

Evaluation of the satisfaction rate of patients after prosthetic rehabilitation of osseointegrated implants

Núñez Otero, María. University Specialist in Oral Implantology (USC). Diploma of Advanced Studies (USC).

Suárez Quintanilla, José María. Titular Professor of Oral Surgery. University of Santiago de Compostela.

Design

Introduction: During the 1980s, the sole requirement for implant treatment was that the fixtures remained immobile in the mouth for as long as possible. However, in the last decades, there has been an increase in the aesthetic and functional demands of patients, and therefore, the clinical planning must largely aim to meet these aesthetic and functional requirements.

This research project stemmed from the need to examine and compare the patients' perspectives on their treatments with the opinions and success criteria outlined by dental professionals.

Materials and Methods: We have conducted a retrospective cross-sectional study using systematic sampling of consecutive cases.

We reviewed 300 surveys from patients who have undergone dental rehabilitation for at least 2 years, covering those who had removable full dentures on implants, hybrid prostheses on implants, complete osseointegrated prosthetic rehabilitation and unitarian restoration on implants. We selected two tests validated in the literature that combine the aspects we wanted to study in a complete rehabilitation of a totally edentulous patient: aesthetics, function, hygiene, and personal satisfaction: the Oral Health Impact Profile -14 (OHIP-14) 94 and the Dental Impact Profile (DIP)

96. With the combined analysis of the two tests, we designed a questionnaire containing 30 questions and thus evaluated the overall patient satisfaction on 30 specific items.

This study has been reviewed and approved by the Bioethics Committee of the University of Santiago de Compostela.

Results: The consensus between the subjective analyses of the patient and the odontologist is moderate, with a Kappa index of 0.465 ($p < 0.001$). There was a 25.7% of cases where the scoring ranges of dental specialist and patient did not match (<4 , $4-6$, >6): in 9.3% of cases, the patient rated higher than the practitioner, and in 16.4% of cases, the clinician marked higher.

Conclusion: After comparing the clinical and subjective evaluations of the rehabilitation with osseointegration implants, the study has shown there is a moderate agreement between the patients' self-perception of their treatment success and the dental professionals' assessment of same clinical procedure.

Keywords: Dental implant, dental prosthetic, dental rehabilitation, edentulous rehabilitation, osseointegration, treatment excellence, treatment satisfaction

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I. Introduction

Rehabilitation with osseointegrated implants has become a predictable clinical procedure, currently showing a high success rate. However, it is a technique that has undergone a profound conceptual change in a very short period.

While in 1980s, the only requirement for implant treatment, demanded by both dental professionals and patients, was that the fixtures remained immobile in the mouth for as long as possible; in contemporary clinical practice, patients are increasingly demanding in terms of both the aesthetic and functional aspects of their treatment. Thus, clinical planning should be directed towards meeting these demands. (1)

The aim of this study was to analyse the patients' self-perception of their osseointegrated implants rehabilitation and to compare the benchmark for treatment excellence defined by odontologists and patients themselves.

During the rehabilitation of edentulous clinical cases, one of the most complex aspects defining

the treatment success or failure is the potential disparity between the criteria the clinician seeks (colour, emergence profile, makeup, type of occlusion, vertical dimension) and the unstated patient's expectations. When the patient's idea of excellence matches the professional's criteria, the probability of treatment success is virtually guaranteed. (2) Our approach to the patients' evaluation of their prostheses had considered current literature which acknowledges that individuals tend to evaluate their own abilities and characteristics in a more positive way than they objectively are.

This optimization of our own image is not an attempt to see what we want to see, but a way of understanding the self-view that each one of us has and it's closely related to the concept of self-perception (how individuals perceive themselves, including their characteristics, abilities, and behaviours) and self-esteem notion (individual's overall evaluation of their own worth, value, and competence).

II. Materials and Methods

The study has been reviewed and approved by the Bioethics Committee of the University of Santiago de Compostela. It complies with the Principles of the Declaration of Helsinki, ICH-GCP, EU legal Framework and GDPR 2018. Participants data have been processed in accordance with the provisions of Spanish Organic Law 3/2018 of December 5 on Data Protection and Digital Rights.

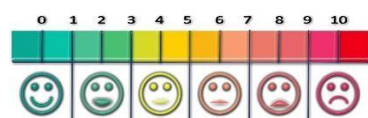
The project has been designed as a retrospective cross-sectional study using a non-probabilistic sampling of consecutive cases.

Prior completing the study survey, potential participants had read and signed the study's information and consent form. The participant's pool was selected from patients who, in the last 2 years, had either removable complete dentures on implants, hybrid prostheses on implants, fixed complete prostheses on implants, or fixed restorations on implants.

From the initial 500 surveys completed by rehabilitated patients, only 380 were validated and among these, only 300 fulfil the study inclusion criteria.

We selected two validated tests from the literature: the *Oral Health Impact Profile -14 (OHIP-14)* and the *Dental Impact Profile (DIP) 96*. With the combined analysis of these two tests, we designed a questionnaire containing 30 questions for patients to measure the aesthetics, function, hygiene, and personal satisfaction of their edentulous implants.

To evaluate specific satisfaction regarding function, aesthetics, and hygiene, Visual Analog Scales (VAS) ranging from 0 to 10 were used, completed by both the patient and the professional.



Patient Selection

A total of 500 patients who had been rehabilitated with osseointegrated implants in the *Teaching Unit of Oral Surgery at the University of Dentistry of Santiago de Compostela* and at the *Dental Clinic Dra. María Núñez Otero, Lugo (Reg. No.: C-27-000801)* were invited to take part in the study.

To collate the surveys to be included in this study, we followed the study's inclusion and exclusion criteria as set below:

Inclusion Criteria:

- Patients aged 18 years or older.
- Patient of any gender
- Fully or partially edentulous patients rehabilitated with prostheses on implants.
- Patients whose treatments had been completed two years before the commencement of the surveys.
- Patients willing to complete the study survey
- Patients able to provide informed consent.

Exclusion Criteria:

- Patients undergoing dental implant treatments whose completion occurred within a period of less than two years.
- Patients with systemic diseases that interfere with adequate osseointegration or occlusal function.
- Oncological or immunocompromised patients.
- Patients with poor perception of reality or personality disorder.
- Non-cooperative patients.

- Patients who would be unable to complete the survey or unwilling to participate in the study.

The final study population consisted of 300 patients, of whom 119 identified as male and 181 as female, aged 30 to 89 years.

Data Anonymization

Once we had selected the surveys that met the requirements for our study, personal data was fully anonymized in accordance with current data protection regulations.

Data Collection

The study survey was designed based on a review of existing scientific literature. The aim was to validate and justify that the variables incorporated were relevant to achieve the stated objectives.

A preliminary evaluation of the test was conducted to feasibility trial involving 10 patients, who completed the survey by answering all its questions in January 2023, obtaining a Kappa of 0.860 (95% CI between 0.840 and 0.890) and a Cronbach's Alpha statistic, which quantifies the level of reliability constructed from the n observed variables. The Alpha value was 0.839432.

Before handling the final survey, the principal investigator ensured potential participants met the inclusion criteria, explained the study activities with its legal implications and recorded written informed consent to the study participation.

Study Variables and Survey

Administrative and Identification Data: First initial of name and last name, age, gender, marital status, profession, education level, address, and membership in a dental insurance plan.

Health Status: Existing and previous diseases, current medication, and mood state, for which we used a visual analogic scale where the patient had to mark from 0 to 10, with 1 being the most favourable mood state and 10 being the least favourable.

Data Related to Technique and Treatment Perception: Cause of tooth loss, reasons justifying treatment, type of patient's implants, reasons for not having undergone treatment until now, time with osseointegrated implants in the mouth, and type of prosthesis used for implant rehabilitation.

Level of Treatment-Related Satisfaction: Treatment satisfaction, improvement in quality of life after treatment, daily aspects improved after osseointegrated implants, reasons for choosing the professional.

Mood Aspects Related to Treatment with Osseointegrated Implants: Cost/result/benefit relationship of implant treatment, aspects of treatment that have disappointed the patient, modification of mood state after implant rehabilitation, main causes of disappointment with treatment if any, feedback from close relatives and friends upon completion of implant treatment, analysis of treatment duration and patient perception, as well as aesthetic analysis of prosthetic rehabilitation on implants.



DATA COLLECTION FORM FOR THE STUDY

Identification Data

First initial of your name and last name:

Age:

Gender:

Male () Female () Other () Marital Status:

Profession:

Education Level: No Education () Basic Education () High School / Vocational Training () University Degree

Address: Postal Code: City:

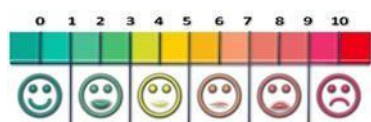
Email: Contact Phone Number:

Dental Insurance Policy: Yes () No () Insurance Company:

Health Conditions:

Regular Medication:

Mood State (visual analog scale) mark current state from 1 – 10:



*1 being very good and 10 being very bad

Surgical and Prosthetic Technique Data (Mark with an X the answer or answers)

1. Facility: Public () Conventional Clinic () Multi-dental () Insurance Company ()
2. Cause of Tooth Loss: Caries () Fracture () Endodontic () Periodontal Disease () Other ()
3. Reasons for Seeking Implant Treatment: Prosthetic () Aesthetic () Psychological State () Professional Recommendation ()
4. Implant Brand: Straumann () Nobel Biocare () Galimplant () Zimmer () Biohorizons () Other brands or companies () Don't know ()
5. Reasons for not having undergone implants until now: Technical doubts () Fear – insecurity () Economic reasons () Other ()
6. Are you satisfied with the treatment outcome?: YES () No () Partially ()
7. Has your quality of life improved with implants? Yes () No () Very little ()
8. Indicate which aspect of your life has improved with implants: Chewing () Speaking () Self-esteem () Relationship with others ()
9. Would you undergo the same implant treatment again? YES () No ()
10. If you answered NO, what would you change?
11. Did you have a different preconceived idea of implant treatment? Yes () No ()
12. How long have you had your implant prosthesis? 2 to 5 years () Between 5 and 10 years () More than 10 years ()
13. What type of prosthesis do you have? Fixed () Removable ()
14. Did the treatment last as long as you expected? Yes () No ()
15. Did the cost/result/benefit ratio of the treatment seem appropriate to you? Yes () No ()
16. What aspect of the treatment has disappointed you the most: Pain – Discomfort () Result () Cost () Treatment duration () None ()
17. The reaction of your family and friends after observing the treatment outcome has been: Favorable () Unfavorable () Indifferent ()
18. Has your mood improved with the treatment? Yes () No () Barely ()
19. In reality, did you imagine that implant treatment would be like this, or did you expect a simpler procedure?: Like this () Simpler () More complex ()
20. Which treatment outcome has disappointed you the most: Chewing () Tooth color () Perception of the prosthesis () Food retention () Speaking () None ()
21. Reasons for choosing this professional: Prestige () Trust () Economic conditions () Advertising ()
22. Under equal professional and economic conditions, would you have chosen another professional for this treatment?: Yes () No ()
23. Subjective aesthetic analysis of the treatment:
Patient: Rate your prosthesis and treatment aesthetically from 1 to 10: *1 being very good and 10 being very bad
Professional: Rate the aesthetic aspect of this patient's treatment from 1 to 10: *1 being very good and 10 being very bad

III. Statistical Analysis

For categorical variables, we will show frequencies and percentages. While for continuous variables, we will present means and standard deviations.

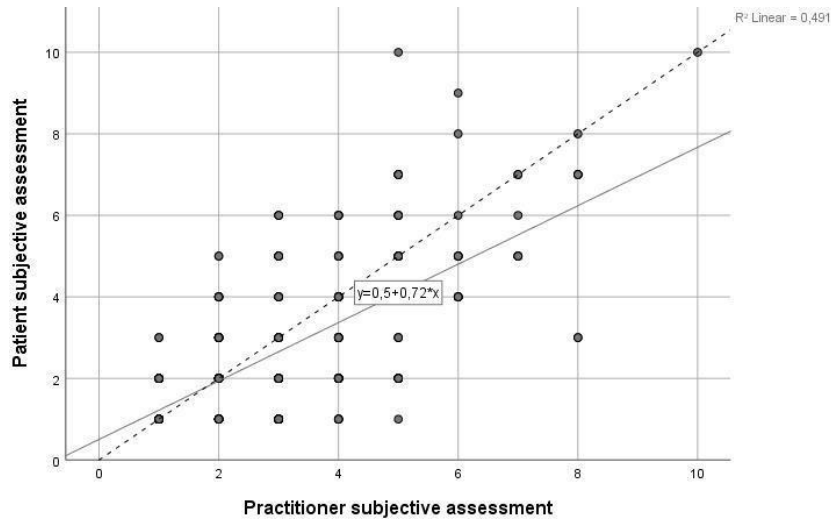
To be able to measure the concordance between the subjective analyses of the patient and that of the clinician, we applied the Pearson Correlation Coefficient (PCC) and the Intraclass Correlation Coefficient (ICC). This allowed us to evaluate the quantitative assessments obtained with different measurement evaluators.

To quantify the proportionality between the ordinal and categorical versions of the subjective analyses, we applied the Kappa Index, whose maximum possible value is 1 (total agreement) and 0 where the interrater reliability is what would be expected solely by random chance. The level of significance used in the analyses was 5% ($\alpha=0.05$). The statistical software used for the analyses was IBM SPSS statistics 26.

IV. Results

Correlation between the patient and clinician subjective analysis: Given the large sample size (n>30), the status quo of the two indices was obtained by applying the Central Limit Theorem.

The regression line proximity to the diagonal would indicate no discrepancies between the data sources, however the Pearson Correlation between the assessments showed a value of 0.701 (p-value <0.001), which in this case can be considered as a moderate proportionality.



As correlation does not always imply concordance, the Intraclass Correlation Coefficient (ICC) was calculated to measure data alignment. Both the ICC for absolute agreement and the ICC for consistency gave moderate figures:

- ICC for absolute agreement: 0.687 (p-value < 0.001)
- ICC for consistency: 0.700 (p-value < 0.001)

Furthermore, the p-value of the paired t-test for paired samples is 0.000 (patient - practitioner difference = -0.373, 95% CI (-0.538, -0.209), t(-4.461,299)), indicating significant differences in the values of the two analyses, with the clinician's average rating is slightly higher than those of the patient. Therefore, the consistency of the rating is moderate.

Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
Pair 1 Patient subjective assessment	2,72	300	1,894	,109
Practitioner subjectiveassessment	3,10	300	1,851	,107

When examining the data further, we have found that we could regroup the scores into three categories, observing that most of the scores are below 4 (70% for patients and 62% for clinicians).

PATIENT ANALISIS					ANALISIS				
	Frequency	Percent	ValidPercent	Cumulative Percent		Frequency	Percent	ValidPercent	Cumulative Percent
Valid <4	210	70,0	70,0	70,0	Valid <4	187	62,3	62,3	62,3
4-6	75	25,0	25,0	95,0	4-6	98	32,7	32,7	95,0
>6	15	5,0	5,0	100,0	>6	15	5,0	5,0	100,0
Total	300	100,0	100,0		Total	300	100,0	100,0	

¹ Because it is not sensitive to constant and proportional differences between measures. A relationship of the type B=A/2+5 would give a correlation coefficient of 1 and an ICC of absolute agreement of 0.37

² Treat any difference between measurements as a mismatch (constant type A=B+3, proportional A=6B or both A=6B+3).

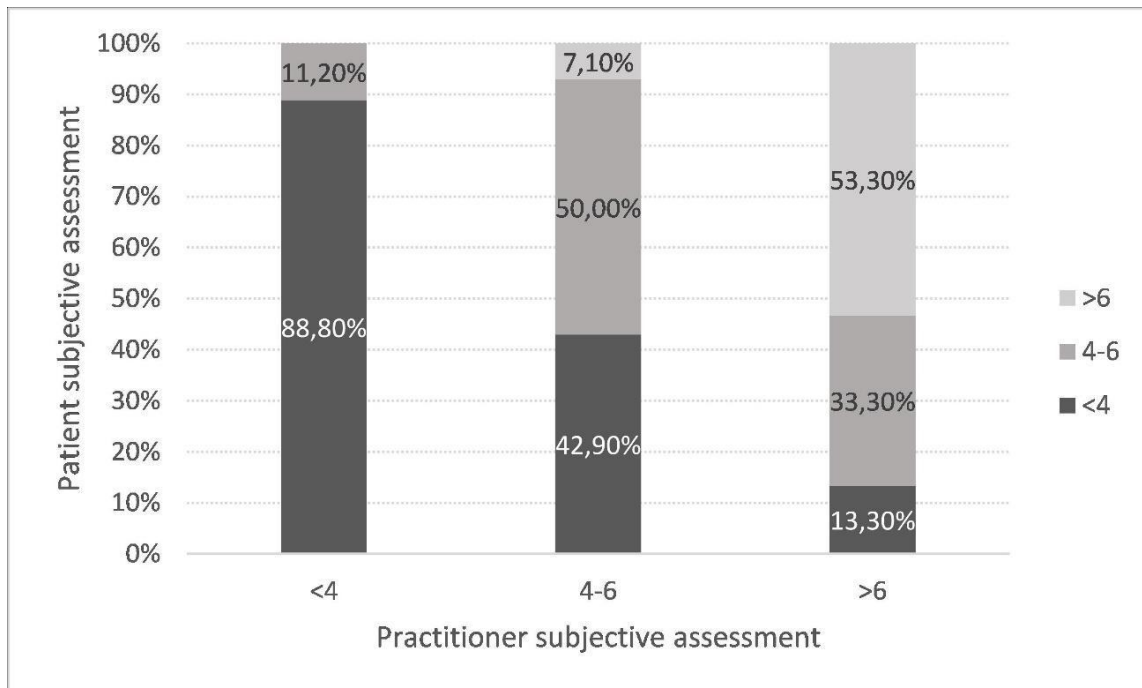
³ It does not consider constant differences (A=B+4) as discordance.

⁴Altman DG. Practical statistics for medical research. New Cork: Chapman and Hall; 1991

While exploring the categorization consistency, we have found the Kappa index is 0.465(p<0.001) again showing a moderate concordance

- **Patient overestimated the clinician:** 11.2% of the time when the specialist rated below 4, the patient rated above; 7.1% of the time when practitioner scored between 4 and 6, the participant scored above 6.
- **Patient underestimated the clinician:** 42.9% of the time when the specialist scored between 4 and 6, the participant scored below 4; 46.6% of the time when the practitioner rated > 6, the patient rated below 6.

		Practitioner subjective assessment							
		Total		<4		4-6		>6	
		Count	Column N %	Count	Column N %	Count	Column N %	Count	Column N %
Patient subjective assessment	Total	300	100,0%	187	100,0%	98	100,0%	15	100,0%
	<4	210	70,0%	166	88,8%	42	42,9%	2	13,3%
	4-6	75	25,0%	21	11,2%	49	50,0%	5	33,3%
	>6	15	5,0%	0	0,0%	7	7,1%	8	53,3%



Overall, there was a 25.7% (7+14+2.3+0.7+1.7) discrepancy rate between the clinician and patient's scoring ranges: in 9.3% of cases, the participant scored higher than the specialist, and in 16.4% of cases, the practitioner rated higher.

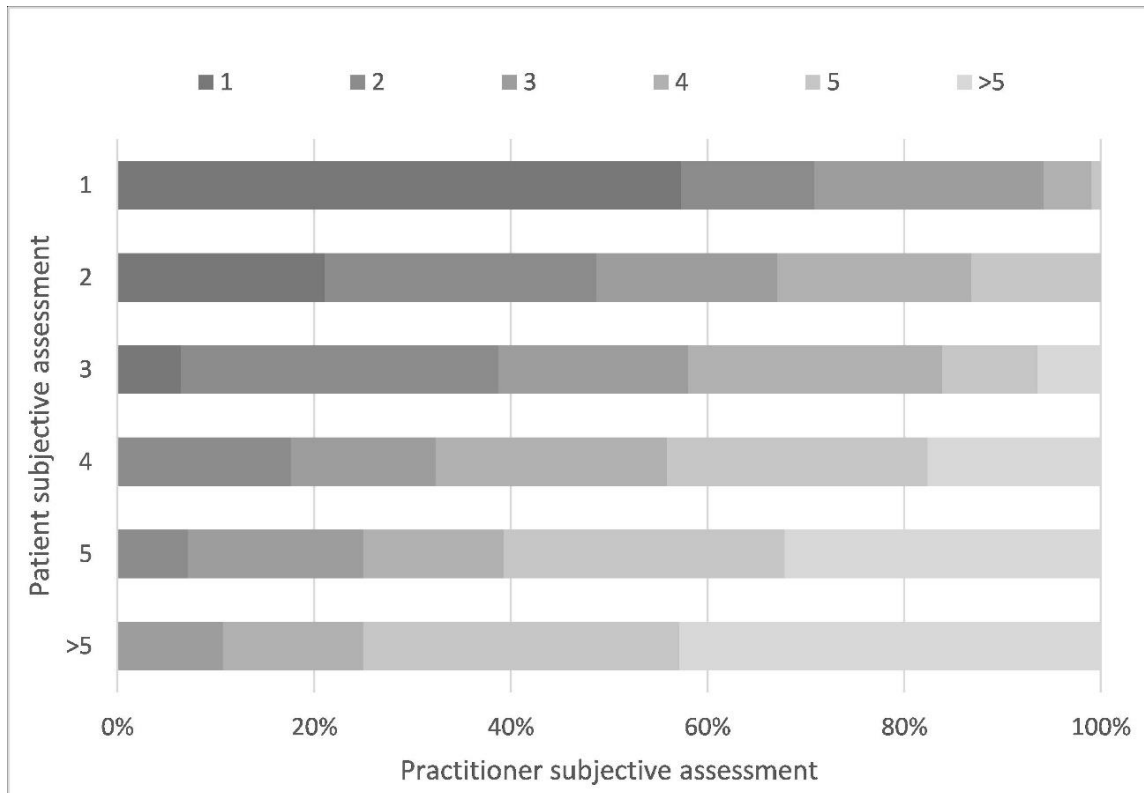
		Practitioner subjective assessment							
		Total		<4		4-6		>6	
		Count	Table N %	Count	Table N %	Count	Table N %	Count	Table N %
Patient subjective assessment	Total	300	100,0%	187	62,3%	98	32,7%	15	5,0%
	<4	210	70,0%	166	55,3%	42	14,0%	2	0,7%
	4-6	75	25,0%	21	7,0%	49	16,3%	5	1,7%
	>6	15	5,0%	0	0,0%	7	2,3%	8	2,7%

The conclusion when comparing the results of participants' aesthetic analysis evaluations with the clinicians' subjective aesthetic evaluations, is that in 125 out of 300 cases, the professionals have rated and scored worse (125/300: 0.416), meaning in 41.6% of implant rehabilitation cases (hence the very low Kappa index if both assessments are considered as ordinal variables, Kappa=0.211 p<0.001).

This is one of the key findings of our study, as it indicates that individual perception of aesthetics is better in patients and is often related to the level of trust, confidence, and esteem the patient has for the professional. Additionally, this result is due to professionals assessing certain technical aspects that do not influence the evaluation of prostheses by patients at all.

Patient subjective assessment * Practitioner subjective assessment

		Practitioner subjective assessment										Total
		1	2	3	4	5	6	7	8	10		
Patient subjective assessment	1	59	14	24	5	1	0	0	0	0	0	103
	2	16	21	14	15	10	0	0	0	0	0	76
	3	2	10	6	8	3	0	0	2	0	0	31
	4	0	6	5	8	9	6	0	0	0	0	34
	5	0	2	5	4	8	5	4	0	0	0	28
	6	0	0	3	4	4	1	1	0	0	0	13
	7	0	0	0	0	4	0	2	4	0	0	10
	8	0	0	0	0	0	1	0	1	0	0	2
	9	0	0	0	0	0	1	0	0	0	0	1
	10	0	0	0	0	1	0	0	0	1	0	2
Total		77	53	57	44	40	14	7	7	1	300	



		Practitioner subjective assessment								Total	
		1	2	3	4	5	6	7	8		10
Patient subjective assessment	1	59	14	24	5	1	0	0	0	0	103
	2	16	21	14	15	10	0	0	0	0	76
	3	2	10	6	8	3	0	0	2	0	31
	4	0	6	5	8	9	6	0	0	0	34
	5	0	2	5	4	8	5	4	0	0	28
	6	0	0	3	4	1	4	1	0	0	13
	7	0	0	0	0	4	0	2	4	0	10
	8	0	0	0	0	0	1	0	1	0	2
	9	0	0	0	0	0	1	0	0	0	1
	10	0	0	0	0	1	0	0	0	1	2
Total		77	53	57	44	40	14	7	7	1	300

V. Discussion

The results of the current study demonstrate a moderate correlation between the dental professional and patient assessments, as when the professional assessment increases, so does the patients, and vice versa, with both perceptions generally being positive.

Tortopidis et al. (5) concluded that there is a discrepancy between the perception of the need for dental treatment among patients and specialists, with patients perceiving a greater need for professional intervention than experts. However, the outcome was evaluated in a less critical manner, creating problems in communication, assessment, and treatment goals.

In this study, we have considered the personal situation of the patients, as some studies indicate that the socioeconomic status of patients appears to impact their ability to evaluate facial attractiveness, with individuals from lower socioeconomic classes being less critical (6).

Current literature also mentions that individuals from lower socioeconomic strata often experience lower levels of self-esteem, which would translate into a greater desire to modify their facial appearance, this would significantly influence the appeal of undergoing aesthetic treatments, where the emphasis would be focused on performing certain procedures rather than assessing the results obtained (7). Additionally, it could be inferred that if the treatment entails a higher economic cost for the patient, they may be more critical and demanding regarding the expected results.

When designing the treatment, it is essential to understand the patient's genuine expectations and discern their true intentions, as well as identify which aesthetic aspects are prioritized in their perceptions, which seems to be crucial to attain more predictable outcomes (8). In this context it would be beneficial to carry out a detailed analysis of patient preferences when assessing aesthetic results, integrating this step at the

beginning of treatment would reduce discrepancies between the practitioner's and the patient's satisfaction with the prosthesis and its functionality. While considering this, it is also evident that establishing specific and concrete rules to guarantee consistent results would be challenging for the odontologist, due to the inherent variations related to patient's gender, culture, and age (9).

Additionally, in other studies like the Kokich Group (10) and the Medina Group (11) noted that dental and orthodontic specialists tend to be more critical in smile analysis than patients themselves, a similar conclusion reflected in Medina's work, where it was found that patients' opinions were more lenient than those expressed by dental professionals when assessing smile aesthetics. Moreover, Flores study (12) found that dentists did not positively value gingival exposure, whereas patients preferred a certain level of gingivalexposure.

VI. Conclusion

The aesthetic appreciation that patients have of their implant rehabilitation is substantially more positive than that expressed by dental professionals when independently judging the outcome of osseointegrated implant rehabilitation.

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