

## CONGENITALLY MISSING OF THE MAXILLARY LATERAL INCISOR: ORTHODONTIC CLOSURE OF THE SPACE

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### ABSTRACT

**Aim of the study:** The aim of the study was to analyze the effectiveness of orthodontic space closure treatment in patients with congenitally missing of upper lateral incisors (CMULI). **Materials and methods.** The study was carried out on a group of 25 patients with CMULI aged between 7-25 years (average age 14.6 years), who presented themselves for CMULI treatment. Fixed orthodontic appliance, protraction facial mask and class III elastics were applied to all patients. The cephalometric radiographs before and after treatment were analyzed to observe if the application of the orthodontic appliance produces dento-alveolar retrusion and the statistical correlations between the studied parameters were analysed. **Results.** The statistical analysis of the studied variables showed that there are no statistically significant correlations between the initial and final cephalometric values, obtained after the orthodontic treatment. **Conclusions** The association of fixed orthodontic appliances together with protraction facemask and class III elastics represents an effective method of treatment of congenitally missing of upper lateral incisor.

**Key words:** lateral incisor, space closure, protraction face mask

### INTRODUCTION

Congenitally missing of upper lateral incisor (CMULI) is usually diagnosed very early (7-8 years), most often by routine clinical and radiological examination [1-4]. In the case of CMULI, the aesthetic damage is most often extremely important and affects self-esteem and quality of life. That's why patients request treatment early, wanting a final solution to aesthetic problems as quickly as possible [3,5].

Due to the absence of teeth and the spaces present in the frontal area, the aesthetic damage is major, and the therapeutic solutions refer either to the orthodontic closing of the space, or to the prosthetic solution [6-10]. In the treatment of CMULI,

the treatment decision must be based on a thorough analysis of some factors that will influence treatment outcomes: the patient's age as an indicator for the presence/cease of growth, the associated malocclusions, the amount of existent space, condition of the adjacent teeth, the technical-economic possibilities of the patient/doctor/laboratory [11,12].

Treatment in the case of CMULI can include several possible options: no treatment; closing the orthodontic space with canine reshape; orthodontic space maintenance and prosthetic replacement of the missing tooth (conventional, adhesive or implant prostheses) [5-7,14]. As in any other anomaly, the treatment of choice should be

the minimally invasive option that satisfies the expected aesthetic and functional goals. In the treatment of CMULI, the role of the orthodontist is important, because a correct positioning of the teeth will lead to excellent aesthetic and functional results [1,8].

Often, growing patients, out of the desire to complete the orthodontic treatment as quickly as possible and to reach the desired aesthetic results, require the orthodontic closure of the space as a treatment method[5].

From an orthodontic point of view, the method of orthodontic space closure represents a challenge, especially in class III skeletal malocclusions, or in class I Angle-borderline cases, with a tendency towards skeletal class III.

## MATERIAL AND METHOD

This retrospective study was carried out by analysing the cephalometric radiographs of 25 orthodontic patients (17 girls, 8 boy) aged between 7-25 years (mean age 14.6 years, SD -4.31) who were diagnosed with congenitally missing of permanent maxillary lateral incisors and were treated orthodontically by closing the space. Patients were diagnosed with unilateral (6 patients) and bilateral (19 patients) CMULI. In all patients included in the study, the profile telerradiographs before and after orthodontic treatment existing in the patient's orthodontic file were analysed. The orthodontic treatment consisted of the application of a orthodontic fixed appliance (Roth, 0.022-inch slot) and facial mask for maxillary protraction and mechanotherapy with class III elastics, to avoid the retroclination of the upper incisors, which occurs during the mechanical closing of the existing spaces in the dental arch. Pre- and post-treatment (I and F) lateral cephalometric radiographs of all patients included in the study were analysed and compared, in order to evaluate the orthodontic changes at the

dental and skeletal level obtained through orthodontic treatment.

Patients were informed about the goals of orthodontic treatment and all patients completed the treatment. All patients included in the study signed the informed consent.

The cephalograms were digitally analysed using the AudaxCeph software (ver.6, Tehnolosky park 18, SI-1000 Ljubljana, Slovenia). The Steiner and Tweed methods were used for the analysis. To assess changes occurring during treatment, baseline variables were compared with end-of-treatment findings. All data were recorded and statistically analysed using IBM SPSS-26 for Windows. NPar tests, Kolmogorov-Smirnov test, T-Test and Paired Samples Test, Bootstap and the classic non-parametric Wilcoxon test were applied to statistically significantly correlate the initial and final parameters studied.

## RESULTS

NPar Tests were applied, comparing the initial and final averages of the 15 variables measured by Steiner and Tweed analysis with the help of AudaxCeph, they showed that there were no very large differences between the initial and final values of the studied cephalometric parameters, which shows that the application of orthodontic treatment to correct CMULI does not essentially change the skeletal cephalometric values (table 1).

**Table 1.** Descriptive Statistics: Initial and final cephalometric values

nr	data	N	Mean	Std. Dev	Minim	Maxim
1	ANB_F	25	1.92	3.402	-6	7
	ANB_I	25	2.72	4.354	-7	10
2	AOBO_F	25	-1.36	3.718	-9	6
	AOBO_I	25	-1.48	4.611	-13	8
3	FMA_F	25	28.92	5.838	21	46
	FMA_I	25	27.48	6.319	18	46
4	HA_F	25	67.72	12.188	42	97
	HA_I	25	64.08	12.619	33	91
5	HP_F	25	46.68	9.196	33	69
	HP_I	25	46.48	9.653	33	65

6	IMPA_F	25	89.44	14.295	61	133
	IMPA_I	25	87.6	17.481	28	126
7	L_F	25	22.16	5.991	9	34
	L_I	25	21.68	6.517	6	32
8	L_Fmm	25	4.24	2.223	-1	8
	L_I_mm	25	4.76	4.666	1	25
9	MbSN_F	25	34.64	7.566	25	60
	Mb-SN_I	25	38.64	22.263	25	141
10	SNA_F	25	81.32	4.571	73	92
	SNA_I	25	82.68	4.171	74	92
11	SNB_F	25	79.24	3.257	72	86
	SNB_I	25	79.56	3.536	70	87
12	SND_F	25	76.92	3.278	68	82
	SND_I	25	74.12	15.46	3	92
13	U_F	25	21.16	8.711	2	40
	U_I	25	21.68	7.403	9	35
14	U_F	25	5.08	4.898	-1	24
	U_I_mm	25	6.2	8.539	0	45
15	UL_F	25	134.92	13.407	90	156
	UL_I	25	130.24	12.81	90	146

Data were statistically verified to be normally distributed by applying the Kolmogorov-Smirnov test (table 2). For a statistical significance ( $p < 0.05$ ) it means that the respective variables do not come from a

normally distributed population and the comparisons will have to be made with a non-parametric test. The initial SND, Mb\_I, UI\_I (mm) and LI\_I variables do not follow the Gauss - Laplace curve (table 2).

Also, the application of T-Test and Paired Samples Test, Bootstrap does not show significant statistical correlations between the initial and final parameters studied (table 3-5).

Even with the Bootstrap statistical method, a robust method compared to the t-test, which does not depend on the type of distribution, significant statistical significances were not obtained.

Only the application of the classic non-parametric Wilcoxon test shows the achievement of statistically significant correlations between the initial/final values of the ANB angle and the anterior height of the face(table6).

Table 2. One-Sample Kolmogorov-Smirnov Test

One-Sample Kolmogorov-Smirnov Test								
	N	Normal Parameters <sup>a,b</sup>		Most Extreme Differences			Kolmogorov-Smirnov Z	Asymp. Sig. (2-tailed)
		Mean	Std. Deviation	Absolute	Positive	Negative		
SNA_I	25	82.68	4.171	.171	.096	-.171	.853	.461
SNB_I	25	79.56	3.536	.210	.125	-.210	1.048	.222
<b>SND_I</b>	25	74.12	15.460	.377	.265	-.377	1.885	<b>.002</b>
ANB_I	25	2.72	4.354	.206	.180	-.206	1.028	.241
AOBO_I	25	-1.48	4.611	.172	.145	-.172	.862	.448
FMA_I	25	27.48	6.319	.187	.187	-.131	.936	.345
<b>MbSN_I</b>	25	38.64	22.263	.342	.342	-.270	1.712	<b>.006</b>
HA_I	25	64.08	12.619	.137	.096	-.137	.687	.732
HP_I	25	46.48	9.653	.189	.189	-.099	.945	.334
<b>U_Imm</b>	25	6.20	8.539	.297	.297	-.234	1.483	<b>.025</b>
U_I	25	21.68	7.403	.139	.139	-.110	.693	.723
<b>L_Imm</b>	25	4.76	4.666	.325	.325	-.237	1.623	<b>.010</b>
L_I	25	21.68	6.517	.106	.084	-.106	.531	.940
IMPA_I	25	87.60	17.481	.214	.182	-.214	1.072	.201
UL_I	25	130.24	12.810	.109	.109	-.105	.547	.926
SNA_F	25	81.32	4.571	.134	.134	-.123	.671	.759
SNB_F	25	79.24	3.257	.114	.114	-.112	.571	.900
SND_F	25	76.92	3.278	.159	.131	-.159	.795	.552
ANB_F	25	1.92	3.402	.149	.079	-.149	.747	.632
AOBO_F	25	-1.36	3.718	.097	.088	-.097	.486	.972
FMA_F	25	28.92	5.838	.122	.122	-.087	.611	.849
MbSN_F	25	34.64	7.566	.146	.146	-.101	.729	.663
HA_F	25	67.72	12.188	.159	.092	-.159	.797	.549
HP_F	25	46.68	9.196	.169	.169	-.114	.847	.469

U_F_mm	25	5.08	4.898	.228	.228	-.110	1.138	.150
U_F	25	21.16	8.711	.136	.136	-.098	.682	.741
L_F_mm	25	4.24	2.223	.194	.174	-.194	.969	.305
L_F	25	22.16	5.991	.141	.141	-.129	.704	.705
UL_F	25	134.92	13.407	.169	.112	-.169	.847	.470

**Table 3. Paired Samples Statistics**

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	ANB_F	1.92	25	3.402	.680
	ANB_I	2.72	25	4.354	.871
Pair 2	AOBO_F	-1.36	25	3.718	.744
	AOBO_I	-1.48	25	4.611	.922
Pair 3	FMA_F	28.92	25	5.838	1.168
	FMA_I	27.48	25	6.319	1.264
Pair 4	HA_F	67.72	25	12.188	2.438
	HA_I	64.08	25	12.619	2.524
Pair 5	HP_F	46.68	25	9.196	1.839
	HP_I	46.48	25	9.653	1.931
Pair 6	IMPA_F	89.44	25	14.295	2.859
	IMPA_I	87.60	25	17.481	3.496
Pair 7	L_F	22.16	25	5.991	1.198
	L_I	21.68	25	6.517	1.303
Pair 8	L_Fmm	4.24	25	2.223	.445
	L_Imm	4.76	25	4.666	.933
Pair 9	MbSN_F	34.64	25	7.566	1.513
	MbSNInial	38.64	25	22.263	4.453
Pair 10	SNA_F	81.32	25	4.571	.914
	SNA_I	82.68	25	4.171	.834
Pair 11	SNB_F	79.24	25	3.257	.651
	SNB_I	79.56	25	3.536	.707
Pair 12	SND_F	76.92	25	3.278	.656
	SND_I	74.12	25	15.460	3.092
Pair 13	U_F	21.16	25	8.711	1.742
	U_I	21.68	25	7.403	1.481
Pair 14	U_Fmm	5.08	25	4.898	.980
	U_Imm	6.20	25	8.539	1.708
Pair 15	UL_F	134.92	25	13.407	2.681
	UL_I	130.24	25	12.810	2.562

**Table 4. Paired Samples Test**

Pair		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
1	ANB_F- ANB_I	-.800	3.719	.744	-2.335	.735	-1.075	24	.293
2	AOBO_F-AOBO_I	.120	4.157	.831	-1.596	1.836	.144	24	.886
3	FMA_F - FMA_I	1.440	4.042	.808	-.229	3.109	1.781	24	.088
4	HA_F - HA_I	3.640	9.394	1.879	-.237	7.517	1.937	24	.065
5	HP_F - HP_I	.200	7.147	1.429	-2.750	3.150	.140	24	.890

6	IMPA_F- MPA_I	1.840	19.924	3.985	-6.384	10.064	.462	24	.648
7	L_F - L_I	.480	7.757	1.551	-2.722	3.682	.309	24	.760
8	L_Fmm- L_I_mm	-.520	4.674	.935	-2.449	1.409	-.556	24	.583
9	MbSN_F-MbS-N_I	-4.000	21.915	4.383	-13.046	5.046	-.913	24	.371
10	SNA_F - SNA_I	-1.360	3.796	.759	-2.927	.207	-1.792	24	.086
11	SNB_F - SNB_I	-.320	2.286	.457	-1.264	.624	-.700	24	.491
12	SND_F - SND_I	2.800	14.646	2.929	-3.245	8.845	.956	24	.349
13	U_F - U_I	-.520	10.288	2.058	-4.767	3.727	-.253	24	.803
14	U_Fmm-U_I_mm	-1.120	9.333	1.867	-4.973	2.733	-.600	24	.554
15	UL_F - UL_I	4.680	19.117	3.823	-3.211	12.571	1.224	24	.233

**Table 5.** Bootstrap for Paired Samples Test

Mean	Bootstrap <sup>a</sup>				
	Bias	Std. Error	Sig. (2-tailed)	95% Confidence Interval	
				Lower	Upper
- .800	.033	.740	.324	-2.160	.760
.120	.059	.792	.875	-1.320	1.760
1.440	-.015	.782	.082	-.039	2.999
3.640	.070	1.812	.068	.161	7.480
.200	-.043	1.402	.898	-2.680	2.639
1.840	.078	3.903	.656	-4.999	9.878
.480	-.019	1.490	.752	-2.360	3.559
-.520	.003	.927	.604	-2.480	1.080
-4.000	.017	4.137	.425	-	1.240
-1.360	-.022	.745	.104	13.159	.040
-.320	-.020	.443	.474	-2.959	.480
2.800	-.002	2.799	.425	-.840	9.077
-.520	-.009	2.080	.813	-4.919	3.279
-1.120	-.023	1.766	.573	-4.959	1.760
4.680	-.003	3.703	.222	-2.437	12.150

- a. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples

**Table 6.** Wilcoxon Signed Ranks Test Test Statistics<sup>d</sup>

	Z	Asymp. Sig. (2-tailed)
<b>ANB_I - ANB_F</b>	-2.071 <sup>a</sup>	<b>.038</b>
AOBO_I - AOBO_F	-.176 <sup>b</sup>	.860
FMA_I - FMA_F	-1.741 <sup>b</sup>	.082
<b>HA_I - HA_F</b>	-2.617 <sup>b</sup>	<b>.009</b>
HP_I - HP_F	-1.252 <sup>b</sup>	.210
IMPA_I - IMPA_F	-.365 <sup>b</sup>	.715
Liniatial - L_F	.000 <sup>c</sup>	1.000
L_Imm - L_Fmm	-.409 <sup>b</sup>	.682
MbSNInial - MbSN_F	-.061 <sup>a</sup>	.951
SNA_I - SNA_F	-1.423 <sup>a</sup>	.155
SNB_I - SNB_F	-.227 <sup>a</sup>	.820
SND_I - SND_F	-.888 <sup>b</sup>	.375
U_I - U_F	-.129 <sup>b</sup>	.898
U_Imm - U_Fmm	-.065 <sup>a</sup>	.948
UL_I - UL_F	-1.080 <sup>b</sup>	.280

- a. Based on negative ranks.
- b. Based on positive ranks.
- c. The sum of negative ranks equals the sum of positive ranks.
- d. Wilcoxon Signed Ranks Test

**DISCUSSION**

Closing the spaces in the case of congenitally missing upper lateral incisor is a useful method, which allows the completion of the treatment, before the growth is complete [11-13]. The study analysed the cephalometric parameters before and after the application of the orthodontic treatment of CMULI through the orthodontic closing of the spaces through the association between

the fixed orthodontic appliance and the maxillary protraction mask and class III elastics, to see how the cephalometric values change and if there is a negative influence of applied treatment biomechanics. Patient selection for the establishment of a type of treatment in the case of congenitally missing of upper lateral incisor through orthodontic space closure and canine substitution must take into account the malocclusion and the

amount of crowding, the patient's profile, the shape and color of the canine and the appearance of the soft tissues, especially the of the upper lip [7, 9], in order to obtain aesthetic and functional results as close as possible to the ideal[19]. The method of orthodontic closure of the spaces in the case of CMULI is criticized by some researchers who argue that the canines cannot replace the appearance of the lateral incisors, and maintaining the result is difficult and also obtaining a functional occlusion. There is still no agreement on the ideal treatment of CMULI, the decision of closing versus orthodontic opening of the spaces for prosthetics is often the doctor's choice. we can say that the suggested treatment options, lack of treatment, closing the orthodontic space [3,10,13–18], must be individualized for each clinical case.

Historically, there have been significant limitations in the treatment of patients with CMULI due to the reduced possibilities to ensure an optimal anchorage to prevent tooth retrusion, especially in cases with Class III Angle skeletal malocclusion[19].

The continued development of temporary anchorage devices (TADs) has expanded the

range of tooth movements in which space closure can be considered when previously unpredictable extended treatment times were deemed difficult, problematic, or unrealistic.

Importantly, acceptable occlusion can be achieved after space closure with good results accepted by patients with improved periodontal health compared to prosthetic replacements[13,14].

## CONCLUSIONS

1. The orthodontic closure of the space allows the completion of the treatment before the cessation of growth, an aspect of major interest for adolescent patients.
2. The use of fixed orthodontic appliances together with protraction facemask and class III elastics is an effective method of treatment of congenitally missing of upper lateral incisor.
3. With this method, better aesthetic results can be obtained in the long term (lack of infraocclusion, lack of periodontal problems), since the tooth has moved together with the periodontium.
4. From a financial point of view, closing the orthodontic space is a cheaper method.

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