Furze D, Byrne A, Donos N, Mardas N. Clinical and esthetic outcomes of single-tooth implants in the anterior maxilla. *Quintessence Int* 2012; **43**: 127–134.
- Mericske-Stern R. Prosthetic considerations. *Aust Dent J* 2008; **53**: S49–S59.
- Schwartz-Arad D, Levin L. Post-traumatic use of dental implants to rehabilitate anterior maxillary teeth. *Dent Traumatol* 2004; **20**: 344–347.
- Mukatash G N, Al-Rousan M, Al-Sakarna B. Needs and demands of prosthetic treatment among two groups of individuals. *Indian J Dent Res* 2010; **21**: 564–567.
- Peck H, Peck S. A concept of facial esthetics. *Angle Orthod* 1970; **40**: 284–318.
- Hunt O, Hepper P, Johnston C, Stevenson M, Burden D. Professional perceptions of the benefits of orthodontic treatment. *Eur J Orthod* 2001; **23**: 315–323.
- Patzner G L. Improving self-esteem by improving physical attractiveness. *J Esthet Dent* 1997; **9**: 44–46.
- Gerritsen A E, Allen P F, Witter D J, Bronkhorst E M, Creugers N H. Tooth loss and oral health-related quality of life: a systematic review and meta-analysis. *Health Qual Life Outcomes* 2010; **8**: 126.
- Kershaw S, Newton J T, Williams D M. The influence of tooth colour on the perceptions of personal characteristics among female dental patients: comparisons of unmodified, decayed and 'whitened' teeth. *Br Dent J* 2008; **204**: E9.
- Atchison K A, Der-Martirosian C, Belin T R, Black E E, Gironda M W. Predictors of risk tolerance among oral surgery patients. *J Oral Maxillofac Surg* 2010; **68**: 2947–2954.
- Adolfi D, de Freitas A J, Groisman M. Achieving aesthetic success with an immediate-function implant and customized abutment and coping. *Pract Proced Aesthet Dent* 2005; **17**: 649–654.
- Kerosuo H, Hausen H, Laine T, Shaw W C. The influence of incisal malocclusion on the social attractiveness of young adults in Finland. *Eur J Orthod* 1995; **17**: 505–512.
- Klages U, Claus N, Wehrbein H, Zentner A. Development of a questionnaire for assessment of the psychosocial impact of dental aesthetics in young adults. *Eur J Orthod* 2006; **28**: 103–111.
- Klages U, Bruckner A, Zentner A. Dental aesthetics, self-awareness, and oral health-related quality of life in young adults. *Eur J Orthod* 2004; **26**: 507–514.
- Klages U, Bruckner A, Guld Y, Zentner A. Dental esthetics, orthodontic treatment, and oral-health attitudes in young adults. *Am J Orthod Dentofacial Orthop* 2005; **128**: 442–449.
- Gazit-Rappaport T, Haisraeli-Shalish M, Gazit E. Psychosocial reward of orthodontic treatment in adult patients. *Eur J Orthod* 2010; **32**: 441–446.
- Sardenberg F, Oliveira A C, Paiva S M, Auad S M, Vale M P. Validity and reliability of the Brazilian version of the psychosocial impact of dental aesthetics questionnaire. *Eur J Orthod* 2011; **33**: 270–275.
- Lin H, Quan C, Guo C, Zhou C, Wang Y, Bao B. Translation and validation of a Chinese version of the psychosocial impact of dental aesthetics questionnaire. *Eur J Orthod* 2011; **17**: epub ahead of print.
- Katsoulis J, Nikitovic S G, Spreng S, Neuhaus K, Mericske-Stern R. Prosthetic rehabilitation and treatment outcome of partially edentulous patients with severe tooth wear: 3-years results. *J Dent* 2011; **39**: 662–671.
- Heydecke G, Locker D, Awad M A, Lund J P, Feine J S. Oral and general health-related quality of life with conventional and implant dentures. *Community Dent Oral Epidemiol* 2003; **31**: 161–168.
- Johannsen A, Wikesjö U, Tellefsen G, Johannsen G. Patient attitudes and expectations of dental implant treatment – a questionnaire study. *Swed Dent J* 2012; **36**: 7–14.
- Towfighi P P, Brunsvold M A, Storey A T, Arnold R M, Willman D E, McMahan C A. Pathologic migration of anterior teeth in patients with moderate to severe periodontitis. *J Periodontol* 1997; **68**: 967–972.
- Tatum R C, Tatum B M, Marfatia-Rege A T, Amant K S. Immediate esthetic treatment for anterior teeth: report of cases. *J Am Dent Assoc* 1989; **118**: 575–577.
- Peñarrocha-Oltra D, Peñarrocha-Diogo M, Balaguer-Martinez J, Ata-Ali J, Peñarrocha-Diogo M. Full-arch fixed prosthesis supported by four implants in patients with recessive dystrophic epidermolysis bullosa. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2011; **112**: e4–10.
- Kapur A, Chawla H S, Goyal A, Gaube K. An esthetic point of view in very young children. *J Clin Pediatr Dent* 2005; **30**: 99–103.
- Ponsi J, Lahti S, Rissanen H, Oikarinen K. Change in subjective oral health after single dental implant treatment. *Int J Oral Maxillofac Implants* 2011; **26**: 571–577.
- Patel P B, Brown S, Nazarian A. A better quality of life with implant-retained overdentures. *Dent Today* 2012; **31**: 156, 158.
- Al-Omiri M K, Hammad O A, Lynch E, Lamey P J, Clifford T J. Impacts of implant treatment on daily living. *Int J Oral Maxillofac Implants* 2011; **26**: 877–886.
- Torres B L, Costa F O, Modena C M, Cota L O, Côrtes M I, Seraidarian P I. Association between personality traits and quality of life in patients treated with conventional mandibular dentures or implant-supported overdentures. *J Oral Rehabil* 2011; **38**: 454–461.
- Gazit-Rappaport T, Haisraeli-Shalish M, Gazit E. Psychosocial reward of orthodontic treatment in adult patients. *Eur J Orthod* 2010; **32**: 441–446.
- Shaw W C. Factors influencing the desire for orthodontic treatment. *Eur J Orthod* 1981; **3**: 151–162.
- Sheats R D, McGorray S P, Keeling S D, Wheeler T T, King G J. Occlusal traits and perception of orthodontic need in eighth grade students. *Angle Orthod* 1998; **68**: 107–114.
- Al-Omiri M K, Karasneh J A, Lynch E, Lamey P J, Clifford T J. Impacts of missing upper anterior teeth on daily living. *Int Dent J* 2009; **59**: 127–132.
- Carlsson G E, Johansson A, Johansson A K, Ordell S, Ekback G, Unell L. Attitudes toward dental appearance in 50- and 60-year-old subjects living in Sweden. *J Esthet Restor Dent* 2008; **20**: 46–55.
- Xiao J, Zhou X, Zhu W D, Zhang B, Li J Y, Xu X. The prevalence of tooth discoloration and the self-satisfaction with tooth colour in a Chinese urban population. *J Oral Rehabil* 2007; **34**: 351–360.
- Akarslan Z, Sadik B, Erten H, Karabulut E. Dental esthetic satisfaction, received and desired dental treatments for improvement of esthetics. *Indian J Dent Res* 2009; **20**: 195–200.
- Wang S W, Repetti R L, Campos B. Job stress and family social behavior: the moderating role of neuroticism. *J Occup Health Psychol* 2011; **16**: 441–456.
- Samorodnitsky-Naveh G R, Geiger S B, Levin L. Patients' satisfaction with dental esthetics. *J Am Dent Assoc* 2007; **138**: 805–808.
- Vallittu P K, Vallittu A S, Lassila V P. Dental aesthetics – a survey of attitudes in different groups of patients. *J Dent* 1996; **24**: 335–338.
- Hassel A, Wegener I, Rolko C, Nitschke I. Self-rating of satisfaction with dental appearance in an elderly German population. *Int Dent J* 2008; **58**: 98–102.
- Tin-Oo M M, Saddki N, Hassan N. Factors influencing patient satisfaction with dental appearance and treatments they desire to improve aesthetics. *BMC Oral Health* 2011; **11**: 6.
- Akarslan Z Z, Sadik B, Erten H, Karabulut E. Dental esthetic satisfaction, received and desired dental treatments for improvement of esthetics. *Indian J Dent Res* 2009; **20**: 195–200.
- Graham R, Mihaylov S, Jepson N, Allen P F, Bond S. Determining 'need' for a removable partial denture: a qualitative study of factors that influence dentist provision and patient use. *Br Dent J* 2006; **200**: 155–158.