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SYSTEMATIC REVIEW

Clinician assessments and patient perspectives of single-tooth implant restorations in the esthetic zone of the maxilla: A systematic review

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ABSTRACT

Statement of problem. Esthetic outcomes associated with implant dentistry are important to both clinicians and patients. However, esthetic satisfaction may vary between the 2 groups. In order to evaluate the current publications relating to this topic, the following focused question was developed, "what are the quantitative and qualitative differences between clinician evaluations and patient perspectives in the assessment of single-tooth implant outcomes in the esthetic zone?"

Purpose. The purpose of this systematic review was to identify differences in esthetic satisfaction between clinicians and patients when evaluating single-tooth implant-supported restorations.

Material and methods. An electronic search of the Medline database and Cochrane Central Register of Controlled Trials (2000 to 2014) was performed. The search was supplemented by a manual search of specific journals. A quality assessment of full-text articles was performed according to Cochrane Collaboration's tool and Newcastle-Ottawa scale for risk of bias assessment. Information regarding outcomes was collected and compared.

Results. The search term combinations identified 555 titles. Subsequent to further review, 11 publications, including 2 randomized controlled trials, were selected for inclusion. Because of the heterogeneity of the study designs, study interventions, and esthetic assessment methods, no meta-analysis was performed. The clinicians identified a satisfactory outcome in 51% to 100% for peri-implant soft tissue and 62% to 90% for implant restorations. Patients showed a mean range score of 43% to 93% for peri-implant soft tissue and 81% to 96% for implant restorations. The visual analog scale score of the dentists was always lower than that of the patients. The review identified correlations between subjective and objective assessments for the Pink Esthetic Score (PES), the Papilla Index (PI), the Implant Crown Aesthetic Index (ICAI), and the modified (mod-ICAI) indices.

Conclusions. Clinicians are more critical of esthetic outcomes than patients. The PES and the PI correlated with the patients' responses concerning the peri-implant soft tissue. The ICAI and the mod-ICAI showed a correlation of both the peri-implant mucosa and implant-supported crown satisfaction. Thus, a comprehensive and practical index should be developed to assess the esthetic outcomes for single-tooth implant restorations in the esthetic zone. (J Prosthet Dent 2017;118:10-17)

As a result of their continuing success and development, dental implants are increasingly used to support esthetic restorations. Procedures for optimizing esthetic outcomes have been suggested,[1] along with recommendations for assessing outcomes. The objective assessment by the dentist has been determined in relation to the dentoalveolar segment that was visible upon exaggerated smile, whereas the subjective assessment was defined as any dentoalveolar area that was visible and important to the patient. For this reason, the esthetic relevance may vary between the clinician and the patient.[2-7]

An acceptable visual appearance is essential in the esthetic zone. Objective esthetic indices commonly used by clinicians have been recently categorized.[8] These indices assess peri-implant soft

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Clinical Implications

Patients are less critical of esthetic outcomes than clinicians. Dentists should be familiar with and consider esthetic factors of esthetic relevance to the patient as these vary from those of clinicians.

tissue using the Papilla Index (PI)[9] and the Pink Esthetic Score (PES).[10] The Implant Crown Aesthetic Index (ICAI)[11] and the Pink and White Esthetic Score (PES/WES)[12] have also been developed to evaluate the peri-implant mucosa and implant restoration. These indices do not always result in good interexaminer and intra-examiner agreement.[13] Furthermore, there is no specific index to assess the patient's esthetic perception. The lack of well-defined parameters for the patient evaluation may be crucial to esthetic outcomes.[14]

Clinician assessment and patient satisfaction of single-tooth implant restorations have been addressed in numerous publications over the previous 10 years. Because knowing how the perception of the patient relates to the objective evaluation of the professional, this systematic review aims to evaluate the concurrence of objective clinician assessment and patient perception of the esthetic parameters in the esthetic zone.

MATERIAL AND METHODS

A systematic review was performed following established guidelines.[15] The methodology included formulating review questions using a Population, Intervention, Comparison, and Outcome (PICO) framework, constructing a search strategy, defining inclusion and exclusion criteria, locating studies, selecting studies, assessing study quality, extracting data, and forming an evidence table prior to interpretation.

The following focused question was developed: "What are the quantitative and qualitative differences between clinician evaluations and patient perspectives in the assessment of single-tooth implant outcomes in the esthetic zone?" MeSH and free-text terms were used in the search and are listed in Table 1.

The search strategy included randomized controlled trials, cohort studies, case control studies, case series (more than 5 patients), and cross-sectional studies reporting on single-tooth implant-supported restorations in the region of the maxillary premolars, canines, and incisors. All articles were published in English from January 2000 to September 2014 and included adult participants (+19 years of age) only.

All studies that failed to meet these inclusion criteria were excluded as follows: articles that failed to report separate data for esthetic and nonesthetic implant restorations; failure to report patient or professional assessments; and failure to report statistical comparison or correlation between clinician and patient assessments.

Table 1. Population, intervention, comparison, and outcome framework

Focus question	What are the quantitative and qualitative differences between clinician evaluations and patient perspectives in the assessment of single-tooth implant outcomes in the esthetic zone?
Search strategy	
Population	1. Jaw, edentulous, partially (MeSH terms) OR partially edentulous OR partial edentulism OR maxilla
Intervention	2. Dental implant (MeSH terms) OR dental implant, single tooth (MeSH terms) OR endosseous implant OR dental implant OR single tooth implant
Comparison	3. Patient satisfaction (MeSH terms) OR patient outcome assessment (MeSH terms) OR subjective assessment OR subjective evaluation OR professional assessment OR professional evaluation OR objective assessment OR objective evaluation OR patient satisfaction OR outcome assessment
Outcome	4. Esthetic, dental (MeSH terms) OR esthetics OR aesthetics OR esthetic index OR esthetic outcomes OR soft tissue OR mucosa OR papilla OR margin OR recession OR mucosal recession OR contour OR form OR colour OR color OR shade OR translucency OR texture OR implant crown OR overall satisfaction OR pink esthetic score OR white esthetic score OR papilla index OR implant crown esthetic index OR visual analog scale
Search combination	1. AND 2. AND 3. AND 4.

Electronic searches of the published reports were conducted using the MEDLINE and Cochrane databases. Manual searches of journals were additionally undertaken to maximize the likelihood of capturing all relevant publications: *Clinical Implant Dentistry and Related Research, Clinical Oral Implants Research, International Journal of Oral and Maxillofacial Implants, International Journal of Prosthodontics, Journal of Clinical Periodontology, Journal of Dental Education, Journal of Prosthetic Dentistry, Journal of Prosthodontics,* and *Journal of Periodontology.* When multiple publications reporting on the same population were identified, only the most recent information was included.

Three reviewers (S.P.A., A.P., A.N.) independently performed the search. All disagreements regarding inclusion were resolved by direct discussion among the 3 reviewers. When title information was inadequate, further evaluation of the abstract was performed. Consequently, abstracts of all potentially relevant titles were obtained and reviewed based on the inclusion criteria. Publications were selected for full-text evaluation when one or more terms of esthetic assessment were presented in the abstract. Full-text versions of selected articles were obtained and evaluated independently by all reviewers prior to final inclusion.

A quality assessment of each included publication was performed. For randomized controlled and controlled clinical trials, the Cochrane Collaboration's tool for assessing risk of bias was used. Nonrandomized controlled studies were assessed using the Newcastle-Ottawa scale.

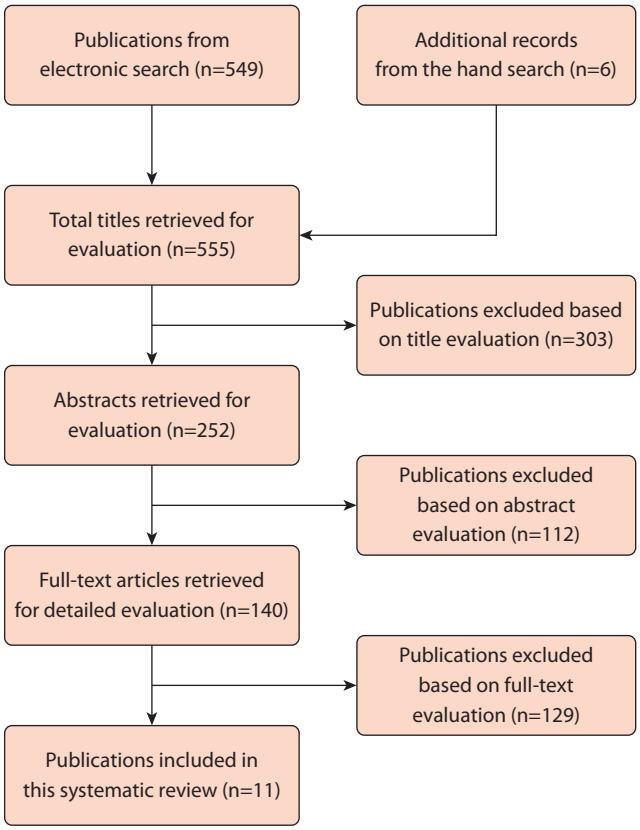

Figure 1. Search strategy.

Standardized descriptive tables were developed to present the data of each study. The authors were contacted directly by email as needed for clarification or missing information. All reviewers evaluated the tables independently, and disagreements were resolved through discussion.

The agreement for data extraction between reviewers was assessed using the Kappa (κ) coefficient. Considerable heterogeneity existed among studies with regard to design, population, and esthetic assessments. A qualitative report of the data was presented by applying descriptive methods, and a quantitative data synthesis for meta-analysis was not performed.

RESULTS

From the 555 titles identified, 252 abstracts were selected for further evaluation (Fig. 1). The Kappa statistic indicated excellent reviewer agreement (κ=0.96, 95% confidence interval [CI]: 0.94 to 0.98). The abstract screening identified 140 full-text articles for further review, again with excellent interexaminer agreement (κ=0.90, 95% CI: 0.85 to 0.94). Eleven citations were identified for inclusion in this study with good interexaminer agreement (κ=0.74, 95% CI: 0.53 to 0.89).

During the full-text evaluation, 129 publications were excluded. The reasons for exclusion were lack of patient-centered outcomes (n=74), lack of esthetic assessment by a clinician (n=26), inability to distinguish data for sites in the anterior maxilla (n=13), lack of adjacent natural teeth (n=6), case series with fewer than 5 patients (n=2), and no statistical analysis of any comparison or correlation between the patient and clinician evaluations (n=8).

Table 2. Studies included for data extraction

Type	Number	Studies
Randomized controlled trial studies	2	den Hartog et al,[16] Meijndert et al[17]
Nonrandomized controlled study	1	Cosyn et al[18]
Case series studies	8	Taylor et al,[19] Hartlev et al,[20] Change and Wennström,[21] Hof et al,[22] Suphanantachat et al,[23] Vilhjálmsson et al,[24] Belser et al,[12] Palmer et al[25]
Total	11	

Eleven publications were selected, including 2 randomized controlled trials,[16,17] 1 nonrandomized controlled study,[18] and 8 case series studies[12,19-25] (Table 2). The 2 randomized clinical trials were considered to have a low risk of bias according to the Cochrane Collaboration tool. The nonrandomized controlled study assessed by the Newcastle-Ottawa method had sufficient quality. The outcomes for the 8 case series studies were diverse. The characteristics of the included studies are presented in Table 3. Timing of implant placement, timing of implant loading, use of bone grafting, and implant neck design were primary focuses for the articles. Most of the studies used ceramic and/or metal-ceramic as definitive crowns. Minimum mean follow-up time was 6 months after implant loading[19,23] and the maximum mean follow-up was 7.5 years after crown delivery.[21]

Table 4 summarizes the esthetic assessment methodology used by clinicians from each study. Most included studies reported on objective esthetic evaluation, using blinded clinical examiners who were not involved in the treatment (n=9). Fifty-five percent of the included studies (n=6) used 2 examiners, with a range from 1 to 6. Photographs were commonly used, showing the implant-supported crown and the contralateral natural tooth (n=6) or a combination of a diagnostic cast with standardized photographs (n=5). The PES was the most frequently used index in the included studies (n=4). Three studies applied the PES/WES, the ICAI, and the PI. Two studies used only the WES criteria based on the original PES/WES. One study did not apply an objective index for the evaluation.

For esthetic assessment by patients, all studies used a questionnaire focusing on the aims of the evaluation (Table 4). A majority of the studies (n=8) used a 100-mm visual analog scale (VAS) with 0 indicating extreme dissatisfaction and 100 indicating complete satisfaction. Two studies used a 5-point rating scale ranging from

Table 3. Characteristics of included studies

Study	Year	Study Design	Treatment	No. of Included Patients	No. of Included Implants	No. of Drop-Out Implants	Prosthesis Material	Follow-up Time After Crown Delivery
den Hartog et al[16]	2013	RCT	Gr.1: smooth neck Gr.2: rough neck with grooves Gr.3: scalloped rough neck with grooves	93	93	1	Ceramic	1 year
Meijndert et al[17]	2007	RCT	Gr.1: chin bone Gr.2: chin bone + Bio-Gide Gr.3: Bio-Oss + Bio-Gide	93	93	2	Ceramic	1 year
Cosyn et al[18]	2012	Non-RCT	Gr.1: early implant placement Gr.2: conventional implant placement	44	49	3	NA	2.5 years after implant placement
Taylor et al[19]	2014	Retrospective	2-stage surgical protocol	27	27	0	26 PFM, 1 Zr	At least 6 months
Hartlev et al[20]	2014	Prospective	Immediate implant placement and immediate provisionalization	68	68	14	37 ceramic, 9 MC, 8 interim	Mean 33 months
Change and Wennström[21]	2013	Retrospective	2-stage surgical protocol	32	32	0	PFM	Mean 7.5 years
Hof et al[22]	2013	Retrospective	Implant placement after block grafting	60	60	0	NA	At least 1 year after implant placement
Suphanantachat et al[23]	2012	Retrospective	NA	40	40	0	NA	At least 6 months
Vilhjálmsson et al[24]	2011	Retrospective	NA	50	50	0	Ceramic	1 year
Belser et al[12]	2009	Retrospective	Early implant placement	45	45	0	MC	2–4 years
Palmer et al[25]	2007	Retrospective	NA	66	66	0	NA	1 year

Gr, group; NA, not applicable; MC, metal-ceramic; RCT, randomized controlled trial.

Table 4. Assessment method of included studies

	Assessment Method by Professionals			
Study	Examiner	Method	Esthetic Index	Questionnaire Assessment by Patients
den Hartog et al[16]	2 blinded examiners	Photographs	PES/WES ICAI	5-point rating
Meijndert et al[17]	1 blinded prosthodontist	Photographs	ICAI	Visual analog scale
Cosyn et al[18]	1 blinded examiner	Photographs	PES WES	Visual analog scale
Taylor et al[19]	2 blinded prosthodontists	Photographs, dental cast	PES/WES	Visual analog scale
Hartlev et al[20]	2 blinded examiners: perio-prosthodontist and oral surgeon	Photographs, dental cast	PES WES	Visual analog scale
Change and Wennström[21]	1 blinded examiner	Photographs, dental cast	PI	Visual analog scale
Hof et al[22]	2 examiners: prosthodontist and oral surgeon	Photographs	PES PI	Visual analog scale
Suphanantachat et al[23]	6 blinded examiners: 2 prosthodontists, 2 periodontists, and 2 orthodontists	Photographs, dental cast	NA	Visual analog scale
Vilhjálmsson et al[24]	2 blinded examiners	Photographs	PES ICAI mod-ICAI	5-point rating
Belser et al[12]	1 blinded prosthodontist	Photographs, dental cast	PES/WES	Visual analog scale
Palmer et al[25]	2 examiners	Photographs	PI	6 rating scale

ICAI, Implant Crown Aesthetic Index; mod-ICAI, modified ICAI; NA, not applicable; PES, Pink Esthetic Score; PI, Papilla Index; WES, White Esthetic Score.

"very dissatisfied" (score 1) to "very satisfied" (score 5). The results were then represented using the combination of scores 4 (satisfied) and 5 (very satisfied). One article used a ranking from 1 to 6 (extremely dissatisfied to extremely satisfied) for each question.

The 11 included studies in Table 5 reported on the evaluation of the peri-implant mucosa. The results revealed that clinicians had a positive though diverse assessment of mucosal appearance at 51% to 100% satisfaction. Studies reported that patient opinion of the peri-implant soft tissue appearance ranged from 43% to 93% satisfaction, similar to clinician judgment. The mean values for esthetic satisfaction (80% to 93%) and the overall satisfaction (85% to100%) concerning implant

Table 5. Peri-implant mucosa assessment

Study	Who	Peri-implant Mucosa Assessment With Mean Score: Esthetic Score	Satisfied With Mucosa (%)	Satisfied With Mucosa Color (%)	Satisfied With Mucosa Shape (%)	Esthetic Satisfaction (%)	Overall Satisfaction (%)	Relevant Findings
den Hartog et al[16]	Professionals	PES=6.3 ±1.7	PES:59.8 ICAI: 56.5					Patient's esthetic satisfaction with appearance of mucosa was correlated with outcome of PES (no statistical data).
	Patients			85.9	81.5		90	
Meijndert et al[17]	Professional		ICAI: 70			ICAI: 66		Peri-implant mucosa showed significant correlation between ICAI and patients' satisfaction ($P<.05$).
	Patients		42.9				100	
Cosyn et al[18]	Professional	PES=10.2 ±2.1	PES: 85			PES/WES: 74		No significant correlation between PES and patient's pink esthetic satisfaction ($r=0.21$, $P=.16$).
	Patients		91-93					
Taylor et al[19]	Professionals	PES=6.1 ±2.4						No significant correlation between total PES/WES and patients' perspective ($r=0.31$, $P=.12$).
	Patients					Median 90		
Hartlev et al[20]	Professionals	PES=9.9	VAS: 73				70	Positive weak correlation between clinicians' and patients' VAS score of peri-implant mucosa ($r=0.32$, $P=.03$).
	Patients		83				94	
Change and Wennström[21]	Professional	PI 3=38% PI 2=53% PI 1=9%						Patient's degree of esthetic satisfaction was not significantly different between having complete or deficient papilla.
	Patients					92.8		
Hof et al[22]	Professionals	PES=11.5 ±0.7 Median PI=2	PES: 60					Patient satisfaction showed significantly moderate correlation to PES ($r=0.42$, $P=.001$) and PI ($r=0.3$, $P=.019$).
	Patients					80		
Suphanantachat et al[23]	Professionals		VAS: 50.6			54.1		VAS score of clinician significantly lower than that of patient with no correlation.
	Patients		67.4			84.5		
Vilhjálmsson et al[24]	Professionals	PES=8, ICAI=9 Mod-ICAI=7	ICAI=6 Mod-ICAI=4					Patient satisfaction of form and color of mucosa correlated with mod-ICAI ($r=0.3$, $P=.05$).
	Patients			72	72			
Belser et al[12]	Professional	PES=7.8 ±0.9	PES: 100			PES/WES: 97.8		No correlation between total PES/WES and VAS response to esthetic questions.
	Patients					60-80	85.2	
Palmer et al[25]	Professionals	PI 3=48.9% PI 2=44.6% PI 1=6.5%		Median 5.5	Median 5			Patients' scores significantly greater compared with those judged by clinicians.
	Patients			Median 6	Median 6			

ICAI, Implant Crown Aesthetic Index; PES, Pink Esthetic Score; PI, Papilla Index; VAS, visual analog scale; WES, White Esthetic Score.

treatment from patients were high. Some studies identified a correlation between the objective assessment and patient satisfaction using the Spearman correlation coefficient.[16,17,20,22,24]

Table 6 presents the data extracted from 9 studies evaluating the implant prosthesis. The clinician assessments showed a mean satisfaction range of 62% to 90% and the patient assessments 81% to 96%. Although some of the studies[12,16,17] did not identify clinical relevance between the objective and subjective evaluation of the implant restorations, other studies[20,24] observed a significant correlation between the objective and subjective evaluations.

A preliminary analysis of the included studies revealed that most studies were case series studies. The evidence from the pooled case series studies should be evaluated with caution because a marked heterogeneity between studies was observed. Therefore, quantitative

Table 6. Implant crown assessment

Study	Who	Implant Crown Assessment with Mean Score						Relevant Findings
		Esthetic Score	Satisfied With Crown (%)	Satisfied With Color of Crown (%)	Satisfied with Shape of Crown (%)	Esthetic Satisfaction (%)	Overall Satisfaction (%)	
den Hartog et al[16]	Professionals	WES=7.3 ±1.5	WES: 79.3 ICAI: 62					No correlation between WES and patients' satisfaction with implant crown.
	Patients			93.3	95.7		90	
Meijndert et al[17]	Professional		ICAI: 90			ICAI: 66		No correlation between ICAI and patients' satisfaction with implant crown.
	Patients		82.4				100	
Cosyn et al[18]	Professional	WES=7.9 ±1.9	WES: 85			PES/WES: 74		No significant correlation between WES and patient's white esthetic satisfaction (r=0.16, P=.32).
	Patients		94					
Taylor et al[19]	Professionals	WES=6.0 ±2.8						No significant correlation between total PES/WES and patients' perspective (r=0.31, P=.12).
	Patients					Median 90		
Hartlev et al[20]	Professionals	WES=7.7	VAS: 70				70	Positive weak correlation between clinicians' and patients' VAS scores of implant crown (r=0.3, P=.02).
	Patients		88				94	
Suphanantachat et al[23]	Professionals			64.3	60.9	54.1		VAS score of clinician significantly lower than that of patient with no correlation.
	Patients			80.8	82.9	84.5		
Vilhjálmsson et al[24]	Professionals		ICAI=9 Mod-ICAI=3					Patient satisfaction of form and color of crown correlated with ICAI and mod-ICAI (r=0.31-0.35, P<.05).
	Patients			88	84			
Belser et al[12]	Professional	WES=6.9 ±1.5	WES: 80			PES/WES: 97.8		No correlation between total PES/WES and VAS response to esthetic questions.
	Patients					60-80	85.2	
Palmer et al[25]	Professionals			Median 5.5	Median 5.5			Patients' scores significantly greater than those judged by clinicians.
	Patients			Median 6	Median 6			

ICAI, Implant Crown Aesthetic Index; PES, Pink Esthetic Score; VAS, visual analog scale; WES, White Esthetic Score.

data analysis and subsequent meta-analysis could not be performed.

DISCUSSION

The focus on patient perspectives has increased, inclusive of esthetic outcomes associated with implant-assisted therapy. Assessment of patient satisfaction varies considerably. Follow-up periods are short, with 1 year being most common for this review. This period, however, may be sufficient for initial esthetic assessment of soft tissue healing[2,9] and to measure patient satisfaction of implant function over this time. The included studies revealed that patients were mostly satisfied, providing high scores for peri-implant soft tissue, implant crown, and overall esthetic satisfaction. It can be concluded that implant-supported single-tooth restorations fulfill patient esthetic expectations.

The articles considered reproducibility of esthetic indices among dental specialties. Vaidya et al[13] considered that the PES/WES and the mod-ICAI are reliable regarding interexaminer and intraexaminer reproducibility. Dental assistants and periodontists provided more favorable ratings compared with other specialties, whereas prosthodontists were most critical. In this systematic review, half of the included studies reported examination by prosthodontists.[12,17,19,20,22,23] Notably, over 80% of the included studies used blinded examiners to prevent bias.

This review identified 5 studies demonstrating a significant correlation between objective clinician assessments and subjective patient perceptions for the mucosal assessment[16,17,20,22,24] and crown restoration.[20,24] The esthetic indices correlating with patient satisfaction were the PES,[16,22] the PI,[22] the ICAI,[17,24] and the mod-ICAI.[24] Markedly, these parameters assess the peri-implant soft

tissue. Similarly, patient responses concerning the prostheses correlated with the ICAI and the mod-ICAI.[24] Another study used the VAS score,[20] which demonstrated a positive correlation between subjective patient and clinician scores for the peri-implant mucosa and the crown. However, these correlations, determined by the Spearman rank correlation, were mostly weak to moderate. The studies assessing esthetic outcomes using similar questions[20,23,25] found patient satisfaction to be significantly higher than that of the clinician. The clinician rating was more critical with a lower score compared with that of the patient with regard to esthetic satisfaction.

Several studies[16-18] evaluated both mucosa and restoration esthetics. The peri-implant mucosa always rated less satisfactory than the implant-supported crown. The implant-supported restoration is influenced by external factors. Technicians manageably control the color of the crown. In some circumstances, veneers or bonded porcelain restorations of the neighboring teeth may allow for appropriate space and the harmonious contour of a single crown on the implant. Although the crown may influence the evaluation, Hartlev et al[20] found little difference in patient satisfaction based on different materials. In patients with inadequate hard and soft tissue before implant placement, the regeneration of peri-implant bone and soft tissue defects played an essential role in the esthetic outcomes of the peri-implant mucosa. Meijndert et al[17] found, for example, that 43% of patients were esthetically satisfied with the mucosa in areas requiring augmentation prior to implant surgery. Consequently, it was more challenging to reach a satisfactory esthetic outcome level for the peri-implant soft tissue surrounding the crown, because these outcomes typically depend on the pretreatment local anatomy.

The appearance of the peri-implant mucosa is an important esthetic concern to the clinicians. One study reported significantly increased mid-facial recession when delayed rather than immediate restorations were used.[3] However, the 0.75-mm mean difference was not commonly noticed by the patients. A dimensional change of the peri-implant soft tissue in the range of 1 mm is typically indiscernible to the patient and does not affect esthetic satisfaction.[4-7] Incomplete papilla fill, resulting in a black triangle in the embrasure area between the implant and the neighboring tooth, is of concern to the clinician from an esthetic perspective. However, Chang and Wennström[21] found that patient satisfaction with single-implant restorations was generally high and not significantly different between those with complete papilla and deficient papilla fill. However, this study reported that the majority of these patients (79%) had an average or low smile line, which could result in the deficient papilla not being visible to the patient.

Some studies found no correlation between the objective indices[12,18,19,21] or professional VAS score.[23] The results from these studies appear to confirm that the patient's esthetic perception of single-implant supported crowns varies from that of the clinician. Although Belser et al[12] did not detect any correlation when considering the entire patient population, this study determined a moderately strong correlation (r=0.82, P=.18) that was not significant between the PES/WES and patient VAS response when only the data from the 4 patients who gave the highest VAS scores were used. Thus, the evaluation method that can result in agreement between clinician assessments and patient opinions on esthetic outcomes of single-implant restoration remains undetermined because of the differences in the study interventions, the small number of patients, and the objective esthetic indices used.

The measurement index used should be considered. The interpretation of the percentage satisfaction from each esthetic index was different. For example, an acceptable outcome for the PES requires a score greater than 8 out of 14. For the PES/WES, a satisfactory score is defined as being greater than 6 on a scale of 0 to 10. Thus, the meaning of a specific esthetic index is difficult to isolate when comparison with VAS scores are attempted.

Currently, both patient and clinician esthetic evaluations are important in defining successful implant-based treatment in the esthetic regions. Factors considered by the clinicians to be of significance may vary from those considered important by the patients. Clinicians must consider the patient's perspective when treating in esthetically relevant areas. Understanding patient expectations facilitates improved treatment outcomes and optimal patient satisfaction.

CONCLUSIONS

Within the limitations of this systematic review, the following conclusions were drawn:

1. The PES and the PI correlated with patient responses concerning the peri-implant soft tissue.
2. The ICAI and the mod-ICAI identified a correlation between the objective and subjective assessment of both the peri-implant mucosa and esthetically relevant implant-supported crowns.
3. The clinicians' VAS scores were always lower than those of the patients. Thus, there is a need to develop a comprehensive and practical index to assess the esthetic outcomes for single-tooth implant restorations that is relevant and understandable to both clinicians and patients.

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