

Is Incisive Papilla a Good Landmark to Predict Clinical Outcomes and the Esthetic Perceptions of Edentulous Patients Treated with Implant-Supported Fixed Prosthesis on Maxillae?

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Purpose: To investigate the effect of incisive papilla on esthetic ratings and lip support for patients who are treated with implant-supported fixed prostheses on edentulous maxillae. **Materials and Methods:** A study population of 118 patients with maxillomandibular edentulism was identified. A self-administered questionnaire was used to evaluate treatment outcomes through a patient perspective. Also, clinical factors such as smile line, maxillary resorption, incisive papilla position, and lip support were evaluated. **Results:** Lip support has a significant effect on the facial esthetic scores of patients, while smile line and incisive papilla localization have not had a proven statistically significant effect on esthetic and facial esthetic scores of patients treated with implant-supported fixed prostheses on maxillae. **Conclusion:** Although the patients were diagnosed with disadvantageous clinical factors such as crestally localized incisive papilla, they still noted higher esthetic scores with their fixed prostheses. Factors that affect the esthetic perception of patients or their priorities should be investigated more to understand the reasons for patient satisfaction with prostheses. *Int J Oral Maxillofac Implants* 2023;38:71–76. doi: 10.11607/jomi.9829

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Restoring the edentulous maxilla with a removable prosthesis (RP) or implant-supported fixed prosthesis (ISF) is a complex procedure. Several factors are taken into consideration while planning these cases. Factors such as facial support, maxillomandibular relationship, lip support, smile line, bone resorption pattern, and vestibular space are critical for decision making because the acrylic flanges of a removable restoration could compensate for high smile line, class III jaw relationship, dark buccal corridors, and sagittally resorbed maxillae (with crestally localized incisal

papilla).^{1–5} Bidra et al evaluated the relationship between lip support and facial esthetic among patients and reported that flangeless removable dentures resulted in a slightly lower score on the visual analog scale (VAS) ratings compared to dentures with flange in terms of lip support and facial esthetics.^{3,4} Lago et al proposed a protocol that analyzed three basic prosthetic aspects to establish the best rehabilitation method for edentulous maxillae. Denture space, lip support, and smile line were evaluated for patients treated with ISFs or RPs on edentulous maxillae.⁶ Incisive papilla is recommended for evaluation as a guide while planning ISF for the maxilla.^{1,7} However, incisive papilla position has not been studied sufficiently for its predictive validity for esthetics of the prosthesis, facial appearance with the prosthesis, and patient satisfaction.

This retrospective investigation aimed to evaluate patient satisfaction levels related to clinical factors, especially incisive papilla position. The hypothesis was that patients treated with ISFs on maxillae with disadvantageous clinical factors, such as crestally localized incisive papilla, higher smile line, and trapped upper lip would have similar esthetic ratings to patients with ideal clinical conditions or patients with RPs. Furthermore, localization of incisive papilla that shows a sagittal resorption pattern for the maxilla was investigated to see if it had a relationship with the amount of vestibular space and lip support.

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Checklist for clinical examination		
Treatment option for edentulous maxilla	<input type="checkbox"/> Implant-supported fixed	<input type="checkbox"/> Removable prosthesis
Smile line (determined during expanded smile)	<input type="checkbox"/> Low	<input type="checkbox"/> Gingiva display
Lip support	<input type="checkbox"/> Entire lip thickness displayed	<input type="checkbox"/> Trapped thin invaginated lip
Vestibular space	<input type="checkbox"/> Little	<input type="checkbox"/> Increased during smiling
Incise papilla position	<input type="checkbox"/> Palatal	<input type="checkbox"/> Crestal
Questionnaire		
Please put a mark on the linear scale below in accordance with the esthetics of dental prosthesis.		

Not satisfied		Totally satisfied
Please put a mark on the linear scale below in accordance with the esthetics of your face with your dental prosthesis.		

Not satisfied		Totally satisfied
Would you prefer a removable prosthesis instead of a fixed prosthesis if the removable one would guarantee better facial esthetics?	<input type="checkbox"/> Yes	<input type="checkbox"/> No

Fig 1 Checklist for clinical examination and patient satisfaction questionnaire.

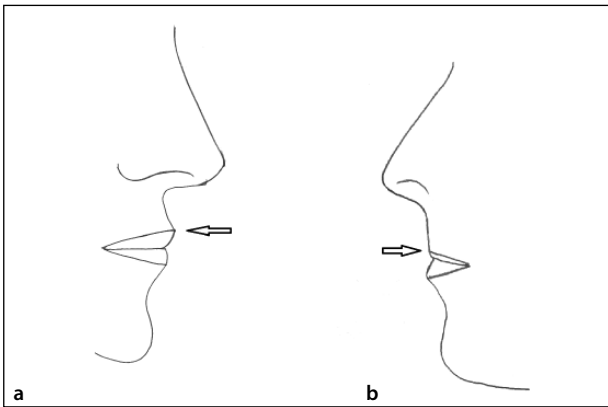


Fig 2 (a) Diagram of well-supported lip with prominent vermilion (arrow) and decreased NLA and (b) insufficient lip support with trapped lip, weak vermilion line, and increased NLA.

MATERIALS AND METHODS

Records of patients treated with implant-supported prostheses were reviewed. Completely edentulous patients treated with implant-supported prostheses at Selçuk University from February 2013 to May 2020 were contacted by phone and invited to a clinic. This study followed the Declaration of Helsinki. The ethical committee of Selçuk University approved the study (04.10.2012 and no.2012/10). All patients signed a written consent form. This study is compliant with STROBE guidelines.

Population Study Group

Completely edentulous patients treated with implant-supported overdentures and/or fixed prostheses with a minimum 1-year period of wearing the prostheses were invited to the clinic and asked to take part in the study. Patients treated with the All-on-4 treatment concept (Nobel Biocare) or zygoma implants were not evaluated for the study. Patients who had only one edentulous

arch or partially edentulous arches and patients with soft or hard tissue inflammation in the oral cavity were not evaluated for the study. Patients with cognitive impairment were not included in the study.

A total of 118 patients who met the criteria and completed the questionnaires were included and grouped according to their treatment protocols. The control group consisted of 46 patients treated with RPs in the maxilla because negative clinical factors could easily be compensated with acrylic flanges. The remaining patients ($n = 72$) were treated with ISFs for the maxilla. Patients with ISFs on the maxilla were grouped as patients with advantageous (palatally localized incisive papilla/low smile line/sufficient lip support/little vestibular sulcus) and disadvantageous (crestally localized incisive papilla/gingiva displayed smile/trapped upper lip/dark buccal corridors) clinical factors.

Measurements

Questionnaire. Patient satisfaction was assessed using a questionnaire prepared by the authors modifying and translating the Oral Health Impact Profile in Edentulous Adults (OHIP-EDENT) questionnaire. The questionnaire was presented to patients by researchers. The patients expressed esthetic satisfaction on the VAS scale by marking their satisfaction with the esthetics of the prosthesis and of their facial esthetics with the prosthesis in place on a linear scale (Fig 1). Demographic data were recorded. Furthermore, the subjects were asked about their preference between a removable or fixed prosthesis.

Checklist for clinical examination. Smile line, lip morphology, and alveolar resorption patterns are the main issues to be evaluated by clinicians to obtain a perfect esthetic with an ISF on the maxilla. These factors were not evaluated for patients who had maxillary RPs, as it was easy to compensate for insufficiencies and

Table 1 Mean VAS Scores Related to Implant-Supported Prosthesis

	Palatally located incisive papilla in patients treated with ISFs		Crestally located incisive papilla in patients treated with ISFs		Patients treated with RPs		
	N	Mean	N	Mean	N	Mean	P
Esthetics of prosthesis (VAS)	43	83.1 ^a	29	91.8 ^b	46	83.9 ^a	.04
Facial esthetics with prosthesis (VAS)	43	83.8 ^a	29	94.75 ^b	46	84.1 ^a	.007
	Low smile line in patients treated with ISFs		Displayed gingiva in patients treated with ISFs		Patients treated with RPs		
	N	Mean	N	Mean	N	Mean	P
Esthetics of prosthesis (VAS)	39	87.1	33	86.01	46	83.9	.12
Facial esthetics with prosthesis (VAS)	39	88.6	33	87.75	46	84.1	.09
	Sufficient lip support in patients treated with ISFs		Trapped lip in patients treated with ISFs		Patients treated with RPs		
	N	Mean	N	Mean	N	Mean	P
Esthetics of prosthesis (VAS)	38	84.6	34	88.8	46	83.9	.055
Facial esthetics with prosthesis (VAS)	38	93.05 ^a	34	82.8 ^b	46	84.1 ^b	.01

ISF = implant-supported fixed prosthesis; RP = removable prosthesis; VAS = visual analog scale. Different superscript letters indicate statistically significant differences between study groups.

obtain a good esthetic with acrylic flanges. The intraoral and extraoral checklist had four subscales:

1. Smile line (low/gingiva display)
2. Lip support (entire lip thickness displayed/trapped thin lip; Fig 2)
3. Vestibular space (little/increased with smiling)
4. Incisive papilla position (palatal/crestal)

Statistical Analysis

The data were statistically analyzed with SPSS (Statistical Package for the Social Sciences) 15.0 program. To compare satisfaction levels between groups, one-way ANOVA or Kruskal-Wallis tests were used. Chi-square tests were used to evaluate the relationship between incisive papilla localization and clinical outcomes.

RESULTS

A total of 118 patients (49 men and 69 women; mean age: 65.6 ± 8.41 years) were included. The average follow-up periods were 42.18 months (range between 12 and 84 months).

A total of 72 patients treated with ISFs in maxillae were evaluated for clinical parameters (localization of incisive papilla, smile line, lip support, and vestibular space) to see if these parameters had any effect on patient esthetic perception and satisfaction. Patients with crestally localized incisive papillae (n = 29) gave significantly higher esthetic and facial esthetic scores than patients with palatally localized incisive papillae (n = 43) and patients treated with RPs (n = 46), which was contrary to the authors' expectations (P = .04, P = .007, respectively; Table 1)

The patients with ISFs on maxillae were grouped according to whether they had dark buccal corridors. Patients who had dark buccal corridors, patients who had an ideal vestibular space, and patients with RPs had similar esthetic and facial esthetic ratings (P > .05).

Patients with crestally located incisive papillae had significantly higher rates of increased vestibular sulcus than patients with palatally located incisive papillae (P = .009). With this result, it was concluded that sagittal resorption of the maxilla leads to transverse resorption (Table 1).

On the other hand, lip support had a significant effect on the facial esthetic scores of patients (P = .01). The patients treated with ISFs were grouped according to their lip support. Patients who were identified with trapped lip (n = 34) had lower mean facial esthetic scores than patients with prominent and well-supported lips (n = 38) and patients from the control group, who were treated with RPs (n = 46; Table 1).

The relationship between incisive papilla localization and the degree of lip support was investigated. Patients with crestally localized incisive papillae had a statistically higher ratio of insufficient lip support (P = .03; Figs 3 and 4)

Smile line did not have a statistically significant effect on the esthetic and facial esthetic scores of patients (P > .05). Patients with ISFs on maxillae with gingiva display (n = 33), patients with ISFs on maxillae with a low smile line (n = 39), and the control group had similar mean VAS scores.

When the patients were asked if they would prefer an RP instead of a fixed prosthesis if the removable one would guarantee better facial esthetic, only 3 out of 72 patients preferred the RP.

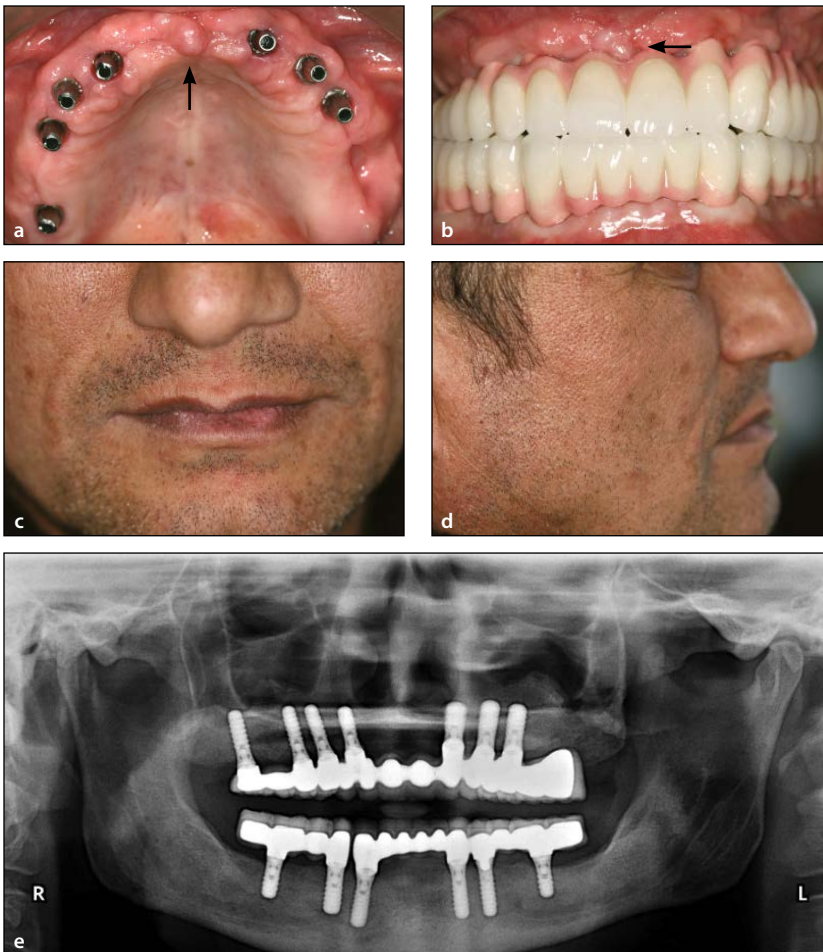


Fig 3 Clinical images of a patient treated with an ISF on the maxilla with (a) crestally located incisive papilla (arrow). (b) Intraoral view of incisive papilla even with prosthetic restoration (arrow). (c) Frontal and (d) profile view of unsupported thin lip. (e) Orthopantomograph (OPG) of patient.

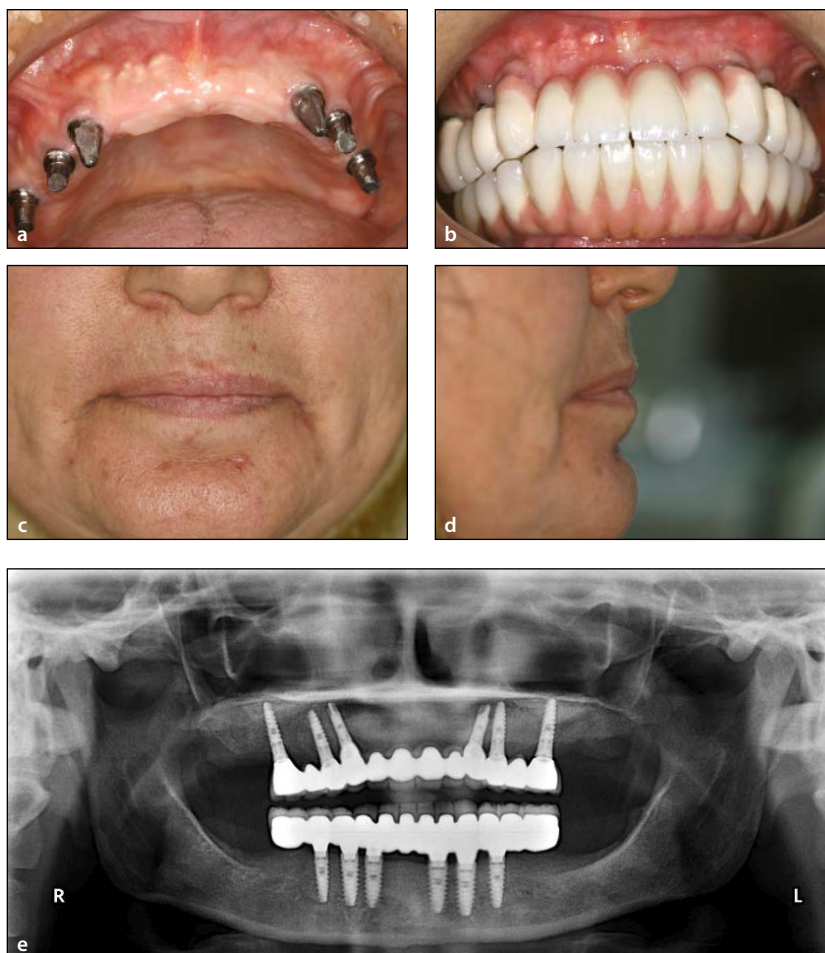
DISCUSSION

Proper prostheses for edentulous patients should be designed according to intraoral and facial factors. The recommended restoration should be discussed with patients, and it may be necessary to convince them that a removable overdenture might be more convenient for their situation. However, patient demands may dominate the treatment plan, as occurred in the present study. When ISFs are planned, it is important that clinicians communicate with patients about disadvantageous clinical parameters and manage patient expectations so that patients are satisfied. The present study evaluated patient perception for prostheses related to anatomical and clinical factors that may affect patient perception. This kind of study on the effect of clinical factors such as lip morphology and incisive papilla on patient satisfaction is rare. In particular, the present study evaluated incisive papilla to see if it had predictive validity on the clinical outcomes of patients.

Bidra et al reported four staged clinical studies that investigated the effect of flange on lip support by using objective and subjective analysis.²⁻⁵ Objective

measurements were carried out on standard photographs by using the nasiolabial angle (NLA; the angle between the columella and subnasal) and ratios of subnasal, labral superior lengths.² However, proper angles or ratios were not concluded to judge proper lip support. Several techniques, such as Rickett's E line, Steiner lip analysis, Holdaway's H line, and Burstone's B line, which were commonly used to aid in diagnosis and treatment planning in orthodontics, were not suitable for prosthesis consideration since clinicians have no control over anatomical landmarks that are used in these analyses. Therefore, clinical analysis of lip support is extremely subjective.² The present study considered and judged the sufficiency of lip support of the patients treated with ISF subjectively by following descriptions of insufficient lip support in the literature.^{1,7} Calvani et al identified deficient lip support by a trapped upper lip, thinning of the upper lip, and inverted position of the lip.⁷ Furthermore, a horizontal line in the philtrum or split philtrum groove shows lip defects in contrast to lips that are supported by flange. In the present study, lip thickness, vermilion line prominence, philtrum groove, and introvert position of the upper lip were diagnostic for insufficient lip support. Prosthodontists in

Fig 4 Clinical images of a patient treated with implant-supported fixed prosthesis on the maxilla with palatally located incisive papilla (a); intraoral view of prosthetic restoration (b); frontal (c) and profile (d) view of well-supported thicker lip with narrower NLA and more prominent vermilion and OPG view of patient (e).



the present study made the final decision on lip support for the patients by evaluating these factors. Bidra et al evaluated the effect of lip support on facial esthetic scores by using VAS as in the present study. In the present study, patients were asked to rate their facial esthetics with the prosthesis and the esthetics of the prosthesis within a 100-mm VAS scale. Blinded and unblinded studies carried out on laypeople, dentists, and prosthodontists reported that VAS ratings of facial esthetics for images with flangeless dentures were significantly lower than that for images with labial flange.^{3,4} However, patient-centered VAS analysis showed that there was no statistically significant difference in facial esthetic ratings between lip support with flange or without flange. In the present study, patients diagnosed with insufficient lip support had significantly lower VAS ratings than patients with sufficient lip support and patients with RPs. Patients with a well-supported upper lip were significantly more satisfied with the esthetics of the prosthesis and their faces. Prosthesis esthetics and clinical outcomes are particularly related to tissue loss, especially in maxillary edentulism.⁸⁻¹⁰

Esthetic and facial esthetic VAS scores of patients in the present study were not affected significantly by

smile line. Since the present study was conducted on elderly people, it was observed that gummy smile had decreased with time. Therefore, it was probably tolerated by patients and did not affect the satisfaction levels. On the other hand, satisfaction with functional recovery made the esthetic outcomes more tolerable to patients. A minority of the patients in the present study reported that they would prefer an RP instead of a fixed prosthesis if only the removable one would guarantee a better esthetic. This result supports the idea that comfortable function is the primary expectation of edentulous patients. Feine et al reported that there was no significant difference in patients' choice between ISFs and RPs.¹¹ A within-subject crossover trial by Heydecke et al noted that a majority of patients with edentulous maxillae preferred implant-supported RPs rather than fixed prostheses, in contrast to the present study.¹²

In the present study, patients with more buccally positioned incisive papillae were more satisfied with their maxillary ISFs than patients with palatally positioned incisive papillae and patients in the RP group, which was unexpected. Furthermore, incisive papilla localization showed a significant relationship to lip support and vestibular space. With these results, it



may be concluded that incisive papilla has predictive validity for lip support and dark buccal corridors of patients with ISFs on the maxilla. This study was the first to investigate predictive validity of incisive papilla on measuring clinical outcomes in edentulous patients treated with ISFs. However, an opinion could not be given about the patient satisfaction for resorbed maxillae. The unexpectedly high esthetic scores of patients who had more resorbed maxillae (crestally localized incisive papilla) could be explained by patient priorities and functional gain. **Although conventional RPs could restore function and esthetics of edentulous patients, they do not provide better treatment than ISFs.** Also, the present study did not investigate the use of RPs before ISF treatment. It is recommended that previous wearing of RPs and duration of wearing RPs before ISFs should be investigated to see if it has an effect on patients' attitudes toward their ISF. Previous literature has shown that clinicians and patients do not share the same esthetic threshold when assessing dental and facial esthetics.^{13,14} Additionally, edentulous patients are a distinct cohort compared to laypeople because they may have low expectations. In the authors' clinical experience, **true guidance of patient expectations before treatment could bring higher satisfaction levels.**

CONCLUSIONS

The literature lacks valid studies that investigate the relationship between patient satisfaction and anatomical factors. Further evaluation and prospective studies are required to explore the satisfaction levels of edentulous patients and the factors that affect satisfaction. Based on this study, it can be concluded that:

- Incisive papilla position is a valid predictor for clinicians since it allows them to infer the final status of vestibular space and lip support following fixed prosthetic rehabilitation.
- Incisive papilla localization and maxillary resorption are not good references for patient perception of esthetics. Even with the clinical factors that are disadvantageous from the clinician's perspective, patients could feel satisfied with their prostheses. However, in this study, extreme cases of patients with buccally located incisive papillae were not evaluated since they were not treated with ISFs.
- Clinicians could risk reasonable esthetic loss and treat patients who have crestally located incisive papillae with ISFs since subjective evaluation through patient perception was not affected by this minimal esthetic loss.
- Anatomical factors in patients who were treated with maxillary fixed prostheses were evaluated in

this study, and **it was concluded that factors such as lip line, incisive papilla, and bone resorption guide the treatment design but are not conclusive factors.**



It is essential to evaluate lip support and resorption of the maxilla to plan the case. However, it is equally important to meet patient demands with optimal esthetics to obtain a satisfied patient population.

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