

# STUDY OF ESTHETIC OUTCOMES OF MAXILLARY LATERAL INCISOR AGENESIS TREATMENT BY ORTHODONTIC SPACE CLOSURE VERSUS IMPLANT PLACEMENT

Rahimi F,<sup>1</sup> Moradpoor H,<sup>2</sup> Raissi S,<sup>3</sup> Akbari N,<sup>4</sup> Golshah A<sup>5</sup>

1. Assistant Professor, Department of Orthodontics, School of Dentistry, Kermanshah University of Medical Sciences, Iran.

2. Assistant Professor, Department of Prosthodontics, School of Dentistry, Kermanshah University of Medical Sciences, Iran.

3. Assistant Professor, Department of Prosthodontics, School of Dentistry, Kermanshah University of Medical Sciences, Iran.

4. General Dentist, School of Dentistry, Kermanshah University of Medical Sciences, Iran.

5. Assistant Professor, Department of Orthodontics, School of Dentistry, Kermanshah University of Medical Sciences, Iran.

## ABSTRACT

**Aim:** Due to the fundamental role of esthetics in the outcomes of dental treatments, especially in the anterior region (esthetic zone), the necessity of considering the matter of esthetics in clinical studies has become into focus in the current era. The aim of this study was the study of Esthetic outcomes of maxillary lateral incisor agenesis treatment by orthodontic space closure versus implant placement.

**Materials & Method:** In this study the sample size was 24 Kermanshahi individuals (16 women and 8 men), with the mean age of  $26.08 \pm 2.84$ . These individuals sought dental treatment for replacement of the congenitally missing maxillary lateral incisor. Convenience sampling method was used and patients were divided into two groups regarding the kind of treatment they received. The two treatment protocols included: 1. Space closure by means of orthodontic treatment and then reshaping the canines; and 2. Space regaining by means of orthodontic treatment and replacing the lateral incisor with dental implants. Photographs of patients were acquired from the frontal view with retraction of the lips using digital cameras. Photographs were evaluated for White esthetic score.

**Results:** No significant difference was detected between the two study groups in the evaluated factors in this study.

**Conclusion:** The results of this study indicated that there is no significant difference in esthetic results in the two groups. Furthermore, both groups lead to similar results in patient satisfaction from treatment outcomes.

**Key words:** Congenital missing of maxillary lateral incisors, Esthetic Evaluation, Space Closure, Dental Implants, Patient Satisfaction.

## Introduction

Face is considered as the most important physical characteristic for the development of self-confidence.<sup>1,2</sup> Individuals having satisfaction with their facial appearance have higher levels of self-confidence than those who don't have such satisfaction.<sup>2,3</sup> Congenital absence of teeth in the posterior-anterior regions can disturb the smile symmetry and have a negative effect on one's self-confidence.<sup>4,5</sup> Treatment plans for replacement of the edentulous space due to the congenital absence of maxillary lateral incisor include removable partial dentures, conventional fixed bridges, fixed condylar prostheses, resin bonded bridges, auto-transplantation, orthodontic canine displacement to close the edentulous space and single-tooth implant placement.<sup>6,7</sup> Space closure requires a mesial displacement of a canine and its morphology to be changed in to that of the lateral incisor. Also, the primary premolar incisor must change to canine. Since these incisors are different in terms of anatomy, color and gingival height, if the deformed incisors is not changed properly, the outcomes of the aesthetic treatment will be impaired.<sup>8,9</sup> Acceptable outcomes can be achieved if this process is carefully planned and carried out based on an appropriate interdisciplinary approach.<sup>7,10</sup> The replaced dental implants can also provide satisfactory aesthetic outcomes.<sup>11</sup> The aim of the present study was to compare the aesthetic outcomes of two methods of orthodontic space closure/space and implant placement in the congenitally missing lateral maxillary incisor. Also, a questionnaire was used to measure patients' level of satisfaction in these two treatment groups.

## Materials & Method

The current study has an ethic code IR.KUMS.REC.1396.344 obtained from Kermanshah University of Medical Sciences in Iran. The present study was conducted on 24 patients with history of unilateral congenital absence of lateral maxillary incisors using for two different therapeutic methods of orthodontic space closure and canine reshaping, and space opening and implant placement. Frontal view of intra-oral photography was taken was prepared from patients using a retractor with a digital camera: Nikon D100R (Nikon, Tokyo, Japan) and a 105mm lens (AF micro Nikkor 105mm 1: 2.8D; Nikon) with a 105mm flash ring (Nikon Macro Speedlight SB-29S; Nikon). The photographs were prepared in order to evaluate the incisor with the opposite incisor taking into account the dental midline of the patient, but in order to evaluate the more details of the photographs, single-teeth photographs were also prepared from of the lateral incisor replaced using the above two methods. Photographs were then printed and provided in electronic format. Evaluation of intraoral photographs was carried out by a dental prosthodontist and one student according to the following framework:

Parameter	Major Discrepancy	Minor Discrepancy	No Discrepancy
Tooth Form	0	1	2
Tooth Volume/Outline	0	1	2
Colour (Hue/Value)	0	1	2
Surface Tuxture	0	1	2
Translucency and Characterization	0	1	2
Maximum total WES Score			10

Table 1: Assessment criteria – WES (WES: white esthetic score)

Assessment criteria - WES; A score range of 0-2 should be assigned, with a possible score range of 0-10 for each measurement index (WES).<sup>13,14</sup> In order to reduce the bias and repeatability of the results of each photography, these two variables were measured twice and in two different days based on the WES.



Figure 1: Frontal view of intraoral photographs



Figure 2: Intraoral photography to record the lateral maxillary incisor information

Patients' level of satisfaction with treatment outcomes was assessed using VAS scale.<sup>15</sup>

After data collection stage, the data analysis was carried out using SPSS Ver. 18 (Inc., Chicago, IL, USA). The data collection method was based on a review of photographs prepared from patients and scoring of the items involved in WES index.<sup>15,14</sup> These variables include:

WES	Tooth form	Tooth volume /outline	Color (hue /value)	Surface texture	Translucency and characterization	Total WES (Max 10)
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Table 2: WES index

A Al-Dosari *et al.*<sup>15</sup> assessed the validity of the questionnaire. The patients' level of satisfaction with the shape and color of the crown, the symmetry of the restoration with the symmetrical tooth in the opposite side, the similarity of restoration with other teeth, smile, color and shape of gums, the function of restoration during eating, the function of restoration during speech, ease of taking care of restoration, the entire treatment process, the

time taken to complete the treatment and the cost of treatment were measured using this questionnaire.

**Results**

The present study consisted of 24 patients, of whom 13 (54.2%) and 11 (45.8%) were assigned in the implant and canine contouring groups, respectively. The mean and standard deviation of the participants' age was 26.08 ± 2.84. There was no statistically significant relationship between gender and type of treatment ( $p = 1$ , Fisher exact test). There was a significant relationship between satisfaction with the entire treatment process and study groups (Monte, Carloe Chi-square,  $p = 0.225$ ). There was no statistically significant relationship between satisfaction with the time taken to complete the treatment and study groups ( $p=0.662$ , Monte Carloe Chi-Square). [Table 4]

		Mean	Standard Deviation	Median	Mean Rank	Percentile 25	Percentile 75	p-value <sup>a</sup>
Tooth form	Implant	1.08	0.64	1.00	12.46	1.00	1.00	1
	Canine Reshape	1.09	0.54	1.00	12.55	1.00	1.00	
Tooth volume /outline	Implant	1.00	0.58	1.00	12.92	1.00	1.00	.776
	Canine Reshape	0.91	0.30	1.00	12.00	1.00	1.00	
Color (hue /value)	Implant	1.62	0.51	2.00	12.38	1.00	2.00	.955
	Canine Reshape	1.64	0.50	2.00	12.64	1.00	2.00	
Surface texture	Implant	1.38	0.51	1.00	12.62	1.00	2.00	.955
	Canine Reshape	1.36	0.50	1.00	12.36	1.00	2.00	
Translucency and characterization	Implant	1.54	0.52	2.00	12.96	1.00	2.00	.733
	Canine Reshape	1.45	0.52	1.00	11.95	1.00	2.00	

<sup>a</sup> Mann-Whitney U.

Table 3: Descriptive statistics related to sub-standard WES

		Implant		Canine Reshape	
		Count	Column N %	Count	Column N %
How satisfied are you with the entire treatment?	Don't Know	0	.0%	0	.0%
	Not Satisfied	0	.0%	0	.0%
	Hardly Satisfied	1	7.7%	0	.0%
	Fairly Satisfied	4	30.8%	9	81.8%
	Very Satisfied	8	61.5%	2	18.2%

Table 4: Frequency and percentage of satisfaction from total treatment by study groups

## Discussion

Considering the important role of aesthetics in the dental treatments, especially in the esthetic zone, the researchers have paid more attention to the aesthetic problem in clinical research in the contemporary period. This study was carried out using a retrospective cohort method to answer the fundamental question of whether there is a significant difference between the aesthetic outcomes of the treatment of congenital absence of lateral maxillary incisors using two methods of space opening by implant placement, and the space closure and canine reshaping. The results of the present study indicated no significant difference between the aesthetic outcomes of the two above-mentioned treatments. Patients' level of satisfaction with the above two methods was also assessed based on VAS scale. There was no significant difference between the two groups in terms of their level of satisfaction. The results also showed that the total mean WES is 6.62 in the implant group, which was somewhat consistent with the results of C Mangano *et al.*'s study,<sup>16</sup> in which the mean WES was  $8.70 \pm 0.92$ , which did not change significantly during the 3-year follow up. The results of Alessandro Lanza *et al.*'s study<sup>13</sup> showed a strong correlation between the aesthetic assessment performed by the dentist using the WES and patient-specific criteria (VAS). It seems that WES is a more suitable index for the aesthetic evaluation of the ICAI. Since the results of the WES evaluation are close to the patients' viewpoint according to the opinions of different observers, including various dental specialties, it is therefore an acceptable index to be used clinically during the aesthetic evaluation process. The results showed no significant difference between the two groups in terms of Total WES variable and its subset variables ( $p = 0.839$ ). In a systematic review study, Kiliaridis *et al.* (2016) evaluated an existing treatment plan for the congenital missing lateral incisors. They evaluated articles published from January 1975 to March 2015, with five articles directly comparing these two methods. According to the results of this study, both treatments are useful, which are consistent with the results of the current study. However, the results of the Kiliaridis's study seem to show that the orthodontic space closure is psychologically more effective, if possible, because it gives the patient the feeling that dentition belongs to him/her and does not require a prosthesis. Björn U. Zachrisson *et al.*<sup>17</sup> argued that orthodontic space closure and insertion of the porcelain veneers of several teeth enable to bring the treatment outcomes closer to those of the natural dentition as much as possible. They also referred to the following advantages of this method:

- 1) Young patients receive treatment outcomes at adolescence;
- 2) General treatment plan can be completed after the orthodontic process
- 3) Long-term compliance of the teeth and its surrounding structures will be normal.

Therefore, orthodontic space closure and canine reshaping are preferable to space opening or its maintenance. Patient

satisfaction is considered as one of the treatment outcomes and one of the major factors in attracting patient involvement and improving clinical outcomes.<sup>18</sup> Patient satisfaction leads to better collaboration and thus having patients with a higher level of health status in the long run.<sup>19</sup> Patient satisfaction is defined as a patient's attitude towards treatment outcomes.<sup>20</sup> Therefore, it will be helpful to assess the patient's satisfaction to improve the quality of the treatment.<sup>21</sup> Ware stated that patients' evaluation from treatment is affected by physician behavior, access to health services, continuity and efficiency of service.<sup>21</sup> In this study, the satisfaction with shape and color of the crown, the symmetry of the restoration with the symmetrical tooth in the opposite side, proportion of restoration with other teeth, smile, gingival shape and color, the function of restoration during eating, the function of restoration during the speech, ease of taking care of the restoration, the entire treatment process, the time taken to complete the treatment and the treatment cost were measured by a questionnaire based on VAS score. There was a significant difference between the two groups in terms of their satisfaction level in the overall treatment process. In the group treated by canine reshaping method, the highest satisfaction was reported to be in the relatively satisfactory range and was in a quite satisfactory range in the implant-treated group. In other cases, there was no significant difference between patients in the two groups in terms of their level of satisfaction. Contrary to the present study, De-Marchi *et al.*<sup>22</sup> showed in their study that the canine-reshaping group was more satisfied with the treatment outcomes and their smile's attractiveness than the implant-treated group, which could be due to the fact that these patients kept their natural teeth in the esthetic zone instead of having dental prosthesis. Other factors affecting the satisfaction of these patients were as follows: the need for sufficient time to complete the facial growth in younger patients in order to perform implant placement as well as the time difference between implant placement in the bone and receiving the prosthesis. Since the mean age of the patients was  $26.08 \pm 2.84$  in the present study, there was no limitation on time of implant placement and it can be said that young age has no significant negative effect on the time constraints for receiving implant therapy as compared to two therapeutic approaches from patients' perspective. S Robertsson *et al.*<sup>12</sup> assessed the patients' opinion about the shape, color, and symmetry of tooth and the proper distribution of the interdental space in the anterior maxilla. The results showed no significant difference between the groups treated by the space closure and the space opening and the restorative treatment methods in terms of their level of satisfaction, except for the tooth color, for which 80% of the patients who received the prosthetic treatment and 45% of those who underwent space closure procedure, were satisfied. The results of this study were consistent with the results of the present study.

## Conclusion

This present study showed no significant difference between the congenitally missing lateral maxillary incisors

treated with two methods of space opening and implant placement, the space closure method and the canine reshaping based on the WES criteria in terms of the aesthetic outcomes, except for the distal papilla variable, in which there was a significant difference between the two types of treatment in such way that the median and mean score of the above variable in the implant-treated group was lower than the group treated with space closure and canine reshaping method. There was no statistically significant difference in other variables. The results also showed no significant difference between the two groups in terms of Total WES variable and its subset variables. There was a significant difference between the two groups in terms of patients' level of satisfaction with the aesthetic outcomes of space opening and implant placement and of space closure and canine reshaping method used to treat congenitally missing lateral maxilla incisors. In the group treated by canine reshaping method, the highest satisfaction was reported to be in the relatively satisfactory range and was in a quite satisfactory range in the implant-treated group. In other cases, there was no significant difference between the two groups in terms of their level of satisfaction.

#### References

- Hershon LE, Giddon DB. Determinants of facial profile self-perception. *Am J orthod.* 1980;78(3):279-295.
- Berscheid E, Walster E, Bohrnstedt G. A psychology today questionnaire: body image. *Psychol Today.* 1972;6(2):57-64.
- Albino JE, Alley TR, Tedesco LA, Tobiasen JA, Kiyak HA, Lawrence SD. Esthetic issues in behavioral dentistry. *Ann Behav Med.* 1990;12(4):148-55.
- Cunningham SJ, O'Brien C. Quality of life and orthodontics. *Seminars in Orthod.* 2007;13(2):96-103.
- Van der Geld P, Oosterveld P, Van Heck G, Kuijpers-Jagtman AM. Smile attractiveness. Self-perception and influence on personality. *Angle Orthod.* 2007;77(5):759-765.
- Rupp RP, Dillehay JK, Squire CE. Orthodontics, prosthodontics, and periodontics: a multidisciplinary approach. *Gen Dent.* 1997;45(3):286-289.
- Krassnig M, Fickl S. Congenitally missing lateral incisors—a comparison between restorative, implant, and orthodontic approaches. *Dent Clin North Am.* 2011;55(2):283-299.
- Rosa M, Zachrisson BU. Integrating space closure and esthetic dentistry in patients with missing maxillary lateral incisors. *J Clin Orthod.* 2007;41(9):563-573.
- Pini NIP, De-Marchi LM, Gribel BF, Ramos AL, Furquim LZ, Pascotto RC. Analysis of width/height ratio and gingival zenith in patients with bilateral agenesis of maxillary lateral incisor. *Dent Press J Orthod.* 2012;17(5):87-93.
- Zachrisson BU. Improving the esthetic outcome of canine substitution for missing maxillary lateral incisors. *World J Orthod.* 2007;8(1):72-79.
- Zarone F, Sorrentino R, Vaccaro F, Russo S. Prosthetic treatment of maxillary lateral incisor agenesis with osseointegrated implants: a 24–39-month prospective clinical study. *Clin Oral Implants Res.* 2006;17(1):94-101.
- Robertsson S, Mohlin B. The congenitally missing upper lateral incisor. A retrospective study of orthodontic space closure versus restorative treatment. *Eur J Orthod.* 2000;22(6):697-710.
- Lanza A, Di Francesco F, De Marco G, Femiano F, Itró A. Clinical application of the PES/WES index on natural teeth: Case report and literature review. *Case Rep Dent.* 2017;2017:9659062.
- Cho HL, Lee JK, Um HS, Chang BS. Esthetic evaluation of maxillary single-tooth implants in the esthetic zone. *J Periodontal Implant Sci.* 2010;40(4):188-193.
- Al-Dosari A, Al-Rowis Re, Moslem F, Alshehri F, Ballo AM. Esthetic outcome for maxillary anterior single implants assessed by different dental specialists. *J Adv Prosthodont.* 2016;8(5):345-353.
- Mangano C, Levrini L, Mangano A, Mangano F, Macchi A, Caprioglio A. Esthetic evaluation of implants placed after orthodontic treatment in patients with congenitally missing lateral incisors. *J Esthet Restor Dent.* 2014;26(1):61-71.
- Zachrisson BU, Rosa M, Toreskog S. Congenitally missing maxillary lateral incisors: canine substitution. *Point. Am J Orthod Dentofacial Orthop.* 2011;139(4):434,436,438.
- Donabedian A. The Lichfield Lecture. Quality assurance in health care: consumers' role. *Qual Health Care.* 1992;1(4):247-251.
- Ebn Ahmady A, Pakkhesal M, Zafarmand AH, Lando HA. Patient satisfaction surveys in dental school clinics: a review and comparison. *J Dent Educ.* 2015;79(4):388-393.
- Al-Abri R, Al-Balushi A. Patient satisfaction survey as a tool towards quality improvement. *Oman Med J.* 2014;29(1):3-7.
- Naidu A. Factors affecting patient satisfaction and healthcare quality. *Int J Health Care Qual Assur.* 2009;22(4):366-381.
- De-Marchi LM, Pini NI, Ramos AL, Pascotto RC. Smile attractiveness of patients treated for congenitally missing maxillary lateral incisors as rated by dentists, laypersons, and the patients themselves. *J Prosthet Dent.* 2014;112(3):540-546.

#### Corresponding Author

##### Dr. Golshah A.

Assistant Professor,  
Department of Orthodontics,  
School of Dentistry,  
Kermanshah University of Medical Sciences, IRAN.  
Email Id: - golshah.a@gmail.com