Revista Mexicana de Ortodoncia

Vol. 1, No. 1 • October-December 2013
pp 33-37

ORIGINAL RESEARCH

Comparative analysis between dental, skeletal and chronological age

Análisis comparativo entre la edad ósea, edad dental y edad cronológica

Norma Angélica Arciniega Ramos,* Mauricio Ballesteros Lozano,§ Arcelia Meléndez Ocampo||

ABSTRACT

The purpose of this study was to determine if skeletal age, dental age and chronological age agreed in 41 subjects. The orthodontist not only needs to know the patient's chronological age, but also he must know what percentage of growth can be expected in one or two years treatment time. This information is obtained by assessing the skeletal age with hand-wrist radiographs, but there are other aids of diagnosis such as the panoramic X-ray on which dental age can be assessed, so that the clinician has two aids for a more comprehensive diagnosis. Unfortunately although these methods are widely commented in Literature in the clinical practice they are not considered that much. In order to evaluate the skeletal age, we used Fishman's method in the hand-wrist radiograph and to assess dental age, Dermirjian's method in the panoramic X-ray was used. *t* test was used to determine the significant differences between the variables and it was applied to a test of analysis of variance (ANOVA). The results suggest exist statistically significant differences between the skeletal age and the dental age, between the dental age and the chronological age, as well as between the skeletal age and the chronological age. In correlation terms it is only observed very little correlation between the chronological age and the dental age.

RESUMEN

El propósito de este estudio fue el de determinar si coincide la edad ósea, la edad dental y la edad cronológica en 41 sujetos. El ortodoncista no sólo necesita conocer la edad cronológica del paciente, también debe saber qué porcentaje de crecimiento puede esperar en uno o dos años que será el tiempo de tratamiento, este dato se obtiene valorando la edad ósea mediante la radiografía digitopalmar, así mismo existen otros auxiliares de diagnóstico como la ortopantomografía, a través de la cual se valora la edad dental, de tal forma que el clínico cuenta con dos auxiliares que complementan el diagnóstico, desafortunadamente aunque estos métodos son ampliamente comentados en la literatura en la práctica no se toman en cuenta. Para evaluar la edad ósea se utilizó el método de Fishman en la radiografía digitopalmar y para valorar la edad dental se utilizó el método de Dermirjian en la ortopantomografía. Se utilizó la prueba *t* para determinar las diferencias significativas entre las variables y se aplicó una prueba de análisis de varianza (ANOVA). Los resultados sugieren que existen diferencias estadísticamente significativas entre la edad ósea y la edad dental, entre la edad dental y la edad cronológica, así como entre la edad ósea y la edad cronológica. En términos de correlación sólo se observa muy poca correlación entre la edad cronológica y la edad dental.

Key words: Dental age, skeletal age, chronological age, biological maturity.
Palabras clave: Edad dental, edad ósea, edad cronológica, madurez biológica.

INTRODUCTION

During orthopedic treatment it is very important to evaluate the individual's growth since most of the patients who require treatment for their malocclusions are in a growth period. The knowledge of the maturation stage of the patient permits a proper evaluation and determines if growth has been completed. This data has influence over the diagnosis, treatment objectives and treatment plan.[1]

Throughout life, people go by different maturational stages that imply an increasing level of maturation. Each individual has its own rhythm or growing period of time and according to it, growth can be fast, average or late.[2]

The most useful method to evaluate biological maturity is the estimation of the skeletal age due to the fact that the changes that bones experience during their maturation process are very similar in all individuals and each ossification center goes through a number of morphological changes that can be easily identified.[3]

The hand-wrist radiograph is the most used radiograph to assess skeletal development.[4] It is used conventionally to estimate skeletal age because there is a large quantity of large and rounded bones in an area that can be easily observed.[5]

Hand-wrist radiographs have proved to be reliable in determining the peak growth. Other methods for

* Graduate from the Postgraduate Studies and Research Division of the National University of Mexico.
§ Professor of the Orthodontic Department at the Postgraduate Studies and Research Division of the National University of Mexico.
|| Professor from the Statistics Department of the Postgraduate Studies and Research Division of the National University of Mexico.

identifying the individuals' maturation stage have been suggested, such as the dental age. Most frequently the dental organs are visible in the oral cavity when their roots have developed three quarters of their final surface, however, studies suggest that root formation is a more reliable maturity indicator that dental eruption.[6]

MATERIAL AND METHODS

In the present study 41 hand-wrist and 41 panoramic radiographs from 8 to 14 year- old -patients from the Orthodontics Department of the Division of Postgraduate Studies and Research of the National University of Mexico and from the Federico Gómez Children's Hospital were used.

From the files, gender information and date of birth was obtained which established the chronological age of the patient. To determine the skeletal age the Fishman method was used because it evaluates the skeletal age by calculating the Skeletal Maturity Index and determines a value of chronological age according to pre-established tables.

The radiographic analysis was carried out in a white light negatoscope by only one person as it was also the case of file selection and data collecting.

The method used for the hand-wrist evaluation was the Fishman Method and the sample was classified in one of the eleven indicators of skeletal maturity (used during adolescence) or in one of the six indicators used during childhood. Then we reviewed the tables in which the average chronological age is proposed according to the skeletal maturity and thus the value for skeletal age was ascribed.

The indicators for skeletal maturity during childhood are designated with the letters F through K and involve developmental stages of the carpian bones, phalanges and metacarpal bones. They are called Skeletal Maturity Indicator (SMI) (*Figure 1)*.

- SMI F: scaphoid bone and/or trapezoid bone present.
- SMI G: capping of the trapezoid and trapezium bones.
- SMI H: in the fourth finger, the distal phalanx the epiphysis is as wide as the diaphysis.
- SMI I: in the fourth finger, in the distal phalanx, the epiphysis is wider than the diaphysis.
- SMI J: in the second finger, in the proximal phalanx, the epiphysis is as wide as the diaphysis.
- SMI K: in the thumb, the epiphysis is as wide as the diaphysis.

The indicators of skeletal maturity (SMI 1 to 11) of the adolescence involve developmental stages of specific phalanges, the thumb adductor sesamoid bone and the radius bone.

Fisherman describes four ossification stages *(Figure 2)*:

1. The width of the epiphysis is equal to the width of the diaphysis.
2. The epiphysis caps the diaphysis.
3. Ossification between the epiphysis and the diaphysis.
4. The Skeletal Maturity Indicators (SMIs) of the adolescence are:

   - SMI 1: Third finger, the width of the epiphysis of the proximal phalanx is equal or wider than the diaphysis.
   - SMI 2: the mesial phalanx of the third finger is equal or wider than the diaphysis.
   - SMI 3: fifth finger, the width of the epiphysis of the proximal phalanx is equal or wider than the diaphysis.
   - SMI 4: ossification of the sesamoid bone of the thumb.
   - SMI 5: fifth finger, the distal phalanx caps both sides of the epiphysis.
   - SMI 6: third finger, the mesial phalanx caps both sides of the epiphysis.
   - SMI 7: fifth finger, the mesial phalanx caps both sides of the epiphysis.
   - SMI 8: third finger, the fusion of the distal phalanx is complete.
   - SMI 9: third finger, the fusion of the proximal phalanx is complete.
   - SMI 10: third finger, the fusion of the mesial phalanx is complete.
   - SMI 11: the fusion of the radius is complete (skeletal growth is complete).

Fusion between epiphysis and diaphysis

There are six intermediate levels in the stages which are important to know in order to consider every possible treatment option.

- SMI 4+: SMI 4 present but just the medial side of the third finger, the distal phalanx is capped.
- SMI 5+: SMI 5 exists only the medial side of the third finger, the medium phalanx is capped.
- SMI 6+: SMI 6 is present just the medial side of the fifth finger, the medium phalanx is capped.