# Evaluation of the Relationship between Subjects' Perception and Professional Assessment of Esthetic Treatment Needs

DIMITRIOS TORTOPIDIS, DDS, PHD*
ANDREAS HATZIKYRIAKOS, DDS, PHD†
MARIA KOKOTI, DDS, PHD*
GEORGE MENEXES, BA, PHD‡
NIKOLAOS TSIGGOS, DDS, PHD§

ABSTRACT

*Purpose:* The purposes of the present study were to (1) evaluate the esthetic dental treatment need by means of two special questionnaires, (2) determine the reliability and the construct validity of the measurement scales derived from these questionnaires, and (3) investigate the relationship between Greek subjects' perception and a professional examiner's assessment regarding the esthetic treatment need.

*Materials and Methods:* Participants in this survey consisted of 132 subjects (48 males with mean age 39.0 ± 14.5 years old, 84 females with mean age 41.7 ± 14.5 years old) with natural teeth and fixed restorations. Subjects were asked to complete a special self-evaluation questionnaire consisting of 12 items. During the next stage, all participants were clinically examined by an experienced examiner and the data collected were used to fill out a second special professional assessment questionnaire consisting of 20 items. The forms structure used were in accordance with well-established indices used in orthodontics for assessing esthetic treatment need.

*Results:* The reliability of the multiple correspondence analysis (MCA) analysis-derived scales was very satisfactory (Cronbach's a coefficient: a = 0.82) for the total scale of the self-evaluation measurement. For the professional assessment scale, the reliability of the total scale was almost perfect (a = 0.92). The MCA revealed one reliable factorial construct for the self-evaluation measurement scale and two reliable constructs for the professional measurement scale. Pearson's correlation coefficient indicated a very low agreement between self-evaluation and professional measurement scales.

*Conclusion:* The findings of this survey suggest that there was a relative disagreement between subjects' perception and professional assessment regarding the need for esthetic dental treatment.

CLINICAL SIGNIFICANCE

In the present survey, the agreement between subjects' perception and clinical assessment of esthetic dental treatment need was found to be very low, which highlighted the discrepancies between patients' and dentists' perceptions of esthetic needs.

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*Lecturer, Department of Fixed Prosthesis and Implant Prosthodontics, Dental School, Aristotle University of Thessaloniki, Greece
†Associate professor, Department of Fixed Prosthesis and Implant Prosthodontics, Dental School, Aristotle University of Thessaloniki, Greece
‡Senior statistician, Department of Applied Informatics, University of Macedonia, Thessaloniki, Greece
§Assistant professor, Department of Fixed Prosthesis and Implant Prosthodontics, Dental School, Aristotle University of Thessaloniki, Greece




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## INTRODUCTION

An important aspect of restorative treatment is the improvement of dental esthetics to enhance patients' expectations and requirements. Subjective assessment questionnaires and interview methods as well as orthodontic and dental esthetic indices have been introduced in studies for the evaluation of a patient's dentofacial appearance using scales, rankings, and scoring systems.[1–4] Photographs of shape, symmetry, and proportion of maxillary incisors[5] and computer-aided image manipulations of photographs[6,7] have also been used in comparative studies of assessment of dental appearance by dentists and nondental subjects.

The reported discrepancy between the patient's and the dentist's perception of dentofacial esthetics[5,6,8] may give rise to problems when it comes to esthetic treatment planning, depending on the patient's readiness for going through the proposed treatment.

Therefore, it is of vital importance for the dentist to be able to define what exactly the patient requires and what actually he or she needs relative to the esthetic restorative treatment.

The aims of the present survey were to: (1) evaluate the esthetic treatment need by means of two special questionnaires; (2) assess the reliability and construct validity of the measurement scales derived from the questionnaires; and (3) examine the relationship between Greek subjects' perception and professional assessment regarding the need for esthetic dental treatment.

## MATERIALS AND METHODS

The study sample consisted of 132 volunteer subjects, of whom 48 were males (mean age 39.0 ± 14.5 years old) and 84 were females (mean age 41.7 ± 14.5 years old). The participants' ages ranged from 17 to 65 years. The subjects were selected from patients referred to the Fixed Prosthesis and Implant Prosthodontics clinics at the University of Thessaloniki Dental School in North Greece for routine prosthetic rehabilitation during a 6-month period in 2005. All the participants had continuous natural dentitions with natural teeth or fixed restorations on posterior teeth, and with no crowns or porcelain laminate veneers in the anterior maxillary segment, except possibly composite resin restorations.

The subjects gave written informed consent to the survey procedures, which were approved by the Ethical Committee of the School of Dentistry, Aristotle University of Thessaloniki, Greece. All the participants knew about the aim of the study and that knowledge may have made them more conscious of dental esthetics than the average population.

### Questionnaires

The first questionnaire used was a self-evaluation questionnaire consisting of 11 simple Yes–No questions (items) aiming to measure the patient's perception of esthetic dental treatment need (Figure 1). One supplementary question (item S12) was left open to be filled and was used mainly for controlling the outcome of the previous stated answers.

The self-evaluation questionnaire (subjective) was composed according to the existing archive of previous evaluation forms,[9–12] with the main aims of achieving simplicity and clarity and avoiding content overlaps and complex terminology. Various additional demographical data have also been collected, pertaining to individual sociocultural condition and including factors such as age, gender, and level of education. The subjects were asked to fill out the self-evaluation questionnaire in the waiting room of the dental clinic (without external interference).

The second professional assessment questionnaire was filled out by an experienced examiner (D.T.) and consisted of three subparts. The first (dentofacial analysis) consisted of four items, the second (dental analysis) comprised three items, and the last one (general dental information) included 13 items where the dentist responded with a

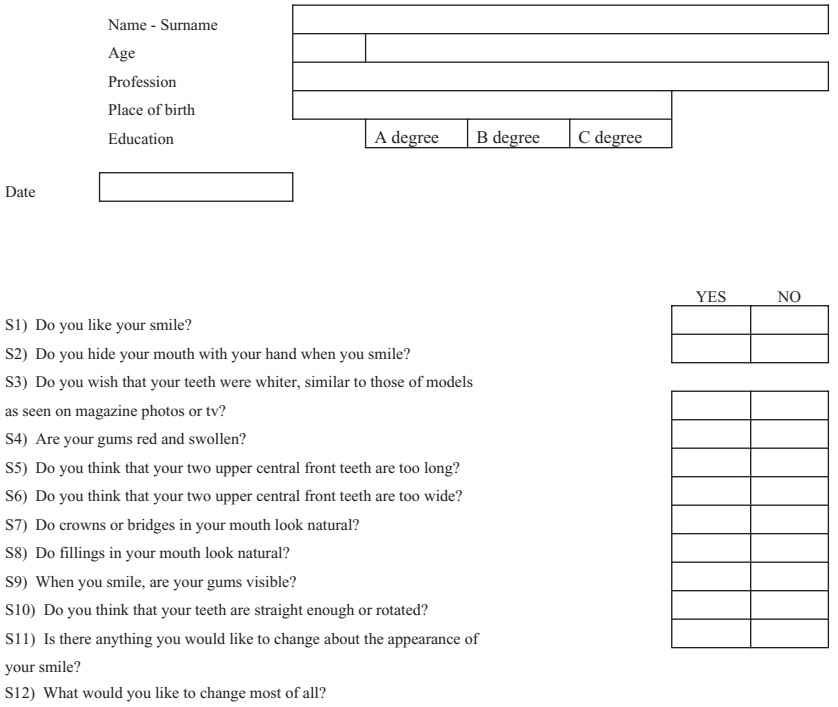


*Figure 1. Evaluation of esthetic treatment need. Self-evaluation questionnaire.*

"Yes" or "No" (Figure 2). The professional (objective) assessment form structure used is in accordance with previous well-established indices[1,4,9,13–16] introduced in orthodontic treatment and esthetic rehabilitation. Informational data collected using standard mirrors and graded calipers were subsequently filled in the special clinical assessment form, regarding the esthetic dental treatment need. Specific issues addressed were:

- the relationship between the upper lip line and the incisor position; the normal geometry definition involves the upper lip covering half of upper teeth height[17](1Ma)
- number of exposed teeth at full smile[18] (1Mb)
- upper midline coincidence with filtrum and upper midline coincidence with lower midline[19] (1Mc,d)
- proportions of central incisors (as measured with special caliper)[20]; the ratio between the width and the height was computed and divided into two classes (above and below 90%) (2a)
- angle classification and skew angles (2b,c)
- data concerning geometry and condition of soft periodontal tissues, such as gingival height asymmetry, discolorations, possible inflammation (discovered after clinical visual examination, with the use of periodontal probe)[21] (3IN1,2,3)
- existence of crowded, rotated, or widely spaced teeth (3IN4,5,6)
- existence of possible wear on occlusal surfaces or discolorations (3IN7,8)
- evaluation of crowns and fillings, regarding their structural integrity, shape, shade, and marginal accuracy (with the use of a probe) (3IN9,10,11,12,13)

**Calibration**

Initially, the professional assessment questionnaire was filled out by four evaluators. The four evaluators (authors) held a series of calibration sessions to reduce the effect of examiner subjectivity and allow the study focus to be on the effect of experience. A sample of 30 subjects was assessed twice by each evaluator (midperiod 4 weeks). In order to examine their reliability–consistency, the Cohen's kappa coefficient was estimated for the items of the professional assessment questionnaire. The final data of the study were filled in by the examiner (D.T.), who showed the highest interexaminer reliability. The reliability levels varied from 0.85 to 1.

**Statistical analysis**

All the statistical analyses were performed using the SPSS v.13 software (SPSS Inc., Chicago, IL, USA) enhanced with the module "Categories." As there was no prior

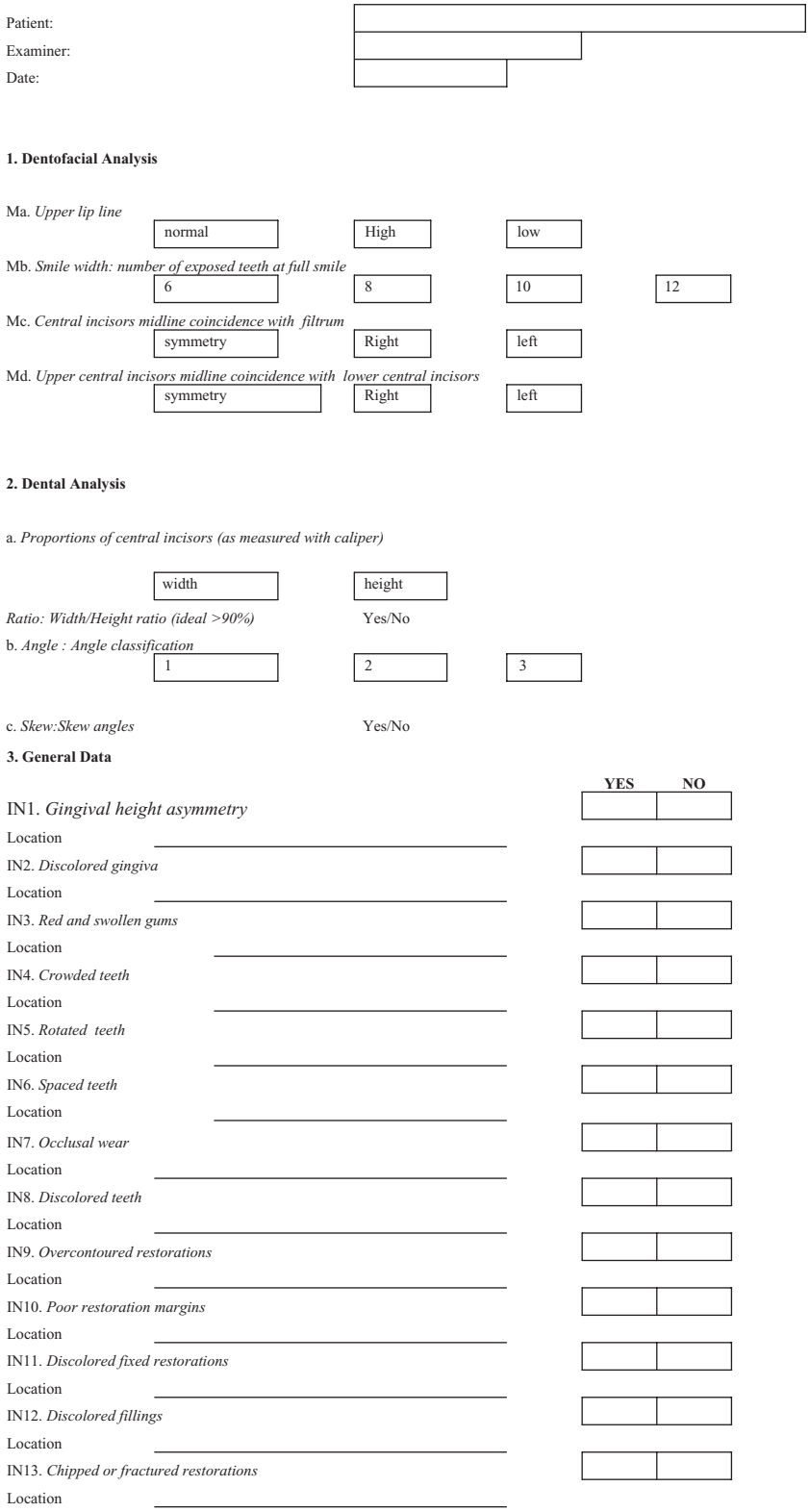


*Figure 2. Evaluation of esthetic treatment need. Professional assessment questionnaire.*

evidence relative to the validity and the reliability of the measures (scales) used to assess the patient's perception and professional assessment questionnaires, we applied a post-hoc procedure based on multidimensional data analysis methods. As a result of the categorical scaling (nominal, ordinal) of the available data, special attention was given to the selection of the appropriate statistical methods used.

Therefore, in order to test the construct or factorial validity[22,23] of the proposed measurement scales, we applied the multiple correspondence analysis (MCA).[24] Although the numerical and graphical results produced by the MCA are very informative in many ways, in the present study we used this method as a pure data reduction technique with optimal scaling features.

To test the reliability—in the sense of internal consistency—of the measurement scales, the Cronbach's a coefficient was used.[25] In order to summarize the available information and develop indices of self-evaluation and professional assessment, two scores for each participant were calculated based on the optimal scaling properties of MCA.

The relationship between subjects' perception and the professional assessment data regarding the esthetic treatment need was

estimated by means of Pearson's correlation coefficient.

## RESULTS

### Reliability and Validity of Measurement Scales

The results of the reliability and validity testing of the self-evaluation and professional measurement scales are listed in Tables 1 and 2.

The discrimination measures presented in the tables can be considered as square loadings in the same sense as the factor loadings in principal components analysis.[26] In order to clarify the interpretation of the factorial axes, and taking into consideration the relatively small total sample size ($N = 132$), we set the lower limit of the clinical significance of the discrimination measures to $\sqrt{30.20}$. The MCA revealed three factors for the self-evaluation scale and three factors for the objective scale as well.

For the self-evaluation measurement scale, the MCA provided three factors that explained 82% of the total variance. The Cronbach's a coefficient for the total scale consisting of the three axes is equal to 0.89, and it is considered very satisfactory. The first factor F1S explains 38.1% of the total variance, and the items that mainly load are S1, S11, S7, S10, S2, and S8. The reliability of the factor is a = 0.64 (satisfactory, above the lowest acceptable limit of 0.60).[27] The second factor F2S explains 22.2% of the total variance, and the items that mainly load are S3, S9, and S11. The reliability of the factor is a = 0.31 (unsatisfactory, below the limit of 0.60). The third factor F3S explains 21.7% of the total variance and the items that mainly load are S6, S4, and S5. The reliability of the factor is a = 0.30 (unsatisfactory).

For the professional measurement scale, the MCA provided three factors that explained 63.5% of the original variance. The Cronbach's a coefficient for the total scale consisting of the three axes is equal to 0.92, and it is considered almost perfect. The first factor F1o explains 29.5% of the total variance, and the items that mainly load are IN10, IN9, IN11, IN13, IN1, and IN3. The reliability of the factor is a = 0.76 (satisfactory). The second factor F2o explains 19.5% of the total variance, and the items that mainly load are IN2, MD, IN5, MC, IN3, and Skew. The reliability of the factor is a = 0.62 (satisfactory). The third factor F3o explains 14.5% of the total variance, and the items that mainly load are MA, MB, MC, and IN6. The reliability of the factor is a = 0.42 (unsatisfactory).

Including only the IN items in the analysis of the total reliability based on three axes is almost perfect as well (a = 0.91).

**TABLE 1. RESULTS OF THE MULTIPLE CORRESPONDENCE ANALYSIS AND RELIABILITY ANALYSIS OF THE SELF-EVALUATION MEASUREMENT SCALE.**

| Items | Discrimination Measures Per axes F1S | F2S | F3S |
|---|---|---|---|
| S1 | 0.432 | 0.020 | 0.057 |
| S2 | 0.268 | 0.000 | 0.005 |
| S3 | 0.107 | 0.334 | 0.022 |
| S4 | 0.114 | 0.000 | 0.263 |
| S5 | 0.051 | 0.130 | 0.251 |
| S6 | 0.086 | 0.042 | 0.521 |
| S7 | 0.372 | 0.193 | 0.005 |
| S8 | 0.200 | 0.112 | 0.062 |
| S9 | 0.100 | 0.320 | 0.003 |
| S10 | 0.288 | 0.016 | 0.069 |
| S11 | 0.385 | 0.219 | 0.106 |
| Eigenvalue | 0.218 | 0.127 | 0.124 |
| Variance explained (%) | 38.1 | 22.2 | 21.7 |
| Total scale Cronbach's a (three axes) | 0.89 | | |
| Average score | 62 | | |

### Scores Derived from Measurement Scales

In order to summarize the available information and develop indices of

**TABLE 2. RESULTS OF MULTIPLE CORRESPONDENCE ANALYSIS AND RELIABILITY ANALYSIS OF THE PROFESSIONAL MEASUREMENT SCALE.**

| Items | Discrimination F1o | Measure F2o | Per axes F3o |
|---|---|---|---|
| Ma | 0.027 | 0.048 | 0.362 |
| Mb | 0.023 | 0.041 | 0.286 |
| Mc | 0.041 | 0.304 | 0.254 |
| Md | 0.102 | 0.386 | 0.196 |
| Angle | 0.127 | 0.064 | 0.107 |
| Skew | 0.074 | 0.262 | 0.014 |
| Ratio | 0.010 | 0.120 | 0.018 |
| IN1 | 0.370 | 0.017 | 0.028 |
| IN2 | 0.042 | 0.528 | 0.002 |
| IN3 | 0.232 | 0.287 | 0.007 |
| IN4 | 0.178 | 0.052 | 0.109 |
| IN5 | 0.086 | 0.313 | 0.027 |
| IN6 | 0.011 | 0.008 | 0.200 |
| IN7 | 0.000 | 0.002 | 0.052 |
| IN8 | 0.056 | 0.032 | 0.027 |
| IN9 | 0.624 | 0.003 | 0.001 |
| IN10 | 0.687 | 0.002 | 0.016 |
| IN11 | 0.518 | 0.007 | 0.007 |
| IN12 | 0.104 | 0.000 | 0.100 |
| IN13 | 0.429 | 0.004 | 0.000 |
| Eigenvalue | 0.187 | 0.124 | 0.090 |
| Variance explained (%) | 29.5 | 19.5 | 14.5 |
| Total scale Cronbach's (three axes) | 0.92 | | |
| Total scale Cronbach's (three axes) only for IN items | 0.91 | | |
| Average score | 81 | | |

self-evaluation and professional (objective) measurement, two scores for each participant had to be calculated. Our demands relative to these scores were to: (1) discriminate the patients to the maximum degree; (2) maximally increase the internal consistency of the scales, (3) take into consideration the correlation between the items; and (4) take into consideration the relative distribution of answers and the particular way the subjects answer these questions. These scores were computed by means of MCA. The participants' scores on the first factor derived from MCA satisfied the four criteria mentioned earlier.[26] Because these scores are like the *z*-scores, with mean equal to 0 and variance equal to 1, we transformed them into a new scale ranging from 0 (dissatisfied, ugly dental appearance) to 100 (satisfied, pretty dental appearance).

### Relationship between Self-Evaluation and Professional Measurement Scales

Using the previously mentioned scores, the Pearson's correlation coefficient was computed. Its value $r = 0.288$, although positive and statistically significant ($p = 0.000$), indicates a very low agreement between the self-evaluation patient's perception and the professional examiner's assessment regarding the need for esthetic dental treatment (values $\geq 0.50$ would suggest relative agreement).

Also, 76 (57.6%) subjects scored above average on the self-evaluation scale, and 93 (70.5%) subjects scored above average on the objective one. Sixty-one (50%) of the participants scored above average on both scales.

Partial results have shown that 68.2% of the subjects noticed that their teeth are not white enough. In contrast, the professional assessment showed that in 74.2% of the subjects there was no such esthetic deficiency (discolored teeth). In addition, partial results from this study revealed that the subjects' primary motivation for seeking esthetic treatment is to acquire bleached-white teeth (68.2%), natural-looking crown and bridges (68.2%), and natural-looking fillings (61.4%). In contrast, the professional assessment showed that crowned teeth (48.5%), occlusal

wear (45.5%), and rotated teeth (34.8%) are the primary needs for esthetic dental treatment.

## DISCUSSION

The need for esthetic dental treatment has been evaluated in a subjective and a professional (objective) manner in this clinical survey, using two special questionnaires. The development of these questionnaires was based on previous dental esthetic evaluation forms and well-established indices used in orthodontic treatment and dental esthetic appearance.[9–16]

The self-evaluation (subjective) questionnaire (Figure 1) consisted of previously used items,[9–13] modified and revised items from the dental aesthetic index (DAI),[4,9] orthodontic treatment need (IOTN),[13] and psychosocial impact of dental aesthetics questionnaire.[28] The data taken out of the patient's perception items focused on overall self-evaluation of smile appearance and self-esteem, media image-look white dentition, patient's image of central upper incisors, anterior tooth shape and position, condition of soft periodontal tissues, natural-looking restorations, and perceived needs for esthetic interventions.

For the self-evaluation measurement scale, the MCA revealed three factors that explained 82% of the total variance. The reliability of the total scale was very high (Cronbach's a = 0.89). Only the reliability of the first factor was satisfactory (a = 0.64). This factor may be termed "Smile appearance self-confidence" according to the items that load mainly on this factor.

The professional assessment questionnaire form (Figure 2) was composed according to existing ones, namely DAI,[9] IOTN,[13] peer assessment rating,[25] and the Swedish Dental Health Board Index.[29] Additional items were generated from the experience of clinicians and from the study of the relevant literature.

For the professional examiner's assessment scale, the MCA revealed three factors that explained 63.5% of the total variance. The reliability of the total scale was almost perfect (a = 0.92). The first factor with reliability a = 0.76 may be characterized as "Quality assessment of dental restorations." The second factor with reliability a = 0.62 may be characterized as "Evaluation of dental and gums esthetics."

In order to facilitate the practical use of the results of the present study, we can propose the following simplification: based on the average scores on the subjects' perception (62) and the objective scale (81) and because the internal consistency (reliability) coefficients of the total scales were high, we can compute a total score for each subject according to the answers to items S1 to S11 and IN1 to IN13. For the subject's perception scale, seven or greater negative answers correspond to an average of > 62, which is the optimal average score for the subjective scale and suggests positive patient's beliefs about their dental appearance and smile. For the professional assessment scale, 11 or greater positive answers correspond to an average of > 81, which is the optimal average for the objective scale and suggests negative clinician's evaluation about the need for esthetic treatment of the subject.

In general, the results from this survey indicate that subjects feel there is more need for esthetic dental treatment than the dentists.

The findings of the present survey have also shown that there was a very low agreement between subjects' perception and professional assessment regarding the need for esthetic dental treatment. This is in line with previous investigations, which have shown that the preferences of dentists and patients about dental esthetic appearance differed significantly.[5,6,30] Brisman[5] concluded that dentists might develop concepts of esthetics that differ from those of patients and that this can create problems in communication and unanticipated difficulties. This might be because of the finding that the patient's primary

motivation for seeking esthetic treatment is to acquire a monochromatic, bleached-white, overcontoured, unrealistic, and media image-looking dental appearance, while the dentist has traditionally been more concerned with improving function and comfort.[31,32] Similarly, a patient who presents with relatively few objective esthetic deficiencies yet insists on an extensive makeover probably has expectancies that can never be met. At the same time, dentists' assessment about esthetic treatment need may not coincide with patients' perception and expectations because of limitations of the restorative therapy; this is where many problems begin. Esthetic treatment planning must be balanced within the technical, financial, or physical limitations of restorative therapy and the patients' expectations and demands.

## CONCLUSION

Esthetic dental treatment need was studied in 132 Greek subjects in a subjective and a professional manner, using two special questionnaires. The reliability of the measurement scales derived from these questionnaires was very satisfactory.

1. The findings of the present survey suggest that there was a discrepancy between the subjects' and dentist's perceptions of esthetic treatment need.
2. The relative disagreement between patients' perception and professional assessment of esthetic treatment need shows the importance of communication between dentist and patient in the esthetic dental treatment planning process. The use of an esthetic self-evaluation questionnaire combined with an in-office professional assessment questionnaire will provide much of the necessary information that can lead to a successful esthetic treatment.

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*Reprint requests: Dr. Andreas Hatzikyriakos, Egnatia 101 str., 54635 Thessaloniki, Greece. Tel.: +302310-999665; Fax: + 30232310-999665; e-mail:ahkyr@dent.auth.gr*