Biomedical & Pharmacology Journal Vol. **9**(3), 1079-1085 (2016)

Determining Chronological Age for the Treatment of Class I, II and III Malocclusion in the Crowd of Iranians

NILOOFAR MOKHTARI*[1] and HASSAN ALI GHAFARI[2]

[1]DDS, Orthodontic Department of Shahed University, Dental Faculty, Tehran, Iran.
[2]Orthodontist Specialist, Assistant Professor, Orthodontic Department of Shahed University, Dental Faculty, Tehran, Iran.
*Corresponding author Email :- dr.niloofar.1369@gmail.com

http://dx.doi.org/10.13005/bpj/1052

(Received: November 28, 2016; accepted: December 17, 2016)

ABSTRACT

The timing of orthodontic treatment is of great importance, treatment plans should be according to type of malocclusion. Some needs early intervention while other type would benefit from delaying the planned treatment. Patients with same chronological age have different rate of maturation having an idea about physiological development will greatly reduce the risk of treatment failure, as well as insufficient coast & effort. Morphology of Cervical vertebrae has been used as a reliable biological (physiological) indicator for determination of skeletal maturation. Aim of this study was to determine the most appropriate chronological age for treatment of patients with class 1, 2 & 3 malocclusions.The study group consisted of 480 lateral cephalogram of patients, which were divided into 240 male & 240 female ranging in age from 8 to 16 years. Each lateral cephalogram was traced using viewbox software & for assessing maturation of cervical vertebrae body of C2(Axis),C3 & C4 were analyzed according to Bacceti modified version of CVS. For data analysis SPSS software version 16 was used. Values of fisher test for different types of malocclusions suggest a significant effect of age on maturation of cervical vertebrae in patients with malocclusion. Values of correlation between gender & skeletal stage in patients with class 1,2 & 3 malocclusions indicate significant difference between genders in class 2 & 3 while in class 1 malocclusion there was no significance difference between genders.The result of this study suggests that girls were ahead of boys in attaining skeletal maturity. Pubertal spurt of our study population occurred approximately at the age of 12.Although there was significant difference between genders in maturation of cervical vertebrae in patients with class 2 & 3 malocclusions, patients with class 1 malocclusion showed no significant difference.

Keywords: Lateral cephalogram, Chronological age, physiological age, cervical vertebral maturation, Malocclusion.

INTRODUCTION

Malocclusion is the most common developmental disorder that affects human communities. It is one of the most common oral diseases in most countries[1]. A malocclusion is defined as irregularities of teeth or inappropriate relationship of teeth with one another [2]. IN addition to aesthetic problem Malocclusion can cause mental discomfort, mastication, swallowing &speaking dysfunction as well as increased susceptibility to trauma and periodontal disease[6-3]. Determining the right developmental stage is one of the most important factors to be aware of for diagnosis and treatment[7]. Based on the relationship of upper first permanent molar, three classes of malocclusion is defined

I. There is normal molar relationship but occlusal line due to displacement and rotation or other causes is confused.
II. Lower molars are located distal to upper molars and occlusal line has no special features.
III. The lower molars are located mesial to upper molars and occlusal line have no special features[8].

Significantly treatment time of Class II malocclusion with what's done about Class I and III malocclusion is different. Contrary to recommendations for early treatment of Class III malocclusion and tooth size, arch size discrepancy it's recommended that treatment of Class II malocclusion delayed until complete development of permanent dentition. All clinical and laboratory studies show that when Class II malocclusion is associated with mandibular retrusion,mandibular growth response using functional devices that are used at the time of maturity is higher[9-11]. Dental maturity can be assessed using the number erupted & un erupted teeth, stages of dentition(deciduous, mixed and permanent), calcification of teeth, stages of crown formation & root development. To assess physiological maturity different bones in human body can be used such as hand bones, feet, knees, arms, shoulders, hips and cervical vertebrae among these bones, method of hand, wrist and cervical vertebrae are widely used as a display of maturity[12].

Hand and wrist method: There are many bones in the hand and wrist area that have different times and & speed of ossification[12].

Cervical vertebrae maturation method: in this method morphology of the body of c2, c3, c4 is used and according to this physiological maturity is determined[13].

Hedayati et al 1384 investigate the degree of evolutionary indicators cervical vertebrae in Cephalometry with hand and wrist radiography. Hand and wrist radiography based on Fishman system and lateral cephalometric radiography based on the method of Hassel and Farman were performed. Finally, it concluded that lateral cephalometric radiography can be easily used instead of hand and wrist radiography[14].

Safavi et al in 1393, investigating the correlation between cervical vertebrae maturation and chronological age among Iranian girls. The results showed that the correlation between cervical vertebrae maturation stages and chronological age was relatively low. Finally it concluded due to low correlations between cervical vertebrae maturation stages & chronological age using other physiological indicators to determine the patients' exact physiological age is essential[15]. Baccetti et al in 2005 with the stated maturity method of cervical vertebrae optimal scheduling for orthodontic treatment were evaluated. In this study, 706 cases of lateral cephalometric from University of Michigan were evaluated using morphology of the body of Axis,C3 & C4, finally concluded that CVM method is a reliable method is assisting dentist for scheduling optimal treatment timing[16].

In this study Cervical vertebrae maturation method is used to determine physiological age of patients in different chronological age intervals with dissociation of their malocclusion, the aim of this study was to estimate the most appropriate chronological age for the treatment of Class I,II,III malocclusion in Iranian population.

MATERIALS AND METHODS

In this cross-sectional study, 480 lateral Cephalogram of patients referred to a radiology centre were evaluated. 480 Cephalogram were classified to 240 males and 240 females with minimum chronological age 8 years and maximum chronological age 16 years according to the type of malocclusion. Inclusion criteria were the presence of good quality lateral cephalometric radiography and Exclusion criteria was poor quality of radiography and any medical or surgical history affecting physiological as well as jaw or tooth development,. patients divided into 8 age group ranging from one year. Patient's demographic data were entered into checklist. All radiography and digital images were traced & evaluated using View Box software version 3 ,according to Angle classification angles types of malocclusion was determined and calculated for each sample.

Desired angles to determine the types of malocclusion were SNA, SNB, ANB and wits evaluation. Then skeletal maturity phases from lateral cephalometric radiography based on the cervical vertebrae maturation method (CMV) expressed by Bacceti using morphology of second, third and fourth cervical vertebrae(C2,C3,C4) were evaluated[5]. To enhance the accuracy and reliability of research results, two observers performed all measurements by. Data analysis was done by entering them in SPSS version 16 software & using

Spearman correlation, t-test, Chi-Square and Fisher test. P value <0.05 considered as significant level.

Findings

In this study, 480 samples were evaluated, half of them female and half were male Table 1 shows morphology of cervical vertebrae based on age categories. According to table until age category 12 or 13 years highest percentage frequency is in CS1. At the age of 13 to 15 years in CS4 and at the age of 15 to 16 years in CS5. Regardless of age can be said CS1 was the most frequent category. According to Fisher's exact test, age has significant effect on morphology of the cervical vertebrae in children and adolescents of 8 to 16 years (P-value <0.001)

Table 1: The relationship between chronological age and physiological age.

In girls most frequency of 11 years related to CS1 and after that most frequency at the different age is variable and in boys most frequent at different age to 13 years related to CS1 and after that most frequency at the different age is variable.

The survey was carried out to determine the type of malocclusion, the highest frequency of malocclusion was Class II with frequency 286 and frequency percentage of 59.58% and after that class III with 109 frequency and frequency percentage of 22.7% and the last was class I with frequency 85 and frequency percentage of 17.7%. Estimation of the physiologic age of in all three classes of malocclusion was statistically significant (P <0.001) in patients with Class 1 malocclusion, the most frequent skeletal stage at the age range of 8-12 years was CS1 and at the age range of 13-16 years was CS4. In patients with Class 2 malocclusion, the most frequent skeletal stage at the age range of 8-13 years was CS1, CS4 at the age range of 13-15 years and CS5 at age range 15-16 years. In patients with Class 3 malocclusion, the most frequent skeletal stage in the age range of 8-11 years was CS1, in the age range of 12-13 years was CS2, in the age range of 13-14 years was CS3 & in the age range of 14-16 CS4 and CS5. About the relationship between cervical vertebrae maturation stages at different ages in class I malocclusion, physiological age CS1 had highest frequency between ages 8-12 years old, while the age range of 13-16 years CS4 had the highest frequency. In Class II malocclusion in the range of 8-13 years the most common skeletal stage was CS1, in the age range of 13-15 years CS4 and CS5 in the age range of 15-16 years.

In Class III malocclusion, in the age range of 8-11 years the most common skeletal stage was CS1, in the age range of 11-12 years CS1 and CS3, in the age range 12-13 years CS2, in the age range 13 -14 years CS3 & in the age range 14-16 years CS4 and CS5.

The relationship between gender and physiological age with respect to classes of malocclusion among the patients showed that in class I there is no significant difference between two genders.

(P-value> 0.05) while the difference in the case of class II and III malocclusion was significant. In all three classes of malocclusion in both the girls and the boys, CS1 skeletal stage was most frequent and then in class I, CS4 was the most frequent stage in both girls and boys, in class II and III malocclusion in the boys CS2 and girls CS4 were the most frequent skeletal stages.in Class 1 malocclusion the most common skeletal stage in both boys and girls was CS1 and then CS4. In Class 2 malocclusion in girls and boys the most frequent skeletal stage were CS1 and CS2 girls and after that CS4. In Class 3 Malocclusion in girls and boys most frequent stage was CS1 and later CS4 in girls and CS2 in boys.

The average age at any skeletal stage with breakdown of classes of malocclusion and gender was as following

In Class 1 malocclusion the average age of the girls in CS1 (11-8 year) ,in CS2 (9-12.5 year), in CS3 (14-10 years),in CS4 (years 14-13) and in CS5 (15-14 year). In boys on stage of CS1 (8-12years), CS2 (10.5-14 year), CS3 (12-14.5 year) ,CS4 (13-15 year) & CS6 (15 year) (Table 4-9 and 4-10)

Table 1: Shows relationship between physiological age and chronological age according to morphology of cervical vertebrae in girls and boys study

			Cervical vertebrae maturation Stages						P-value
			1	2	3	4	5	6	
Chronological age	8-9	Number	47	12	1	0	0	0	<0.001
		Percent	78.3%	20.0%	1.7%	0.0%	0.0%	0.0%	
	9-10	Number	46	12	2	0	0	0	
		Percent	76.7%	20.0%	3.3%	0.0%	0.0%	0.0%	
	10-11	Number	42	12	6	0	0	0	
		Percent	70.0%	20.0%	10.0%	0.0%	0.0%	0.0%	
	11-12	Number	35	18	7	0	0	0	
		Percent	58.3%	30.0%	11.7%	0.0%	0.0%	0.0%	
	12-13	Number	20	15	16	8	1	0	
		Percent	33.3%	25.0%	26.7%	13.3%	1.7%	0.0%	
	13-14	Number	12	12	15	18	3	0	
		Percent	20.0%	20.0%	25.0%	30.0%	5.0%	0.0%	
	14-15	Number	7	10	12	21	10	0	
		Percent	11.7%	16.7%	20.0%	35.0%	16.7%	0.0%	
	15-16	Number	0	5	7	17	24	7	
		Percent	0.0%	8.3%	11.7%	28.3%	40.0%	11.7%	
	Total	Number	209	96	66	64	38	7	
		Percent	43.5%	20.0%	13.8%	13.3%	7.9%	1.5%	

Table 2: Shows the relationship between chronological age and physiological age in girls

Physiological age according to cervical vertebrae morphology									
P-value						**Chronological age**			**Gender**
	6	5	4	3	2	1			
<0.001	00.0%	00.0%	00.0%	00.0%	620.0%	2480.0%	Number	8-9	
							Percent		
	00.0%	00.0%	00.0%	26.7%	516.7%	2376.6%	Number	9-10	
							Percent		
	00.0%	00.0%	00.0%	620.0%	620.0%	1860.0%	Number	10 -11	GIRL
							Percent		
	00.0%	00.0%	00.0%	723.3%	723.3%	1653.3%	Number	11- 12	
							Percent		
	00.0%	13.3%	723.3%	1240.0%	413.3%	620.0%	Number	12 -13	
							Percent		
	00.0%	310.0%	1653.3%	826.7%	310.0%	00.0%	Number	13 -14	
							Percent		
	00.0%	826.7%	1550.0%	310.0%	26.7%	26.7%	Number	14 -15	
							Percent		
	413.3%	1756.7%	826.7%	13.3%	00.0%	00.0%	Number	15 -16	
							Percent		

Table 3: Correlation between chronological age and physiological age in boys

P-value	Physiological age according to cervical vertebrae morphology Chronological age								Gender
	6	5	4	3	2	1			
<0.001	0	0	0	1	6	23	Number	8-9	
	0.00%	0.00%	0.00%	3.30%	20.00%	76.60%	Percent		
	0	0	0	0	7	23	Number	9-10	Boy
	0.00%	0.00%	0.00%	0.00%	23.30%	76.60%	Percent		
	0	0	0	0	6	24	Number	10-11	
	0.00%	0.00%	0.00%	0.00%	20.00%	80.00%	Percent		
	0	0	0	0	11	19	Number	11-12	
	0.00%	0.00%	0.00%	0.00%	36.70%	63.30%	Percent		
	0	0	1	4	11	14	Number	12-13	
	0.00%	0.00%	3.30%	13.30%	36.70%	46.70%	Percent		
	0	0	2	7	9	12	Number	13 -14	
	0.00%	0.00%	6.70%	23.30%	30.00%	40.00%	Percent		
	0	2	6	9	8	5	Number	14 -15	
	0.00%	6.70%	20.00%	30.00%	26.70%	16.70%	Percent		
	3	7	9	6	5	0	Number	15 -16	
	10.00%	23.30%	30.00%	20.00%	16.70%	0.00%	Percent		

Table 4: Demonstrate relationship between gender & physiological age in different classes of malocclusion

p-value	Skeletal stage							
	6	5	4	3	2	1		
0.182	0	6	9	6	6	16	Number	Girl class
	0.00%	14.00%	20.90%	14.00%	14.00%	37.20%	Percent	Imalocclusion
	1	0	8	6	7	20	Number	Boy
	2.40%	0.00%	19.00%	14.30%	16.70%	47.60%	Percent	
<0.001	1	15	28	25	22	58	Number	Girl class II
	0.70%	10.10%	18.80%	16.80%	14.80%	38.90%	Percent	malocclusion
	0	4	5	18	40	70	Number	Boy
	0.00%	2.90%	3.60%	13.10%	29.20%	51.10%	Percent	
0.018	3	8	9	8	5	15	Number	Girl class III
	6.30%	16.70%	18.80%	16.70%	10.40%	31.30%	Percent	malocclusion
	2	5	5	3	16	30	Number	Boy
	3.30%	8.20%	8.20%	4.90%	26.20%	49.20%	Percent	

In Class 2 malocclusion

The average age of girls in CS1 (8-11years), CS2 (9-12years), CS3 (10-13years), CS4 (13-14years), CS5(14-15years) and CS6(15 years) and in boys on CS1(9-12years),CS2(9-13years),CS3(11.5-15),CS4(13-15years) and CS5 (15 years) (table 11-4 and 12- 4).

In Class 3 malocclusion

The average age of girls in CS1 (8-11years), CS2(9-10years), CS3(11-13years),CS4(12-14years), CS5(15-13 years and CS6(15 years). in boys CS1 (8-11.5years), CS2 (10-14years), CS3(13-15years), CS4(14-15years),CS5(14-15years)& CS6(15 year).

The average age of boys in each skeletal stage is higher than girls which indicates girls reach earlier to each stage of physiological age than boys.

Table 4 demonstrate relationship between gender & physiological age in different classes of malocclusion.

The correlation coefficient between physiological age and chronological age in girls and boys with class I malocclusion, respectively: 82% (0.82) and 76% (0.76). In Class II malocclusion, in girls and boys were: 78% (0.78) and 50% (0.5) and in class III malocclusion in girls and boys respectively: (0.82) 82% and 73% (0.73).

DISCUSSION AND CONCLUSION

The results of our study showed that the age group of 12 to 13 years of study CS1 has the highest percentage. At the age of 13 to 15 years most of samples were in the category of CS4 and in 15 to 16 years at category of CS5. Regardless of age, the highest prevalence was the category of CS1. The highest frequency of skeletal age in the age groups 8-9, 9-10, 10-11 and 11-12 years in girls was CS1 and in age 8-9 and 10-11-year results were in line with the results of Abesy et al in 1394 but in Abesy et al in age groups of 9-10 years and 11-12 years most of girls were in CS2[17].

Evolution of physiological age clearly was lower in boys than girls so that in the age range of 8-14 years, the most common skeletal stage was CS1.

This early maturation in girls can be seen in other studies and the results of our study are consistent with other studies which indicate that girls mature earlier and are consequently in higher skeletal stages comparing to boys of their own age. The great thing about the comparison groups in this study was consistent with results of other studies, the evolution of the cervical vertebrae in girls was observed earlier and this fact is very helpful in estimating the initiation of treatment [19-17]. The highest prevalence of malocclusion was for Class II with frequency percentage of 59.58%, followed by the class III with frequency percentage of 22.7% and after that class I with frequency percentage of 17.7%.

The results of our study was different with Shahri et al in Zahedan city, Khane Masjedi in Ahvaz, Ramezan Zade in Neyshabur, and Azarbayejani in Isfahan[8-20] & this is probably due to type of patients selection in our study. the most important factor to be considered is using of physiological age rather than chronological age for planning & initiation of orthodontic treatment. In this study, although the chronological evolution of the cervical vertebrae with age, significantly increased, but a great variety of chronological age at any stage of maturity of cervical vertebrae (skeletal age), showed that chronological age is a poor indicator to determine the status of maturity. It's also has been shown in other studies that chronological age is not a reliable indicator to assess the maturity. Growth modification treatments should be done earlier in girls than boys because girls reach pubertal growth spurt earlier & this factor can highly influence outcome of treatment. Although CVM method is a reliable and efficient method for assessing the maturity and development of growing patients but for accurate determination of the continuation or completion of craniofacial growth it is better to take two cephalometric radiograph within six month to precisely compare the growth & maturation[22]. CVM method must be used along with careful evaluation of soft and hard tissue, extra & intraoral clinical examination. Since the initiation of orthodontic treatment vary according to types of malocclusion having an accurate idea about growth & development of patients is highly essential. Some patients require early intervention and treatment while some need the treatment to be postponed. In all cases, early intervention is not necessary and even can cause problems such as insufficient cost & effort it also can cause loss of patient cooperation in future.

REFRENCE

1. Liu Z, McGrath C, Hagg U. The impact of malocclusion/orthodontic treatment need on the quality of life. *Angle Orthod.* **79** (3): 585-91(2009).
2. Walter DP, Houston WIB, Iones ML, Oliver RG. Walther and Houston's orthodontic

notes. 5th ed. Boston: Wright; (1994).
3. Kenealy P, Frude N, Shaw W. An evaluation of the psychological and social effects of malocclusion: some implications for dental policy making. *Soc Sci Med* .28(6): 583-91(1989).
4. Proffit WR, Fields HW. Contemporary orthodontics. 3rd ed. St Louis: Mosby; 2000.
5. Grimm S, Farzao P, Antunes IL, Castellanos RA, Narval PC. Dental injury among Brazilian schoolchildren in the state of Sao Paolo. *Dent Traumatol*. **20** (3): 134-8(2004).
6. Greiger AM. Malocclusion as an etiologic factor in periodontal disease: a retrospective assay. *Am J Orthod Dentofacial Orthop.* **120** (2): 112-5(2001).
7. Kloehn SJ.Orthodontics force or persuasion .*Angle Orthod* 23:56 (1953).
8. Urban Fariba, Alireza Khosravi Khosroshahi. The prevalence of malocclusion in 12 and 13-year-old students in Zahedan. *East Physician* 1382; **5** (3): 165-
9. McNamara Jr JA , Bookstein FL,Shuaghnessy TG.Skeletal & dental changes following functional regulator therapy on class II patients.*Am J Orthod*.**88**:91-110(1985).
10. Baccetti T,Franchi L,Toth LR,McNamara Jr JA.Treatment timing for twin block therapy.*Am J Orthod.Dentofac orthop*.**118**:159-170 (2000).
11. Petrovic A Sttutzmann JJ, Oudet C.Controll process in the postnatal growth of the condylar cartilage. In: McNamara Jr JA, ed.determination of mandibular form & growth.AnnArbor:Monograph4, Cranofacial Growth Series, Center for Human Growth & Development, University of Michigan; (1975).
12. Dhiman S, Maheshwari S, Verma SK. Assessment of maturity in orthodontics: A review. *J Adv Clin Res Insights.* **2**:100-103(2015).
13. Baccetti T, Franchi L, MC Namara JA. An improved version of the cervical vertebral maturation (CVM) method for assessment of mandibular growth. *Angle Orthod.* **72**: 316-323(2002).
14. Navigate Venus, Shahid flame, M. Pears race. Check degree of maturation indicator in Cephalometry hand and wrist radiographs of the cervical spine. Journal of Dental Medicine, Shiraz University of Medical Sciences. **6** (3 and 4): 151(1384).
15. Safavi SM, Beikaii H, Hassanizadeh R, Younessian F, Baghban AA. Correlation between cervical vertebral maturation and chronological age in a group of Iranian females. *Dental Research Journal.* **12** (5): 443-448(2015).
16. Baccetti T, Franchi L, McNamara JA. The cervical vertebralmaturation (CVM) method for the assessment of optimal treatmenttiming in dentofacial orthopedics. *Semin Orthod*. **11** (3): 119-29(2005).
17. Absy Frida, Fatah Side Star, Haghanifar Sinai, the Promised E., A. V., Khafri Soraya. Study match chronological age and morphology of the cervical spine in lateral cephalometric radiographs of Iran's population. *Journal of Mashhad Dental School* ; **39** (1): 61-70(1394).
18. Baccetti T, Franchi L, Toffol L, Ghiozzi B, Cozza P. The diagnostic performance of chronological age in the assessment of skeletal maturity. Prog Orthod 2006; 7(2): 176-88.
19. Foster LW. Dental condition in White and Indian children in Northern Wisconsin. *J Ame Dent Assoc.* **29**:225-55(1942).
20. Khanehmasjedi Mashallah, Leila Basir. The frequency of tooth-jaw anomalies based on the classification of parasites in students 11 to 14 years Ahwaz schools in the academic year 79-80. *Journal of Medical Science*. **42**: 20-25(1383).
21. Azerbaijani Saeed, Mirsafaei R., purpose Shahla, J. M., civil Said. The relationship between types of malocclusion in students of Isfahan, age and sex. *Journal of Isfahan Dental School*. **11** (2): 143-152(1394).
22. Jmaes A McNamara, Laurie McNamara, Lee W.Graber.Optimizing orthodontic & dentofacial orthopedic treatment timing.Current Principles & Techniques.5th Edition.