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Research Article

Skeletal and Dentofacial Features In Patients with Isolated Maxillary Lateral Incisor Agenesis (MLIA)

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Abstract

Purpose: The objective of this study is to investigate the characteristic skeletal and dentofacial morphological features of patients with isolated bilateral or unilateral congenital absence of maxillary lateral incisors in three dimensions through comparing them with non-hypodontia control group.
Material and Methods: The sample of the study will be comprised of "63" school students, males and females within an age range (12–15) years, who had permanent dentition and affected by isolated bilateral or unilateral congenital absence of upper lateral incisors, excluding third molars, in order to measure some of traditionally used parameters and to be compared with non-hypodontia control sample. The significance test for the differences in dimensions between hypodontia and non-hypodontia subjects was performed using Student t-test.
Results: Both of the angles ANB and the inclination of the occlusal plane to SN were significantly reduced in the patients compared with that of the controls; $p < .05$. The length of premaxilla in the MLIA group was shorter compared with that of the control group; $p < .05$. Moreover, this parameter was more noticeably reduced in the subjects of the bilateral agenesis subgroup (BMLIA) compared with those of the control sample; $p < .05$.
Conclusions: This study concluded that the influence of MLIA appears exclusively in the 'external complex', which consists of: The anterior frontal part of the cranial base, ANS and premaxilla and the development of these parts decreases along with diminished upper lateral incisor-number.

Keywords

Agenesis, Skeletal features, Maxillary lateral incisor, Congenital absence.

Declaration of Conflicting Interest

The authors declare that they have no conflict of interest.

Acknowledgement

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INTRODUCTION AND LITERARURE REVIEW

Although there are many researches and articles in abundance all over the world revolving round the congenital absence of permanent teeth, yet researches handling isolated maxillary lateral incisors agenesis (MLIA) are still rare; this phenomenon has been studied in the context of congenital absence of teeth in general. In the light of the aforementioned, there is an urgent need to address this topic to fill the gap and to set forth a more profound study.

Congenitally missing teeth (CMT) is a frequent phenomenon in the permanent dentition and introduces an imbalance in potential maxillary and mandibular dental length. This possibility must, therefore, be borne in mind when evaluating a patient for orthodontic treatment [14,22,24].

As it is expected that there might be changes in dentofacial structures after extraction, it seems logical that tooth agenesis can affect dentofacial structures compared with normal [12,21].

Several reasons might exist for a possible relationship between CMT and skeletal pattern:

1- The neural crest cells contribute both to odonto - and skeletogenesis in the facial region [30]. Thus, it can be hypothesized that the skeletal pattern could be unique in CMT patients.

2- According to Moss's functional matrix concept [23], bone grows in response to the functional relationships established by its functional units. Teeth serve as a functional unit in the process of jaw growth. Thus, absence of tooth buds might be correlated with underdevelopment of the apical base.

3- The dentofacial structure in persons with advanced hypodontia exhibits a functional compensation rather than a different growth pattern [25].

Several studies have examined the relationship between CMT and skeletal pattern. Wisth et al (1974); Sarnas and Rune (1983) and Göyenc (1993) found the maxilla was more retrognathic and shorter, and the sagittal jaw relationship was smaller than normal (i.e ANB was smaller).

Woodworth et al (1985) reported that patients with bilateral congenital absence of maxillary lateral incisors showed a class III tendency, the upper and lower anterior and posterior face heights were significantly less than normal, and he claimed that the cranial base and maxillary length were shorter and the maxilla was more retrognatic.

Ogaard and Krogstad (1995) found that the upper and lower incisors were significantly more retroclined in the agenesis groups compared with the control group and no statistically significant difference between the control and the hypodontia groups regarding prognathism of mandible or the length of the two jaws were found. Moreover, the inclination of the mandibular plane angle (MP/NSL) showed a reduction, and the facial axis a significant increase with increasing number of missing teeth. No significant differences in the upper anterior facial height were found although a significant reduction in the lower anterior facial height was noted in the hypodontia groups, and no significant differences in posterior facial height were observed. Regarding soft tissue profile, a reduction in the protrusion of the upper lip was observed with increasing severity of agenesis.

In (1997) Yüksel and Ücem investigated the effect of tooth agenesis on dentofacial structures according to the location of the absent teeth, and they concluded that there were no significant differences between main groups for skeletal values, but the upper incisors showed a statistically significant proclination relative to the SN plane in tooth agenesis groups compared with the control group. In this study, ANB angle in all tooth agenesis groups showed a class I skeletal relationship in the anterior posterior direction.

Simultaneously, in 1997, a paper was presented to the European Orthodontic Society [7] in which the following points were stressed: "It is especially important to note that the nasion, situated on the external cortex of the frontal bone, normally advances at the same time and in the same way as point A and ANS, which in turn lies on the anterior cortex of the maxilla. The premaxilla also develops by displacement of the two hemi-premaxillas and antero-Lateral displacement of its external cortices, influenced by the developing tooth germs, the tongue, occlusal forces, the nasal cartilage and the naso-Labial muscles. The anterior frontal part of the cranial base and the antero-Lateral part of the maxilla together form the 'external complex', and develop for a longer period of time and in the same way. This explains why the nasion, the maxillary buttresses, the premaxilla and the zygomatic processes of the maxilla normally move at the same time".

Ben-Bassat and Brin (2003) studied the skeledontal patterns in patients with congenital missing teeth and they reported that in the (CMT) patients, the maxillary and mandibular basal bones were more retruded than in normal populations, the profile was flatter than in the normal population and the dental pattern was characterized by upright incisors, and they concluded that not only the number of missing teeth is important but also where the absence occurs; this might imply the predominant influence of anterior tooth absence on the skeletodontal configuration in the mixed group.

The observations of some scientists [1,2,5,6,11,15,19,20,28,33] throughout the last decades about the role of maxillary incisor, enrich the contributions of Harvold's (1979; 1981) and Linder Aronson's (1973; 1979) princeps works in the etiopathologic field of malocclusions. They raise a serious question deals with the driving force feature of the development of the maxillary incisors in the premaxillary morphogenesis.

Talmant. J (2005) stated "the expansive capacity of the maxillary incisors germs contributes undoubtfully to the transverse growth of the vertical part of the future maxillae, and the presence of these germs in their crypta, then of the roots of these teeth, are necessary for the frontal development, then for the maintenance of the basal and alveolodental volume which they help to conquer. Conversely, the maxillary incisor agenesis deprives those envelops of the power of the volumetric expansion specific to the missing tooth".

For Bernier and Pirlot (1977) the function doesn't precede the organ, but appears with it and its exercise (operation) improves as the organ develops.

As long as the question of the role of the teeth in the development of the face was deprived of a true answer one could allow himself to poach on Tweed's preserves, even it means carrying on the reflexion on a relation which, curiously hardly worries the orthodontists in spite of the frequency of the "relapses" [31].

On the other hand, others have found no relationship between hypodontia and the size of the mandible [13], the general growth pattern [27], and lip position and facial esthetics [29].

Because of the inconsistencies in the literature, the aim of the present research is to compare the skeletodental patterns of patients with bilateral or unilateral congenital absence of upper lateral incisors with those of normals.

AIM OF THE STUDY

The aim of this study was to investigate the characteristic skeletal and dentofacial morphological features of patients with bilateral or unilateral congenital absence of maxillary lateral incisors in three dimensions. Hopefully, that will guide the orthodontists to determine the possible skeletal pattern of the patients with MLIA, and to help making decision and formulating an effective treatment plan to obtain the most optimal and stable result.

This study tried to shed the light on the consequences of this phenomenon by identifying the skeletal and dentofacial features in the affected subjects after comparing them with those of the control sample. This helps us realize the role of maxillary lateral incisors and resultant defect caused by its loss, apart from other factors which may have an effect on the skeletal pattern. Based on the fact that accurate and proper diagnosis is the cornerstone in setting up a plan for a successful treatment.

MATERIAL AND METHODS:

1. Research samples

The sample of our research will be comprised of "63" Syrian school students, males and females within an age range (12–15) years, affected by isolated bilateral or unilateral congenital absence of upper lateral incisors. This sample resulted from a previous study which studied the prevalence of isolated maxillary lateral incisor agenesis (MLIA) in Syrian adolescents after selecting only the students who had permanent dentition.

Inclusion criteria are as follows:

- No previous orthodontic treatment
- No previous history of maxillary lateral incisor extraction
- No previous restorative reshaping or crowing of the maxillary lateral incisors.
- Students with cleft lip and palate, craniofacial anomalies, and diagnosed syndromes will be excluded.
- Syrian Arabian origin.

The controlled sample will be comprised of "30" sex-matched students. They will be selected randomly from the same schools under one condition; all students have normal occlusion criteria.

2. Research methods

- radiographic examination: lateral and frontal cephalograms.
- statistical study.

3. Research protocol

some selection criteria will be adopted to be computerized measured on lateral and frontal cephalograms, then comparisons of these measurements among the different groups will be made:

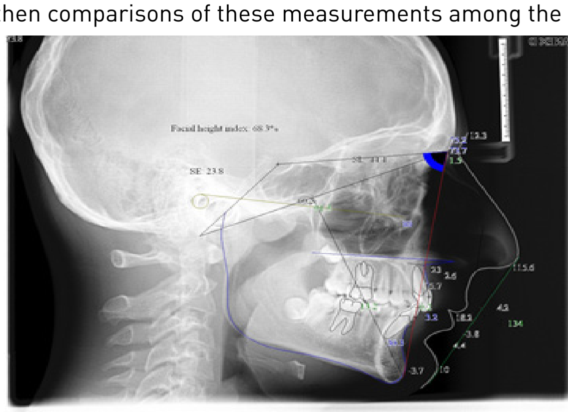

Figure 1. Angular and linear measurements used in this study

Table 1:

L=Linear measurement A=Angular measurement	Selection criteria	Description	Skeletal evaluation
A1	^ SNA	Describes horizontal position of the maxilla to the cranium.	
A2	^ SNB	Describes the horizontal position of the mandible to the cranium.	
A3	^ ANB	Describes the horizontal imbalance of the mandible and maxilla.	
A4	Oc.p to SN	Describes the inclination of the occlusal plane relative to the cranial base.	
L1	SE Distance	Describes the horizontal position of the condyle relative to the cranial base.	
L2	SL Distance	Describes the horizontal position of the mandible relative to the cranial base.	
L3	(CC-Na) Anterior Cranial Length	Describes the length of the anterior cranial base.	
A5	Facial Axis (Pt-Gn/Ba-Na)	Used to determine the direction of growth of the chin.	
L4	Anterior/Posterior Ratio S-GO/Na-Me	Describes the ratio of anterior face height to posterior face height.	
L5	Convexity A to Na- pog	Describes the horizontal relation of the maxilla to the mandible.	
A6	Facial Angle (Na-Pog/FH.P)		
A7	Mandibular.p Angle FMA		
L6	Premaxilla Length Np to A		
L7	A & Pog to Mac.Line		
L8	Nasal width	Describes the width of the nasal cavity.	
L9	Nasal width R	Describes the width of the right nasal cavity.	
L10	Nasal width L	Describes the width of the left nasal cavity.	
L11	Nasal height	Describes the height of the nasal cavity.	
L12	Maxillary width JR-JL	Used to determine the width of the maxilla and the possible cause of skeletal crossbite.	
L13	Mandibular width AG-AG	Used to determine the width of the mandible and the possible cause of skeletal crossbite	
L14	Max-Mand width left	Used to describe a skeletal crossbite.	
L15	Max-Mand width right		

Table 2:

A8	I/i Intercisal angle	Describes both the vertical and horizontal dimensions of the occlusal of the incisors.	Dental evaluation
L16	i to A-pog plane	Describes the protrusion of the lower denture.	
L17	I to A-pog plane	Describes the protrusion of the upper denture.	
A9	i inclination to A-pog	Describes the position of the lower incisor relative to the mandible and maxilla.	
A10	I inclination to A-pog	Describes the position of the upper incisor relative to the mandible and maxilla.	

Table 3:

A11	Nasolabial Angle	Used to appraise soft tissue.	Esthetic and soft tissue evaluation
L18	Upper lip length	Used to determine the cause of lip strain.	
L19 L20	Upper lip To E plane Lower lip	Describes lips protrusion relative to Rickett's Esthetic line.	
L21 L22	Upper lip To S plane Lower lip	Describes lips protrusion relative to Steiner's Esthetic line.	
L23	Soft Glabella to S Plane		
L24	Soft Pronasal to S Plane		
L25	Soft Pog to S Plane		

Reliability of measurement

In order to calculate the measurement error, (10) randomly selected subjects were simultaneously remeasured after four weeks of the initial measurement. The method error was calculated by using Cronbach's alpha coefficient which was within the range (0.714→0.997). This value indicates that the reliability of all measurements is very high.

Statistical analysis

Darling Anderson test was used to examine the data distribution. We found that all variables are normally distributed, which enables us to use following parametric analyses:

- Student t -test: to compare between the independent samples and to measure the significant difference between the means of the quantitive parameters.
- Phi and Cramer's coefficients (derived from chi-square test) were used to measure the correlation between two nominal variables.
- Chi-Square test and Odd ratios: were used to measure effect size (that means to study the significant difference between two percentages).

The statistical significance level was established at $p < .05$.

Descriptive statistics were also used to measure the means and the standard deviations. All descriptive and comparative statistical analyses steps were performed using the IBM SPSS-version 22 and Minitab-version 16 software packages.

Sample Power of the entire study group and sub-groups was tested, the outcome fell in the range (.79 – 1.0) which means that the sample size is acceptable and sufficient to emphasize the accuracy of the results.

The null hypothesis of this study was that there are no significant differences in the mean measurements among the different groups.

RESULTS

Having made a comparison between MLIA and control groups, it was found that there were significant differences between the two groups for many skeletal measurements:

• ANB Angle in the MLIA group was significantly smaller compared with that of the control group, $p < .05$.

• The inclination of the occlusal plane to SN in the MLIA group showed highly significant reduction compared with that of the control group; $p < .05$.

• The point A to McNamara line showed a significant retraction in the subjects of the MLIA group compared with that of the controls (by 1.4719 mm); $p < .05$.

• The length of premaxilla in the MLIA group was shorter compared with that of the control group and reduced by 1.609 mm, which is statistically considered highly significant; $p < .05$ (see Table 4).

Table 4. Mean skeletal measurements of MLIA and control groups

Skeletal Criteria (Linear = mm & Angular = grad)	Control group N=30 subjects		MLIA group N=63 subjects		
	Mean	SD	Mean	SD	P Value
SNA	81.1867	3.05159	80.6810	4.00036	.542
SNB	77.7267	3.53660	78.0540	3.55754	.679
ANB	3.4500	1.51082	2.5778	2.61129	.045
Facial angle (Na-Pog/FH.P)	88.2267	2.84980	87.7952	2.43737	.452
Facial axis angle (Pt-Gn/Ba-Na)	89.4000	3.91610	89.8810	3.78732	.573
FMA	24.9167	3.05976	25.1365	4.73451	.817
Occlusal.P to SN(angle)	18.0700	3.25991	15.6079	4.23226	.006
Convexity (A to Na-Pog)	2.9667	1.85069	1.8794	2.94866	.033
SL	45.6967	8.80014	46.7476	6.83418	.530
SE	20.3667	2.65737	20.4095	3.01586	.947
A to McNamara line	1.1767	2.37569	-.2952	3.15382	.026
Pog to McNamara line	-3.3200	5.29706	-4.0000	4.41749	.517
CC-Na	54.6567	3.45150	53.4159	2.54249	.054
Length of Premaxilla	9.7933	1.29773	8.1841	1.80592	.023
Facial height index	62.4467	4.21547	63.4175	4.36971	.314
Nasal Width	28.8800	2.39675	29.3968	2.24837	.313
Nasal Width L	14.1833	1.34730	14.3079	1.31165	.672
Nasal Width R	14.6800	1.23076	15.0413	1.28234	.202
Nasal height	45.1600	3.66348	44.4810	3.35732	.378
Maxillary Width	65.3633	4.36336	64.0143	3.28265	.100
Mandibular Width	83.2367	4.30184	83.4571	3.85991	.805
Max-Mand Width Right	37.4455	4.64191	38.8867	3.39125	.188
Max-Mand Width Left	37.3818	4.72372	38.4900	3.31685	.190

Regarding the dental values, it was found that there were highly significant differences in three measurements:

- The Angle (i to A-Pog) was smaller and significantly reduced in the MLIA group compared with that of the control group; $p < .05$.
- The Interincisal angle showed a significant reduction in the MLIA group compared with that of the control group; $p < .05$.
- the distance (I to A-Pog) was significantly shorter in the MLIA group and reduced by .96698 mm; $p < .05$ (see Table 5).

Table 5. Mean dental measurements of MLIA and control groups

Dental Criteria (Linear = mm & Angular = grad)	Control group N=30 subjects		MLIA group N=63 subjects		
	Mean	SD	Mean	SD	P Value
I to A-Pog (angle)	27.0267	4.69827	24.9222	6.51662	.117
i to A-Pog (angle)	30.3467	4.40945	27.2127	4.96213	.004
Interincisal angle	122.6200	6.94080	127.8635	9.81178	.010
I to A-Pog	5.9067	1.46451	4.9397	1.95296	.018
i to A-Pog	2.8067	1.35289	2.1619	2.03489	.119

Regarding the Esthetic and soft tissue values, there were no significant differences between the two groups except for two measurements:

- The distance (Soft Glabella to Subnasal) was larger in the subjects of MLIA group compared with the controls and increased by 2.52190 mm, which is statistically considered highly significant; $p < .05$.
- The Length of upper lip was shorter and showed highly significant reduction (1.56 mm) in the MLIA group compared with that of the control group; $p < .05$ (see Table 6).

Table 6. Mean esthetic and soft tissue measurements of MLIA and control groups

Esthetic and soft tissue Criteria (Linear = mm & Angular = grad)	Control group N=30 subjects		MLIA group N=63 subjects		
	Mean	SD	Mean	SD	P Value
Nasolabial Angle	110.1767	8.12284	109.7556	14.60839	.883
Soft Glabella to S Plane	8.3048	3.79155	10.8267	3.90258	.004
Soft Pronasal to S Plane	8.4433	1.53638	9.0921	2.19018	.148
Upper Lip to S Plane	1.1600	1.57296	.6016	2.31444	.235
Lower Lip to S Plane	1.8300	2.28068	1.9889	2.89667	.793
Soft Pog to S Plane	8.6700	3.90403	8.2206	4.55848	.643
Upper Lip length	19.9967	2.04307	18.4333	2.07900	.001
Upper lip to E Plane	-2.7167	1.47206	-3.4683	2.55859	.139
Lower lip to E Plane	-.7633	1.98989	-1.0381	2.60375	.611

More profoundly, another comparison was made between the Control and BMLIA groups to investigate the influence of maxillary lateral incisor agenesis in depth.

Skeletally, it was found that there were significant differences between the two groups for many **skeletal measurements:**

- ANB Angle in the BMLIA group was significantly smaller compared with that of the control group, p <.05.
- The inclination of the occlusal plane to SN in the BMLIA group showed highly significant reduction compared with that of the control group; p <.05.
- The convexity (A to Na-Pog) was significantly shorter in the BMLIA group and reduced by 1.5867 mm, p <.05.
- The point A to McNamara line showed a significant retraction in the subjects of the BMLIA group compared with that of the controls (by 1.6mm); p <.05.
- The distance (CC -Na) was highly significant shorter in the subjects of BMLIA group compared with the controls and reduced by 1.2767 mm, p <.05.
- The length of premaxilla in the BMLIA group was shorter compared with that of the control group and reduced by 2.09 mm, which is statistically considered highly significant; p <.05 (see Table 7).

Table 7. Mean skeletal measurements of control and BMLIA groups

Skeletal Criteria (Linear = mm & Angular = grad)	Control group N=30 subjects		BMLIA group N=30 subjects		
	Mean	SD	Mean	SD	P Value
SNA	81.1867	3.05159	80.6200	4.33776	.561
SNB	77.7267	3.53660	78.3300	3.74093	.523
ANB	3.4500	1.51082	2.2000	2.34433	.017
Facial angle (Na-Pog/FH.P)	88.2267	2.84980	88.1933	2.64600	.963
Facial axis angle (Pt-Gn/Ba-Na)	89.4000	3.91610	90.1633	4.18120	.468
FMA	24.9167	3.05976	25.1500	5.97130	.850
Occlusal.P to SN(angle)	18.0700	3.25991	14.7500	4.84460	.003
Convexity (A to Na-Pog)	2.9667	1.85069	1.3800	2.75135	.011
SL	45.6967	8.80014	47.5067	7.35808	.391
SE	20.3667	2.65737	19.9133	3.15318	.549
A to McNamara line	1.1767	2.37569	-.4233	3.59278	.046
Pog to McNamara line	-3.3200	5.29706	-3.3467	4.76986	.984
CC-Na	54.6567	3.45150	53.3800	2.80645	.000
Length of Premaxilla	9.7933	1.29773	7.7033	1.89800	.000
Facial height index	62.4467	4.21547	63.7767	5.42864	.294
Nasal Width	28.8800	2.39675	29.8733	2.29060	.106
Nasal Width L	14.1833	1.34730	14.5633	1.16574	.247
Nasal Width R	14.6800	1.23076	15.2567	1.37883	.053
Nasal height	45.1600	3.66348	45.5700	3.31820	.651
Maxillary Width	65.3633	4.36336	64.8100	3.27849	.581
Mandibular Width	83.2367	4.30184	83.6633	4.13417	.697
Max-Mand Width Right	37.4455	4.64191	40.6567	3.27843	.056
Max-Mand Width Left	37.3818	4.72372	39.8400	2.95849	.096

Regarding the dental values, it was found that there were highly significant differences in four **measurements**:

- Both of the angles (I to A-Pog) and (i to A-Pog) in the BMLIA group were smaller and significantly reduced compared with those of the control group; p <.05.
- The Interincisal angle showed a significant increase in the BMLIA group compared with that of the control group; p <.05.
- the distance (I to A-Pog) was significantly shorter in the BMLIA group and reduced by 1.31 mm; p <.05 (see Table 8).

Table 8. Mean dental measurements of control and BMLIA groups

Dental Criteria (Linear = mm & Angular = grad)	Control group N=30 subjects		BMLIA group N=30 subjects		
	Mean	SD	Mean	SD	P Value
I to A-Pog (angle)	27.0267	4.69827	23.5133	6.25756	.017
i to A-Pog (angle)	30.3467	4.40945	26.8500	5.51223	.009
Interincisal angle	122.6200	6.94080	129.6400	10.50401	.003
I to A-Pog	5.9067	1.46451	4.5967	1.89782	.004
i to A-Pog	2.8067	1.35289	2.0067	2.33857	.110

Regarding the Esthetic and soft tissue values, there were no significant differences between the two groups except for two measurements:

• The distance (Soft Glabella to Subnasal Plane) was larger in the subjects of BMLIA group compared with the controls and increased by 2.29 mm, which is statistically considered highly significant; $p <.05$.

• The Length of upper lip was shorter and showed highly significant reduction (1.9034 mm) in the BMLIA group compared with that of the control group; $p <.05$

• The Upper Lip relative to both of S plane and E plane in the BMLIA group showed retraction by 1.4067 mm and 1.3233 mm respectively, which is statistically considered highly significant; $p <.05$ (see Table 9).

Table 9. Mean esthetic and soft tissue measurements of control and BMLIA groups

Esthetic and soft tissue Criteria (Linear = mm & Angular = grad)	Control group N=30 subjects		BMLIA group N=30 subjects		
	Mean	SD	Mean	SD	P Value
Nasolabial Angle	110.1767	8.12284	114.3133	15.26953	.195
Soft Glabella to S Plane	8.5367	3.79155	10.8267	4.23845	.031
Soft Pronasal to S Plane	8.4433	1.53638	9.4767	2.29372	.055
Upper Lip to S Plane	1.1600	1.57296	-.2467	2.30632	.008
Lower Lip to S Plane	1.8300	2.28068	2.5600	3.23894	.317
Soft Pog to S Plane	8.6700	3.90403	8.3333	4.50366	.758
Upper Lip length	19.9967	2.04307	18.0933	1.93959	.000
Upper lip to E Plane	-2.7167	1.47206	-4.0400	2.37742	.012
Lower lip to E Plane	-.7633	1.98989	-1.4833	2.47583	.219

Since statistical analysis revealed some significant differences in the mean measurements between MLIA and control groups, null hypothesis can be rejected.

DISCUSSION

1. Study sample:

The crowns of the permanent teeth (except third molars) are generally completed between five to seven years of age. Root development takes about six to seven years later. The third molars show a very large variation in development; they start to mineralize between the eighth and eleventh year of life [16]. A sex difference has been observed in tooth development; with girls are averages half a year ahead of boys [26]. For this reason, only students older than 12 years were included in the present study sample. As for the maximum limit, it was 15 years old; these narrow-limits sample was intended for the sake of unifying the criteria which the individuals had undergone.

2. Discussion of results:

Several studies have examined the relationship between CMT and skeletal pattern. However, the present study is more profound and specific; we found that there were significant differences between the affected group (MLIA) and the control group for many skeletal parameters: ANB angle was smaller, the length of premaxilla was shorter, Point A was retruded relative to McNamara line and the inclination of the occlusal plane to SN in the MLIA group showed highly significant reduction, i.e the maxilla was more retrognathic and shorter, and the sagittal jaw relationship was smaller than normal and the influence of MLIA appears exclusively in the anterior section of the maxilla (premaxillary section), which is consistent with some studies; Wisth et al (1974), Sarnas and Rune (1983) and Göyenc (1993) and does not agree with the results of the most former studies where the influence of hypodontia appeared obvious in the whole skeletal pattern. The explanation for this inconsistency could be due to the variation in sampling techniques; the samples of the former studies included all forms of hypodontia, whereas the present study sample included only the subjects with isolated MLIA.

Dentally, it was found that the Interincisal angle showed a significant increase and both of the distance I to A-Pog and i to A-Pog angle were significantly reduced in the subjects of MLIA group compared with the controls. This indicates that the incisors were retroclined which agrees with Ogaard and Krogstad (1995) and that might explain the reduction of inclination of the occlusal plane relative to SN.

Having made the same comparison between BMLIA subgroup and the control group, it was noted that the influence of maxillary lateral incisors agenesis became more profound and obvious not only through including more significant differences for additional skeletal parameters, which were the distance of convexity and cranial base (CC-NA) to be significantly shorter in BMLIA subgroub, but also the increasing significance of differences for the same skeletal parameters. These were already existent in the previous comparison. The increasingly retrusive position of point A and steadily reducing length of premaxilla apparently reveal that the development of the incisive bone or premaxillary section decreases along with diminished upper lateral incisor–number. That do support the hypothesis of Talmant (2005) when he attributed an important motor role to the maxillary incisors in the development of premaxilla and facial envelope.

On the other hand, this close and clear correlation among the significant differences for all aforementioned skeletal parameters resulting from the congenital absence of bilateral maxillary lateral incisors strongly supports what Delaire (1997) mentioned when he stressed the following points: "It is especially important to note that the nasion, situated on the external cortex of the frontal bone, normally advances at the same time and in the same way as point A and ANS, which in turn lies on the anterior cortex of the maxilla. The premaxilla also develops by displacement of the two hemi-premaxillas and antero-Lateral displacement of its external cortices, influenced by the developing tooth germs, the tongue, occlusal forces, the nasal cartilage and the naso-Labial muscles. The anterior frontal part of the cranial base and the antero-Lateral part of the maxilla together form the 'external complex', and develop for a longer period of time and in the same way. This explains why the nasion, the maxillary buttresses, the premaxilla and the zygomatic processes of the maxilla normally move at the same time".

Moreover, it was found that there was an additional significant difference between BMLIA subgroup and the control sample for a new dental parameter which was I to A-Pog angle in addition to more significant differences for the same dental parameters of the previous comparison. More specificall, this apparently reveals that lack of length of the anterior length of maxilla in the group with BMLIA is not only at the expense of the shortness of premaxillary section but also due to the retroclination of the central incisors. Simultaneously, since point A is retruded, that indicates undoubtedly that the incisors in BMLIA group are retroclined and their position is more retrusive.

Regarding soft tissue profile, the effect which was slight in the whole affected sample (MLIA) and included only the shortness of upper lip and retruded soft Glabella, became apparent in BMLIA subgroup compared with the control sample which reflected obviously the skeletal influence, taking into consideration the difference in the nature of tissues and other associated functional factors. The effect was manifested in increased reduction in both of the protrusion of upper lip and soft Glabella and the length of upper lip.

From all the above, we could realize that The dentofacial structure in persons with maxillary lateral incisors agenesis exhibits both; a functional compensation and a special growth pattern.

CONCLUSIONS

Based on the findings of this study, the following conclusions can be drawn:

1. Lack of length of the anterior length of maxilla in the group with MLIA is not only at the expense of premaxilla length, but also as a result of central incisors' retroclination.
2. the influence of MLIA appears exclusively in the 'external complex', which consists of: The anterior frontal part of the cranial base, ANS and premaxilla. This parts develop in the same way and at the same time.
3. Based on the aforementioned, the dentofacial structure in persons with maxillary lateral incisors agenesis exhibits both; a functional compensation and a special growth pattern.
4. Development of the parts which form the 'external complex' decreases along with diminished upper lateral incisor-number.

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