The Evaluation of Face Mask and Face Mask with RME Effect on Skeletal Class III Growing Children

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Abstract

Background: To evaluate the skeletal and dental effects of the face mask (FM) treatment with and without rapid maxillary expansion (RME) in young children with Class III malocclusion.

Material and methods: In this retrospective cohort study☐ pretreatment and posttreatment cephalometric radiographs from 62 subjects who were diagnosed as skeletal Class III malocclusion were analyzed. The subjects were divided into two groups: FM group (N 32; 5 male and 27 female subjects; mean [SD] age 8.3 [1.18] years) was treated with FM only☐ while the RME+FM group (N 30; 3 male and 27 female subjects; mean [SD] age 14.67 [1.53] years) was treated with both FM and RME. Seven cephalometric linear and fifteen angular variables were measured to assess skeletal changes in three dimensions (vertical☐ sagittal) and dental changes in both vertical and sagittal dimensions. Paired t-test and independent t-test were used to analyze within and between groups changes.

Results: Both FM and FM+RME groups demonstrated significant forward displacement of the maxilla however☐ only FM group undergone statistically significant clockwise rotation of the mandible. The sagittal relationship of upper and lower arches was improved significantly☐ in both groups. The proclination of maxillary incisors were increased significantly in both groups; however the mandibular incisor position were decreased significantly only in FM group.

Conclusion: Forward movement of the maxilla can be obtained in young children after face mask treatment with or without RME. However☐ considering overall positive effects of RME and FM in both sagittal and vertical skeletal dimensions☐ the difference between these two groups is not considered clinically significant enough to persue clinicians to apply RME in cases without any need for pretreatment expansion.

Keywords: Face mask; Rapid maxillary expansion; Class III malocclusion

Introduction

Treating growing children (early treatment) with malocclusion Cl III has been one of the major changes in recent decades. Treating patients with CL III malocclusion is on the most complex conditions that Orthodontists deal with (1). According to the conducted studies there are three main conditions considered as cause of this malocclusion (5) : 1) Protruded Mandible 2) underdeveloped Maxilla 3) combination of both.

Less than three decades the solution for treating Cl III patients were to use Chin cup in order to prevent Mandible growth (6 ,7). The treatment plan was derived from the fact that cl III abnormality is synonymous with Prognathism of the mandible. Due to inadequate effect of chin cup there is a probability for camouflage treatments or combination of comprehensive orthodontics plus surgery in later ages which is both dangerous and expensive for the patient 8. Recent studies concluded that the etiology factor of two thirds of the CL III patients is retrognathic maxilla, the following underdevelopment can occur in both anterior-posterior and vertical dimensions (2, 9-13).

Orthopedic treatments are more successful in adolescents (end of primary dentition, start of mixed dentition) before puberty. This will cause a satisfying result, better facial balance and re-direction of Maxillomandibular growth for these patients. Success in these treatments is to target the complex that has the main role in the occurrence of this malocclusion and has the most variability in these treatments.

Maxilla is connected to anterior, posterior and superior sections by 6 pairs of sutures which creates a favorable variable field for this skeletal component. These sutures are not completely fused between 7 to 10 years of age, therefore applying expansion forces and protraction on these sutures will result in remodeling and favorable changes in anterior-posterior and vertical dimensions in the following skeletal component (19 ,20).

Since 1970's, by increasing the awareness of orthodontic specialists regarding the above phenomena and the development and evolution of treatment methods based on maxilla protrusion Rapid Maxillary with or without facemask application became more common. The mechanism of facemask is to regenerate sutures by applying a forward and downward force and cause the downward and forward movement of Maxilla (9,21-26).

Researchers suggest the early mixed dentition as a proper time for this treatment, which is between 8-12 years old or less, starting from 6 years old (14, 15, 17, 18).

New studies have considered RME as an important component along with Facemask in treating Cl III patients. The duodenum of this treatment includes Improving the width of the maxilla and correcting the posterior crossbite with a decrease in circum maxillary sutures and anterior-inferior movement of the Maxillary complex (25,27-30). It was shown that Facemask along with RME can pull point A about 1.5 mm towards inferior and inferior resulting in backward and downward movement of mandible (5,9,31-33)

The aim of the current study was to compare the cephalometric changes in patients using Facemask with and without RME in order to provide a more efficient treatment to patients.

Method and Materials

The following retrospective study consisted of the results from 62 CL III patients (19 male, 45 female) who visited a private Orthodontic practice and were treated with Facemask or Facemask +RME.

The Inclusion Criteria was late primary or mixed dentition, negative overjet, CL III malocclusion, zero ANB or less with maxillary retrusion and =1 witts or less, mild to moderate CLIII, straight or concave profile. Lateral cephalograms before treatment (T0) and end of treatment with Facemask (T1) (this is before any comprehensive treatment), no orthodontic involvement was applied before or during FM and RME treatment. We excluded craniofacial syndromes, pre-treated patients, non-cooperate patients and severe skeletal CLIII patients. The samples were randomly divided in to two groups. One were treated with Facemask only and other with Facemask+ RME.

All cephalograms were taken by (planmeca phinland) in habitual body posture. It was asked from the patients to keep their teeth in centric occlusion during exposure. Lips were in rest so they would not cause unexpected soft tissue change. The lateral cephalometries before start of treatment T0 and after achieving positive overjet or CLI occlusion (end of facemask therapy and before comprehensive treatment) T1.

Patients were divided into two groups, group 1 treated by Facemask alone (Group FM ;N=32 ; 6 male, 26 female) and group 2 treated with Facemask and Rapid maxillary expansion (Group FM+RME ; N=32 ;13 male , 19 female). The Average age (SD) in group FM and FM +RME were 8,13(1.49) years and 8.34 (1.18) year respectively.

Patients used " Petit" brand facemask, Lutz, D-101 Pet Lane 4614 Masel (Florida,USA) for 14 to 16 hours/day. FM has two pads ; one placed on the forehead and the other one on the chin. They are connected with a stainlesstainless s steel rod that is located on the midline (Fig 1-A). A Nance appliance was used for anchorage in FM group, consists of two bands on the first molars and an acrylic button on the palate (Figure 1-B). Two reverse hooks come from acrylic button to the distal of canines which will attach the elastic to the facemask and this will pull the maxilla downward and forward , in order to decrease the open bite , the elastics (16 OZ) were placed on maxillary canines.
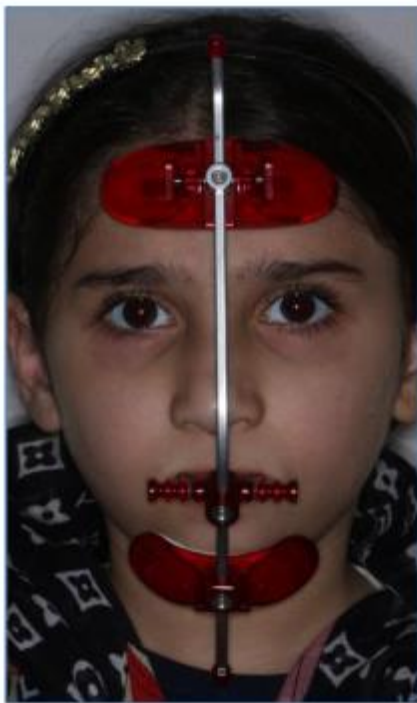

Figure1-A
(facemask)

Figure 2-B (Nance appliance)

In FM+RME group, The RME used in this study , was suggested by Haas (figure 2), which consists of two bands on the first permanent molars or second primary molars and an occlusal rest that is bonded on first primary molars or primary canines. An opening screw is placed in mid palate inside the acrylic and this system is soldered to the band on molars with a 0.45 wire. Two reverse hooks come from the acryl of the appliance towards the distal of the canines and connect to the facemask appliance by the elastics. The appliance is turned two times a day by the patient for a week (0.25 mm/turn) . In patients who did not have maxillary constriction the facemask therapy started after a week. In patients with maxillary constriction the screw turning continued until the buccal inclination of the maxillary molars lingual cusps met the lingual inclination of mandibular molars buccal cusps and after that the facemask therapy started.

Figure2 —Haas   appliance

For maxillary protraction 400-600 gram of force was applied on each side. In this study heavy pull elastics with 6.4 mm diameter with 208 OZ from American Orthodontist company was used. We asked the patients to wear the appliance for 14-16 hours/day. The FM treatment continued until the overjet was positive and CL II permanent molar relationship or Distal step in primary molars were achieved. The average treatment time in FM group was 1.03 year and 9 months for FM+RME group. Lateral Cephalograms were taken from the start (T0) and end (T1) of treatment from all patients. 13 landmarks were selected on each cephalogram , 26 variables were analyzed. 3 variables were qualitative ,21 were quantitative , 6 were linear variable and 15 were angular. Analysis was done by Dolphin (Dolphin imaging and management solutions, Chatsworth, CA, USA).

Statistical Analysis

Statistical analysis were done by SPSS software package for windows (version 21.0 SPSS , Chicago,III) ; and P<0.05 was considered significant. Independent t-test was used for each group . due to unequal division between girl and boys, independent t-test was done to analyze the sex differences in both group. Meanwhile in order to illustrate the differences between both groups, they were both compared with each other by independent t-test. Non- Parametric Kolmogorov-Smirnov and Shapiro- W ilk test was done to analyze the normality of the data.

Results

From 62 patients with CL III malocclusion, 30% of them were boys and 70% were girls, 36% with Mild CL III and 64% with moderate CL III, the average age for FM and FM+RME in T0 were 8.34 and 8.39 respectively. The coefficient of reliability was over 0.90 (between 0.90-0.98).

Analyze variables in sex at T0 (Table 1), Cephalometric analysis : 1) sagittal plane : No significant difference. 2) Vertical plane : S-Ar-Go variable with average of (boys = 3.69 and girls = -0.69) and sum of posterior(average Girls= 1.48 and Boys=6.23) were significant (P=0.023 and P=0.021) respectively (Table 1).

Analyze variables in both groups in T0 (Table 2), Sagittal plane skeletal: SNA was significant with P=0.012, N FH to Pog with P=0.015, N FH to A with P<0.0001 (Table 2). In Sagittal plane dental: Interincisal angle was significant with p=0.027(Table 2).

FM group before and after treatment – FM+RME group before and after treatment (Table 3,4). Sagittal plane skeletal: in FM group SNA with (P=0.021) and in FM+RME with SNB (P=0.019) were significant. ANB in FM group (P=0.02) and in FM+RME with (P<0.0001) were significant. Witts analysis was significant in FM group with (P=0.018) and in FM+RME with (P<0.0001). Mandibular length and Maxillary length were significant with (P<0.0001) and (P=0.001) significantly. N   FH to A were significant with (P<0.0001) and (P=0.004) respectively (Table 3and 4).

Sagittal plane dental: U1- SN in FM and FM+RME were significant (P=0.005 and P=0.024) respectively. L1_MeGo(degree) in FM group was (P=0.019) significant. Interincisal angel (p<0.0001) was significant in FM+RME (Table 3,4).

In vertical skeletal: N-S-Ar in FM group was significant (P=0.012). Sum of posterior was (P=0.036) significant in FM group. SN_MeGo was significant (P=0.002) in FM+RME group. Pal- GoMe in Fm and FM+RME with (P0.009) and (P=0.001) was significant (Table 3,4).

Table 5 illustrates the comparison results between FM with and without RME. In Skeletal Sagittal plane witts analysis was significant with P<0.0001. Mandibular and maxillary length were significant with P=0.016 and P=0.024 respectively. The average change of these values were more significant in FM+RME group than FM group. The linear measurements N FH to A and N FH to Pog with P=0.05 and P=0.03 were respectively significant (Table 5).

In Sagittal dental plane, the interincisal angel was significant with P=0.005 and average of changes were more prominent in FM+RME group than FM group. There were no significant changes in vertical dimension.

Angular measurments	Boy Mean	Boy SD		Girl Mean	Girl SD	T value	P value
N_S_Ar	2.69	3.59		2.08	6.83	0.309	0.758
S_Ar_Go	3.69	5.26		-0.69	6.22	2.325	**0.023
Ar_Go_Me	-1.23	5.62		0.59	4.54	-1.222	0.227
Sum of posterior	6.23	6.63		1.48	6.34	2.373	**0.021
S_N_Gn	-0.84	3.13		0.14	3.8	0.861	0.393
Pal_Go Me	3.53	5.57		2.44	4.52	0.735	0.465
Sn_GoMe	2.15	4.23		1.2	4.02	0.749	0.457
SNA	1.15	1.57		1.2	3.25	-0.054	0.957
SNB	0.84	2.79		-0.73	3.21	-0.114	0.91
ANB	2	2.23		1.85	2.98	0.161	0.873
SN_Pog	-1	2.54		-0.28	2.9	-0.808	0.422

U1 to SN	7.23	12.55	4.71	10.31	0.747	0.458
L1 to mandibular plan	-1.15	7.59	-2.12	6.52	0.46	0.647
intrincisal angel	-4	5.98	-4.34	8.3	0.141	0,888
Linear measurments						
S Go_N Me	0.01	0.04	-0.005	0.03	1.588	0.117
Witts appraisal	2.61	3.97	4.03	4.05	-1.124	0.265
mandibule length	0.53	4.75	3.06	6.77	-1.259	0.213
maxillary length	1.3	4.88	1.69	5.02	-0.248	0.805
N FH to Pog	-2.15	5.53	-0.69	5.57	-0.84	0.404
N FH to A	1.84	2.11	2.22	3.75	-0.348	0.729

**P≤0.05

Table 1. Comparing cephalometric analysis in girls and boys before Facemask (FM) therapy with or without Rapid Maxillary expansion (RME)

	FM		FM+RME			
	Mean	SD	Mean	SD	T value	P value
Angular measurments						
N_S_Ar	122.65	5.1	120.9	7.16	1.117	0.286
S_Ar_Go	143.43	7.1	145.36	7.56	-1.04	0.274
Ar_Go_Me	127	5.41	128.43	6.02	-0.986	0.303
Sum of posterior	392.78	7.37	394.33	7.1	-0.843	0.304
S_N_Gn	76.96	4.82	76.96	5.35	0.002	0.999
Pal_Go Me	25.5	5.27	24.7	6.06	0.555	0.581
Sn_GoMe	34.59	6.42	35.66	4.88	-0.737	0.464
SNA	77.62	3.52	79.7	2.73	-2.578	**0.012
SNB	77.96	4.13	78.9	3.41	-0.963	0.34
ANB	-0.34	1.77	0.7	2.74	-1.791	0.078
SN_Pog	78.43	4.21	78.73	2.85	-0.321	0.749
U1 to SN	97.62	10.54	100.46	8.78	-1.149	0.255
L1 to mandibular plan	92.37	4.75	90.26	6.75	1.429	0.158
intrincisal angel	130.09	7.11	135.06	9.95	-2.275	**0.027
Linear measurments						
S Go_N Me	0.63	0.06	0.61	0.61	1.571	0.121
Witts appraisal	-3.62	3.47	-4.05	2.4	0.557	0.58
mandibule length	68.4	7.12	66.83	4.37	1.039	0.303
maxillary length	48.34	4.83	47.66	4.39	0.576	0.576
N FH to Pog	-9.59	6.04	-6.13	4.74	-2.495	**0.015
N FH to A	-5.71	3.51	-2.3	3.63	-3.768	**0.0001

Table 2. Average, SD and independent t-test before and after Facemask (FM) therapy with and without Rapid maxillary expansion (RME)

	Pretreatment			Posttreatment			
	Mean	SD		Mean	SD	T value	P value
Angular measurments							
N_S_Ar	122.65	5.1		124.71	5.1	-2.652	**0.012
S_Ar_Go	143.43	7.1		144.28	5.54	-0.82	0.418
Ar_Go_Me	127	5.41		126.53	4.87	0.536	0.596
Sum of posterior	392.78	7.37		395.5	6.86	-2.196	**0.036
S_N_Gn	76.96	4.82		76.84	4.93	0.222	0.825
Pal_Go Me	25.5	5.27		28.12	5.53	-2.766	**0.009
Sn_GoMe	34.59	6.42		35.18	5.82	-0.769	0.448
SNA	77.62	3.52		79.15	3.97	-2.436	**0.021
SNB	77.96	4.13		77.75	3.95	0.387	0.702
ANB	-0.34	1.77		1.15	2.09	-3.324	**0.002
SN_Pog	78.43	4.21		77.9	3.9	0.918	0.366
U1 to SN	97.62	10.54		104.03	6.44	-2.998	**0.005
L1 to mandibular plan	92.37	4.75		88.96	6.49	2.464	**0.019
intrincisal angel	130.09	7.11		128.46	5.18	1.279	0.21
Linear measurments							
S Go_N Me	0.63	0.06		0.63	0.05	0.037	0.97
Witts appraisal	-3.62	3.47		-2.1	2.77	-2.505	**0.018
mandibule length	68.4	7.12		68.15	4.89	0.236	0.815
maxillary length	48.34	4.83		48.5	3.61	-0.184	0.855
N FH to Pog	-9.59	6.04		-12.06	6.38	3	**0.005
N FH to A	-5.71	3.51		-4.4	3.34	-3.126	**0.004

*FM : Facemask , RME : Rapid maxillary expansion   ** P ≤ 0,05

**Table 3** Average, standard deviation and independent t=test results before and after Facemask therapy.

	Pretreatment		Posttreatment			
	Mean	SD	Mean	SD	T value	P value
Angular measurments						
N_S_Ar	120.9	7.16	123.26	6.14	-1.644	0.111
S_Ar_Go	145.36	7.5	144.93	8.25	0.352	0.727
Ar_Go_Me	128.43	6.02	129.36	6.97	-1.109	0.276
Sum of posterior	394.33	7.1	396.56	5.61	-1.928	0.064
S_N_Gn	76.96	5.35	76.96	4.33	0.0001	1
Pal_Go Me	24.7	6.06	27.43	0.04	-3.704	**0.001
Sn_GoMe	35.66	4.88	37.93	4.73	-3.495	**0.002
SNA	79.7	2.73	80.53	3.47	-2.091	**0.045
SNB	78.9	3.41	77.56	3.01	2.474	**0.019
ANB	0.7	2.74	3	1.53	-4.081	**0.0001
SN_Pog	78.73	2.85	78.4	3.03	0.791	0.436
U1 to SN	100.46	8.78	104.46	6.96	-2.388	**0.024
L1 to mandibular plan	90.26	6.75	89.93	5.09	0.371	0.713
intrincisal angel	135.06	9.95	127.96	6.22	5.114	**0.0001
Linear measurments						
S Go_N Me	0.61	0.03	0.61	0.04	0.425	**0.002
Witts appraisal	-4.05	2.4	2..05	2.59	-10.232	**0.0001
mandibule length	66.83	4.37	72.33	6.01	-5.373	**0.0001
maxillary length	47.66	4.39	50.83	3.63	-3.674	**0.001
N FH to Pog	-6.13	4.74	-5.56	5.23	-0.512	0.613
N FH to A	-2.3	3.63	0.73	3.22	-3.958	**0.0001

*FM : Facemask , RME : Rapid maxillary expansion   ** P ≤ 0,05

Table 4 Average, standard deviation and independent t=test results before and after Facemask + Rapid Maxillary expansion therapy.

	*FM		*FM+RME			
	Mean	SD	Mean	SD	T value	P value
Angular measurments						
N_S_Ar	2.06	4.39	2.36	7.88	-0.189	0.851
S_Ar_Go	0.84	5.82	-0.43	6.73	0.8	0.853
Ar_Go_Me	-0.46	4.95	0.93	4.6	-1.152	0.427
Sum of posterior	2.71	7	2.23	6.34	0.285	0.254
S_N_Gn	-0.12	3.18	0	4.19	-0.133	0.895
Pal_Go Me	2.62	5.36	2.73	4.04	-0.089	0.929
Sn_GoMe	0.59	4.36	2.26	3.55	-1.648	0.105
SNA	1.53	3.55	0.83	2.18	0.924	0.359
SNB	-0.21	3.2	-1.33	2.95	1.423	0.16
ANB	1.5	2.55	2.3	3.08	-1.115	0.269
SN_Pog	-0.53	3.27	-0.33	2.3	-0.273	0.785
U1 to SN	6.4	12	4	9.17	0.879	0.383
L1 to mandibular plan	-3.4	7.81	-0.33	4.91	-1.838	0.071
intrincisal angel	-1.62	7.18	-7.1	7.6	2.915	**0.005
Linear measurments						
S Go_N Me	-0.0003	0.04	-0.002	0.03	0.221	0.826
Witts appraisal	1.51	3.42	6.1	3.26	-5.389	**0.0001
mandibule length	-0.25	6	5.5	5.6	-3.892	**0.0001
maxillary length	0.15	4.79	3.16	4.72	-2.49	**0.016
N FH to Pog	-2.46	4.65	0.56	6.06	-2.218	**0.03
N FH to A	1.31	2.37	3.03	4.19	-2.003	**0.05

*FM : Facemask , RME : Rapid maxillary expansion   ** P ≤ 0,05

Tabel 5 Average standard deviation and independent t=test result from comparison between the results from FM treatment with or without Rapid maxillary expansion.
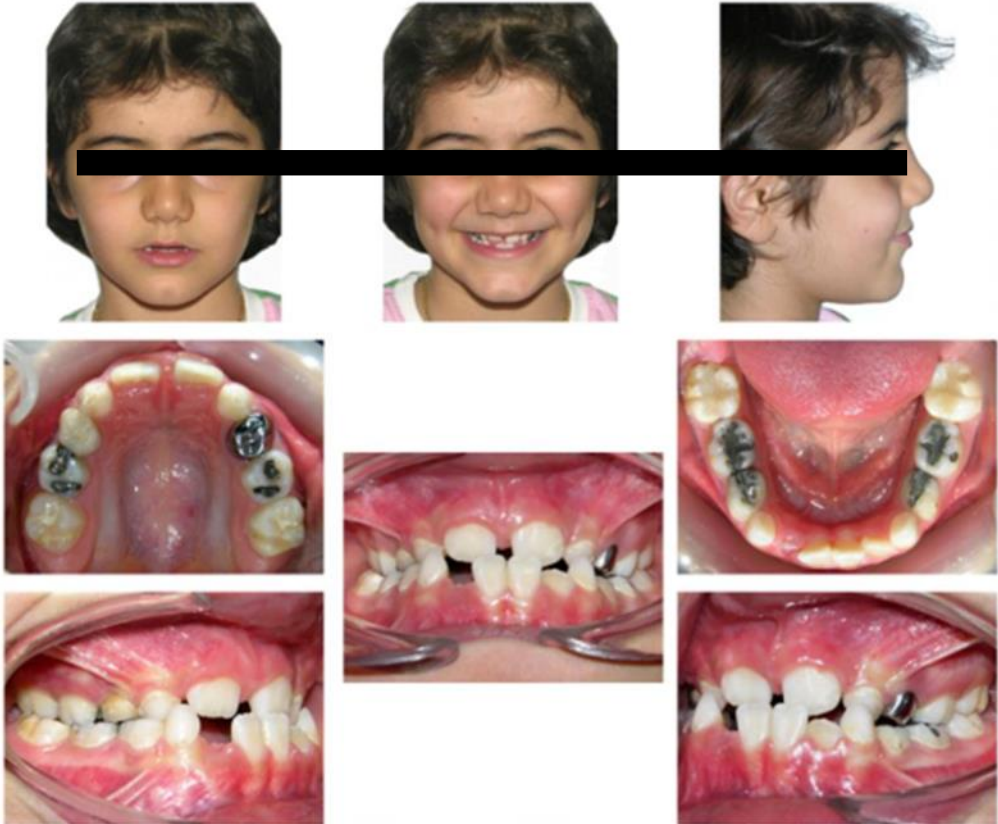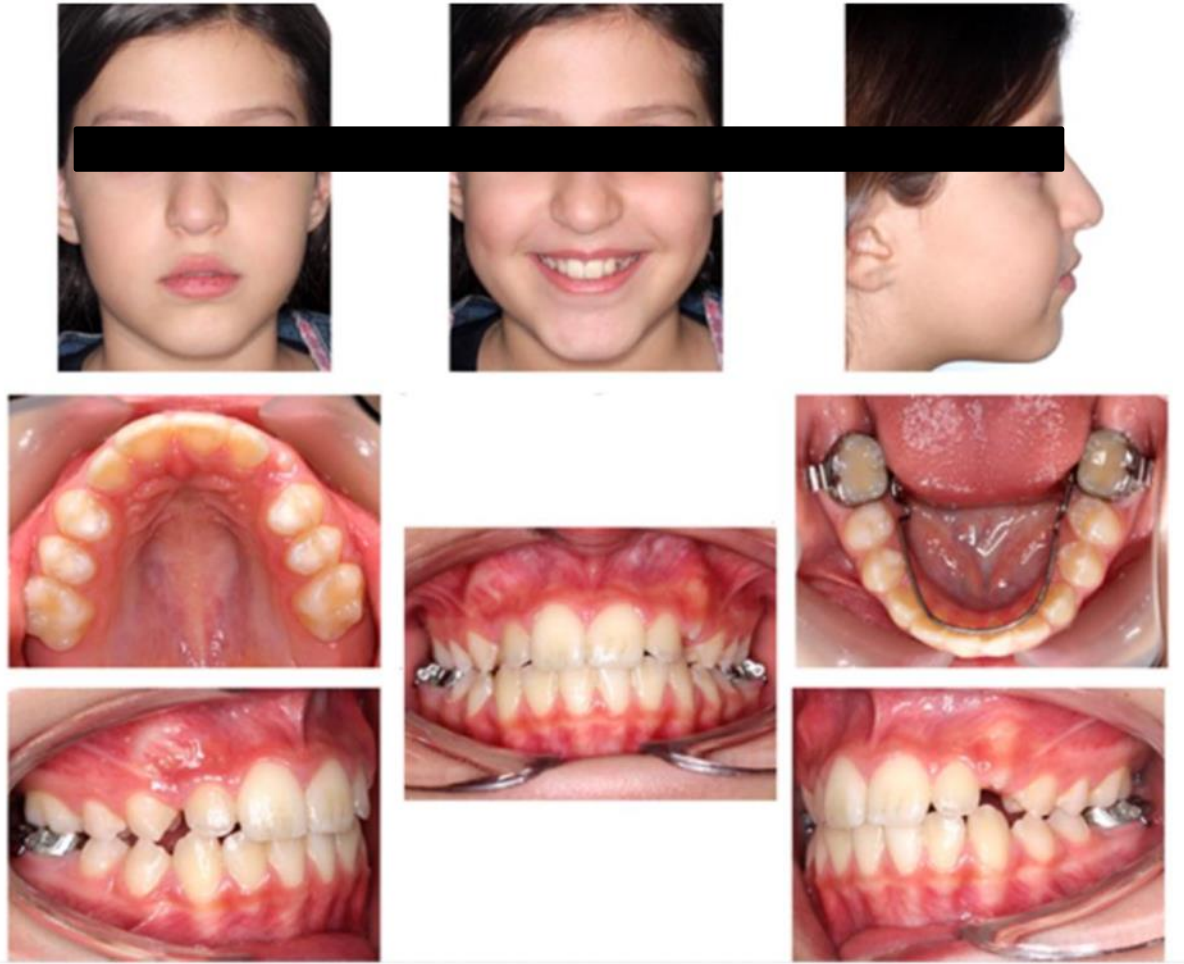
Figure 03- Before

Figure 3 - After

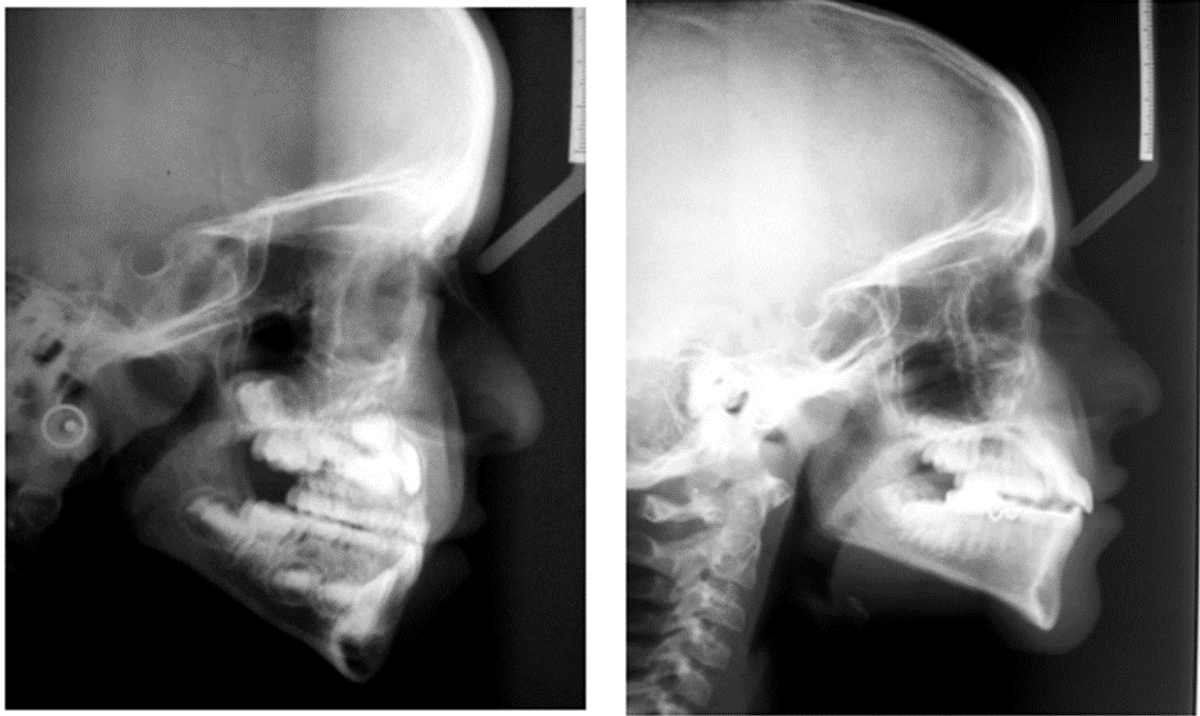**Figure 3** – Before and After lateral cephalometry

Figure 4 - Before

Figure 4 - After

Figure 4 – Before and After Cephalometry

Discussion

Treating CL III malocclusion is one of the most difficult Orthodontic treatments (1). Many studies have shown that the prevalence of this malocclusion is high around 14-15 percent in Asian population and less is white population around 1-5 percent (3, 66-69). The main reason for this type of malocclusion is prominence or extra growth of mandible, insufficiency of growth in Maxilla or combination of both. Keep in mind that Maxilla is mostly the faulty jaw (2,3,5,9-13). In these cases, instead of preventing the growth of Mandible, advancing Maxilla and stimulating its growth was applied to solve the malocclusion, therefore for the past 40 years Maxillary protraction, anterior replacement and mandibular redirection has been used. Meanwhile Maxillary expansion has been suggested as an effective treatment along with Facemask (6,7).

in 1961, Haas reported the orthopedic effects of Rapid Palatal Expansion. According to his study maxillary expansion will result in tipping, downward and forward rotation of maxilla and backward rotation of mandible. The combination of these changes facilitate CLIII treatment (32).

Starn bach and colleagues reported the effect of palatal expansion not only on intermaxillary suture but, on circum maxillary connections (70). Turley also mention the disarticulation of maxilla by RPE and the start of cellular reactions in circum maxillary resulting in reacting to protraction forces created by facemask (25).

Despite variety of studies suggesting the use of RME with Facemask, there are not many studies to statistically analyze the compare the use of Facemask in matched groups (gender, type, severity of malocclusion). The aim of this study was to answer to questions; First, is Facemask and ideal treatment for Cl lll malocclusion or not, secondly, does the use of Facemask and RME together enhance the effectiveness of Facemask or not.

Independent t-test was used to compare start age, treatment length and cephalometric characteristics in T0 between two groups. There were not any statistically significant differences between two groups except for SNA, which illustrates demographic and cephalometric similarities in both groups.

In order to statistically evaluate the result of treatment independent t-test was used for each group. SNA, ANB, Witts were increase and NFH to A was decreased as expected , which reveals the forward movement of Maxilla. These results are same as previous studies.

In this study, SNA was increased by 1.53 degrees (p=0.021) in FM group and 0.82 degrees (p=0.045) in FM+RME group. A point had a forward movement which is the positive effect of FM protractor in Maxillary growth, 1.31 mm (p=0.004) in FM group and 3.03 mm (p<0.0001) in FM+RME group. Saddia and Torres, Mermigos and colleagues ,Gallager and Baik reported lower maxillary movement than the current study. Most of these studies consider the positive effect of Facemask with or without RME , however the differences among the results studies may be due to several factors such as , type of appliance, treatment period and the duration of appliance use. Meanwhile, the palatal plane rotation effects the forward movement of point A in sagittal plane. In meta-analysis study in 2015 Zhang et al, proved that maxillary protraction is an appropriate treatment to correct anterior crossbite due to maxillary retrusion(21).

Both treatments caused decrease in measurements related to point B and Pog in mandible at point B. 0.025 decrease in SNB in FM group and 1.34 degree in FM+RME group, 2.47 decrease in Pog in FM group and 0.5 mm in FM+RME group) these findings were same as Nartallo-Turley and Macdonald et al. (1999) Ngan(1998).although B point and Pog decrease , they are not statistically significant. This is due to the mandible growth pattern and the orthopedic appliances inability to control mandible growth. This is the reason why previous treatments focused on mandible such as Chincup were not successful as much.

The downward and backward rotation of mandible was similar to other studies(52,65,72). SN-MeGo was increased by 0.5 degree in FM group and 2.27 degree in FM+RME group, these changes were significant in FM+RME group(P=0.002). This can be explained by the downward and backward rotation of of RME (39,65). On the other hand when RME is combined with FM due to a distallizing force on chin of the patient and the force vector of facemask , the downward and backward rotation of mandible is increased. This was shown in Haas(1961),Baik (1991),Patrick K.Turley(2002),Koray)Halicioglu(2013) studies. Mermigos and colleagues (6)did protraction on maxilla without applying any expansion and there was not any change in planes, meanwhile Turley ,Ngan and colleagues Kapust, Macdonald observed increased changes in mandible angle in FM+RME group which was similar to the current studies.

During Facemask therapy the backward rotation of mandible occurs not only by chin cup effect but by the counter clockwise palatal plane rotation due to the elastics connected from the oral appliance to the Facemask(65,73). There are both skeletal and dental changes in maxillary and mandible dentition (Table 3,4). Kapust, Baik, Ngan also submitted the dental changes in their studies.

In both groups U1 to SN had significant increase. L1 to MP had decreased in both groups and it was significant in FM+RME. These results match with other Facemask studies done by Nartallo Macdonald et al 1999,Ngan et al 1998, Turley 1998.

According to the findings in this study Facemask protraction with or without RME is an appropriate treatment for CL III patients. The changes in both groups were similar in most measurements (Table 5).

In FM+RME , FH to N , Witts , FH To Pog had more favorable changes this is while the treatment time in FM+RME group was shorter than FM group. These findings were similar to study by Kim and colleagues in 1999. Researchers also found more significant changes in FM+RME. Baik and colleagues achieved more forward movement of point A in FM+RME compared to FM group, therefore the use of RME without dental or skeletal crossbite in Prospective randomized clinical trial study by Vaughn and colleagues was confirmed.

Result

Our knowledge in treating Cl III with facemask and maxillary expansion has raised a lot in the past years, however there are many remaining questions.

The current study along with other studies confirm that Facemask therapy with or without RME is an effective treatment in CL III cases when they start at the beginning of mixed dentition.

Anterior Crossbite correction and Cl III molar relationship is achieved within 6-9 months. Overjet overcorrection and molar relationship are advised to be corrected later. It is more favorable to use Facemask with or without RME in maxillary retrusive and Hypodivergent cases. According to current results palatal expansion should be evaluated based on clinical conditions and treating Cl III.

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