STUDYING IN ORTHODONTAL TREATMENTS AT MIXED DENTITION STAGE USING 2X4 FIXED APPLIANCES

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ABSTRACT

Using fixed appliances 2x4 in early treatment of malocclusion at mixed dentition stage will adjust the relative correlation of occlusion; which has been studied internationally. However, in Vietnam, there are few publised studies about the effective function of this appliance in treatment. We have conducted the study about the effects of using this appliances in malocclusion early treatment for 36 mixed dentition stage patients. ***Objective:*** The study aimed for evaluating the results of malocculsion early treatment using 2x4 fixed appliances. ***Methods:*** Prosspective study. ***Results*** have shown the 2x4 fixed applianes in early treatment would adjust the relative correlation of occlusion both vertically and horizontally, in which the front teeth aligned neatly, retroclined and a deep overbite conditions improved significantly and maxillary crowded anterior teeth condition was also corrected. The indexes on Cephalometric before and after treatment desmontrated well correlation in anterior-posterior plane.

I. INTRODUCTION:

Angle Class II malocclusion is characterized as the movement of teeth due to the protrusive prominent of the maxilla or due to mandibular retrognathism or both maxilla prognathism and mandibular retrognathism. The common manifestation is the misaligned teeth along with the incorrect correlation sagitally of maxilla-mandibular relationship due to the adaptation of the incisors to the dysfunction of the masticatory system. The width of the maxillary arch is also affected by neuromascular compensation. Therefore, the goal of interventional orthodontic treatment of Angle class II malocclusion is to correct the sagitally disparity of the maxilla and mandible by improving the growth of the maxilla and mandible in Angle class II malocclusion. Hence, the optimal time to start treatment is during the mixed dentition, particularly when maxillary and mandibular incisors have erupted. Indeed, the early interventional orthodontic treatment at this stage of dentition will not require tooth extraction. However, the potential growth and predication in which time it will take place are important criteria for choosing appropriate treatment. Treatment must be appropriate to the occlusal condition, soft tissues and patient's expectations. Patients should not be imposed to be suitable for provider's treatment.

There are many treatment plans to correct the malocclusion in the mixed dentition period, we have selected an early orthodontic treatment using 2x4 fixed appliances for 36 patients with the following objectives: evaluation of the results of early treatment of patients with mixed dentition with 2x4 fixed appliances.

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II. PARTICIPANTS AND METHODS

2.1. Participants: Angle class II malocclusion patients having mixed dentition stage.

Inclusion criteria: from 7.5 to 12 years old, having permant maxilla and mandible anteriors and all first permanent molars; malocclusion with the following characterisitcs: overbite greater than 3mm, overjet more than 5 mm and possibe crowding anteriors, voluntarily participate in orthodontic treatments.

Exclusion criteria: young patients having class I, III malocclusion, unilateral or bilateral posterior crossbite, patients older than 12 years old or do not voluntarily participate in orthodontic treatments.

2.2. Methods: Prosspective study.

Data collection: all information of study patients is recorded in the patients' progression charts

Clinical examination to determine occlusion condition, cephalometric and panorex Xrays, Xray analysis, straight front face and lateral face profile photos, study stone models and index measurements.

Making treatment plan and explaining to the patient about the treatment plan.

Implementation of the treatment plan: most of the patients were early treated with 2x4 fixed appliances. At first, NiTi 0,14 is used to rebuild tooth vertical axis, then 0.16x0.22ss wire break to realign the axis of incisors. All 36 patients received the same treatment, with only difference in the duration of the NiTi wire was used. Monthly, the patient would follow up until the permanent teeth fully erupt. Cephalometric and parorex Xrays were taken before and after treatments for comparison.

Duration of treatment: from attaching of 2x4 fixed appliances until all permanent teeth fully erupt.

2.3. Data analysis: Software SPSS for Windows 19.0.

2.4. Result analysis: The difference between before and after treatments was analyzed with independent t-test and chi-squared test, p-value less than 0.05 was considered to be statistically significant. Cephalometric analysis: using software program FACAD (llexis AB, Sweden) to check the difference before and after treatment.

III. RESULTS

Patient information: Total number of patients is 36, 14 males and 22 females, mean ages: 8.2917±0.59010. Mean duration of treatment: 3.6806 years ±0.57511 months.

Table 1: Mean values (mm) of overbite and overjet before and after treatments.

Occlusion relationship	Before		After		P
	Mean value	Disparity from normality	Mean value	Disparity from normality	
Overjet	4,7242	0,19150	2,0689	0,1036	< 0,001
Overbite	3,4167	0,7653	2.0089	0,0066	< 0,001

In total 36 participant patients, the mean overjet decreases from 4.7242 mm to 2.0689mm ($p < 0.001$) and that of overbite decreases from 3.4167 mm to 2.0089 mm ($p<0.001$).

Table 2: Crowding anterior teeth before and after treatments.

Maxilla	Before	After	P
	Number of patients	Number of patients	
Normal aligned teeth	9	36	(p< 0,05)
Crowding	27	0	
Total	36	36	
Mandible			
Normal aligned teeth	11	16	(p> 0,05)
Crowding	25	20	
Total	**36**	**36**	

In all 27 patients having maxillary crowding anteriors, after treatment these teeth are aligned normally with p-value less than 0.05.

Table 3: Mean index values measured on Cephalometric Xray before and after treatments.

Cephalometric index	Before		After		P
	Mean value	Disparity from normality	Mean value	Disparity from normality	
SNA	84,8778	0,37880	83,7131	0,13253	< 0,001
SNB	79,6431	0,11411	80,0725	0,03008	< 0,001
ANB	4,3508	0,12489	2,1569	0,06112	< 0,001
I - Pal	110,28	0,32545	109,12	0,3988	< 0,001
I - MP	1,1592	0,3055	1,6186	0,1748	< 0,001
Interincisal	126,63	0,40994	124,04	0,8634	< 0,001

After orthodontic treatment, the mean value of SNA angle decreased from 84.8778^0 to 83.7131^0 with p-value less than 0.001, that of SNB angle increased from 79.6431^0 to 80.0725^0 with p-value less than < 0.001, and that of ANB angle decreases from 4.3508^0 to 2.1569^0 with p-value less than < 0001. In addition, the mean value of the interincisal angle reduces from 12663^0 to 124.04^0 with p-value less than 0.001, I-Pal angle reduces from 110.28^0 to 109.12^0 with p-value less than 0.001 and finally the I-MP angle increases from 1.1592^0 to 1.6186^0 with p-value less than 0.001.

IV. DISCUSSION

Angle class II malocclusion early interventional treatment: Early treatment at mixed dentition stage is often controversial study among researchers although all malocclusion types can be observed clearly in mixed dentition stage [2]. Several researchers suggest early intervention to prevent the progression of more severe malocclusion condition. Studies have demonstrated that early intervention in children, particularly in mixed dentition stage, results in more stable occlusion. Additionally, the risk of having occlusal trauma is also considered as the good reason for early intervention, for example, children having large overjet value are more likely receive higher risks of accident trauma for anterior teeth [5]. Some researchers argued that early intervention only results in 15-20% occlusal disorders. Recent retrospective study

of Norwegians children proved that early interventions indeed improved malocclusion condition, and then the treatments would continue carrying on until all permanent teeth have erupted [4]. Studies of early interventional treatments have focused mainly on two-stage treatments for patients having Angle class II malocclusion. On the other hand, according to several studies among Finnish children, early treatment plans have been found to be successful, especially at the residential areas with higher density of experienced orthodontists [3].

Via scientific theories and results achieved through clinical treatments from many experience orthodontists, we have conducted early interventional treatment with 2x4 fixed appliances for 36 malocclusion patients, the obtained results could change the correlation of the occlusion relationship both transversally and sagitally.

2x4 fixed appliances in early intervention of Angle class II malocclusion: the use of 2x4 fixed appliances at mixed dentition stage for Angle class II malocclusion early intervention has result in changing the correlation of occlusion relationship transversally and sagitally, aligning the anterior incisors, adjusting the arch length and controlling the spaces of posterior molars [7]. In addition, this appliance does not interfere tongue function or occlusal surfaces. When attaching the brackets and bands, we should pay attention to avoid the root of lateral incisor moving distally, so that the root of this incisor would not be resorbed because the root is closely facing the permanent erupting canines. It is also necessary to reverse the brackets of the right and left central incisors in order to change the direction of crown divergence and root convergence.

During the progression of Angle class II malocclusion treatment, it is important to monitor the E space because it plays a crucial role in creating molar class I occlusion. According to normality, there is a significant difference between the size of incisor E and mandibular #5 (permanent second premolar). According to Steven M.H Lee [6], in the mandibular arch, the mean size of primary teeth E is larger than that of mandibular second premolar. The difference in size creates about 1.7mm space, which is called Leeway space. The maxillary Leeway space is about 0.9 mm on each quadrant. If the loss of primary maxillary incisor E happens earlier than the loss of primary mandibular incisor E, it results in the reduction of the maxillary arch length and consequently it results in the maxillary crowding teeth and class II occlusion relationship. On the other hand, if the loss of primary mandibular incisor E happens earlier than that of primary maxilla incisor E, it results in reduction of the mandibular arch length and consequently it results in mandibular crowding teeth. We can take advantage of the E space to increase the mandibular arch length about 3-4 mm. Many crowding teeth cases require tooth extraction, however, if we can maintain the spaces before the disappearance of E space and mesial drift of the first molar, tooth extraction is not necessary during the treatment.

Early intervention during mixed dentition can reduce overbite, overjet and maxillary anterior incisors crowding:

Using 2x4 fixed appliance during mixed dentition stage can reduce the overbite and overjet. Bergensen [1] emphasized the importance of simultaneously correcting both overbite and overjet in order to increase the stability of occlusal correction by

establishing appropriate correlation of anterior incisors. Bergensen also noted that if teeth movements are adjusted before the maturity of collagen fibers, it likely prevents malocclusal relapse. Therefore, early interventional treatment, particularly at mixed dentition stage using 2x4 fixed appliance can lead to good results from correction of overbite and overjet. Through 36 patients participating in our study, the mean value of overjet decreases from 4.7242 mm to 2.0689 mm (p-value <0.001) and that of overbite decreases from 3.4167 mm to 2.0089 mm (p-value <0.001). Besides, maxillary teeth crowding is corrected to normal teeth alignment and position (p-value <0.05) (table 3.2). However, the results obtaining from early intervention at mixed dentition stage serve as the premise for the sequentially following treatment phase. By adjusting the sagitally correlations of occlusion and alignment of teeth simultaneously, 2x4 fixed appliance could represents a comprehensive early intervention approach, followed by long term maintenance until all permanent teeth erupt.

V. CONCLUSION

The use of 2x4 fixed appliance in eatly intervention at mixed dentition stage can be effective in improving the correlation of occlusal relationship transversally and sagitally, aligning maxillary anterior incisors, reducing overbite and overjet values. All index on the Cephalometric before and after treatments indicated that the improvement of correlation of occlusal relationship sagitally. With these results, 2x4 fixed appliances can be powerful tools in enhancing the correlation of anterior incisors in Angle class II malocclusion at mixed dentition stage. However, more studies are needed to evaluate the long term effectiveness of 2x4 fixed appliances in early treatment of Angle class II malocclusion.

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EXTRAORAL PHOTOGRAPHS OF PATIENT UNDERGOING ORTHODONTIC TREATMENTS

1. PHAM VAN PHAP, 9.5 years old. Angle class II malocclusion, maxillary and mandibular crowding teeth. Treatment plan: 2x4 fixed and straight wire applicances.

2. LE DAN HA, 7 years old. Overbite. Treatment plan: 2x4 fixed appliance until all permanent teeth erupt, re-evaluate and continue the treatment using straight wire appliance.

3. NGUYEN HUYNH LAN ANH., 10 years old. Angle class II, maxillary crowding teeth. Treatment plan: 2x4 fixed appliance and straight wire appliances.