Bilaga till rapport

Åldersbedömning – röntgenundersökning av visdomständer i underkäken / Age estimation by examination with panoramic radiography of lower third molar, rapport 333 (2021)

Bilaga 3. Tabellverk över inkluderade studier/ Appendix 3. Included studies

Author **Year** **Country** **Ref nr**	Arany et al (1) 2004 Japan 2017
Study design	Retrospective cross-sectional study
Setting **Time period**	Division of Dentistry and Oral Surgery, Akita University Hospital, Akita, Japan Time period: 1995-2003
Population Age, sex, ethnicity Sample	Japanese 596 males, 686 females; 14-24 years
Indextest	Developmental stages of the mandibular third molar teeth were assessed according to the Demirjian et al. classification method.
No of observers	Two observers. The scores were determined by two observers who had previously not established agreement concerning reference panoramic radiographs on the classification of teeth. Therefore, individual differences in the examination were included intentionally in order to evaluate the variation between independent observers. Intraexaminer reliability was tested by repeated evaluations of 100 orthopantomograms at intervals of two months.
Reference test	According to record
Outcome, results	Mean ages (with 95 % confidence intervals) of Demirjian's stages assumed from Japanese juveniles
Comments	
Risk of bias	Moderate

Author **Year** **Country** **Ref nr**	Cantekin et al (2) 2012 Turkey 2030
Study design	Retrospective cross-sectional study
Setting	The faculty of dentistry at Ataturk University, Erzurum

Time period	Time period not specified
Population Age, sex, ethnicity Sample	Turkish population 622 males, 726 females; 7–22 years
Index test	Developmental stages of the mandibular third molar teeth were assessed according to the Demirjian et al. classification method.
No of observers	Performed independently by two investigators (one researcher in orthodontics, the other in pediatric dentistry) without any knowledge of the children's chronological ages. To assess reliability, 120 randomly selected radiographs were reexamined 30 days after the initial examination by the same observers, and inter- and intra-observer agreement was determined using the paired t-test
Reference test	According to record
Outcome, results	Chronological mineralization age of 38
Comments	
Risk of bias	Moderate

Author **Year** **Country** **Ref nr**	Duangto et al (3) 2017 Thailand 44
Study design	Retrospective cross-sectional study
Setting **Time period**	Dental Hospital, Faculty of Dentistry, Chiang Mai University, Chiang Mai, Thailand. From August 2012 to December 2014.
Population Age, sex, ethnicity Sample	1867 digital panoramic radiographs of Thai individuals aged between 8 and 23 years. Divided into training and test samples: Test sample was 20.03% of the total (175 males and 199 females). Lower left third molars
Index test	Developmental stages of the mandibular third molar teeth were assessed according to the Demirjian et al. classification method. The selected radiographs were obtained from the patients' radiographic databases. Digital panoramic radiographs produced using the Orthophos XG 3D® (Sirona, Bensheim, Germany) or Kodak 9000C 3D® (Carestream, Rochester, NY, USA) machines.
No of observers	A month after the first assessment of all samples by the first observer, 100 digital panoramic radiographs were randomly selected using simple random sampling from the total samples by the first observer

	and set aside for another month, when intra- and inter-observer agreement were tested. The 100 selected radiographs were assessed without the information of age and sex by the first observer to test for intra-observer agreement and by the second observer to test for inter-observer agreement. Cohen's kappa test was used to evaluate the intra- and inter-observer agreements.
Reference test	The chronological age was calculated from the birth date and the digital panoramic radiograph date and expressed as years with two decimal places. The patients' demographic data, including patients' names, sexes, dates of birth, and the dates of the radiographs, were recorded confidentially.
Outcome, results	Demirijian´s stages
Comments	
Risk of bias	Moderate

Author **Year** **Country** **Ref nr**	Elshehawi et al (4) 2016 Malta 45
Study design	Retrospective cross-sectional study
Setting **Time period**	Radiographic archives of the Dental Department, Mater Dei Hospital, Malta Time period was not specified.
Population Age, sex, ethnicity Sample	The Maltese Reference Data Set was developed from 1593 Dental Panoramic Tomograms of patients aged between 4 and 26 years.
Index test	Developmental stages of the teeth were assessed according to the Demirjian et al. classification method. All Dental Panoramic Tomograms (DPTs) were taken using a Gendex Orthoralix 9200 DDE, (Gendex Dental Systems, Italy), and digital radiograph software application, (VixWin Pro, Version 1.5f, Gendex Dental Systems, USA). These were collected and imported in jpeg format.
No of observers	Ten DPTs for subjects of known age were randomly selected and assessed by both investigators on two occasions, 2 weeks apart, to test intra examiner and inter examiner agreement. The index was calculated using Cohen's Kappa.
Reference test	Data was collected from the department's Patient Appointment System giving the information on Maltese National ID Number, Date

	of Birth, Date of Radiograph, Gender, Ethnicity, Identifiable Human Group
Outcome, results	Demirijans stages
Comments	
Risk of bias	Moderate

Author **Year** **Country** **Ref nr**	Guo et al (5) 2014 China 60
Study design	Retrospective cross-sectional study
Setting **Time period**	Department of Oral Radiology, the Affiliated Stomatological Hospital of Xi'an Jiaotong University Health Science Center, China. From February 2012 to May 2013
Population Age, sex, ethnicity Sample	A total of 3.512 digital panoramic radiographs of 1.255 male and 2.257 female northwestern Chinese subjects aged between 11 and 26 years.
Indextest	The mineralization status (MS) of the third molars was assessed using the formation stages described by Demirjian
No of observers	All digital radiographs were viewed by two well-trained examiners who observed the radiographs after a period of mutual calibration without knowing the knowledge of age and gender: 1.711 cases by one radiologist and 1.801 cases by the other radiologist. To test intra- and inter-examiner reliabilities, two different examiners staged the development of teeth and the impaction status in each case on an independent 100 randomly selected. radiographs. Each observer re-examined the orthopantomogram after 1 month, and the kappa test was performed to calculate the intra- and inter-examiner agreements.
Reference test	The chronological age of each subject was calculated by subtracting the date of birth from the date of the radiograph.
Outcome, results	Demirijians stages
Comments	
Risk of bias	Moderate

Author **Year** **Country** **Ref nr**	Guo et al. (6) 2015 China 2041
Study design	Retrospective cross-sectional study

Setting **Time period**	Department of Oral Radiology at the Affiliated Stomatological Hospital of Xi'an Jiaotong University Health Science Center, China. From February 2012 to May 2013
Population Age, sex, ethnicity Sample	Northern Chinese origin 3212 panoramic radiographs (1551 males, 1661 females) age 5–25 years.
Indextest	Digital radiographs. The mineralization status of the third molars was assessed using the formation stages described by Demirjian et al.
No of observers	All the digital radiographs were viewed by two well-trained examiners who examined the radiographs after a period of mutual calibration without knowing the age or sex of the subjects: 1734 cases were evaluated by one examiner and 1478 cases by the other examiner. Both examiners were Masters students in dentistry. Intraexaminer and interexaminer agreement was calculated.
Reference test	The chronological age was based on the date of the radiograph and the date of birth, according to records.
Outcome, results	Statistical data age of mineralization of teeth (years) for the modified Demirjian's stages
Comments	
Risk of bias	Low

Author **Year** **Country** **Ref nr**	Hassan et al (7) 2021 Egypt 2043
Study design	Retrospective cross-sectional study
Setting **Time period**	Oral and maxillofacial radiology department, Faculty of Dentistry, Cairo University and Faculty of Dentistry Benisuef University Time period was not specified
Population Age, sex, ethnicity Sample	Egyptian 350 (180 females and 170 males) digital panoramic radiographs of patients aged between 14 and 24 years.
Indextest	Evaluation of left lower third molar maturation stage was done according to Demirjian et al. (1973) Planmeca Proline CC X-ray machine (Helsinki, Finland).
No of observers	The panoramic radiographs were examined by two oral and maxillofacial radiologists blinded to patients' age and sex.

	Two weeks following the first evaluation, 40 randomly selected radiographs were reassessed by one of the radiologists to test for the intra-observer variability. Other 40 radiographs were reassessed by a third radiologist for the inter-observer variability.
Reference test	Egyptians of known age (according to record)
Outcome, results	Demirjian's stages (C-H) Sensitivity, specificity, accuracy, post-test probability, positive likelihood ratio and negative likelihood ratio
Comments	
Risk of bias	Low

Author **Year** **Country** **Ref nr**	Kasper et al (8) 2009 USA 52
Study design	Retrospective cross-sectional study
Setting **Time period**	Radiographic images from North Texas were compiled from four dental offices in the Dallas area. Time period was not specified.
Population Age, sex, ethnicity Sample	In total, panoramic radiographs of 950 Hispanic individuals of known age and sex were evaluated; 528 were from North Texas (Dallas) and 422 were from South Texas (Cameron County). There were 535 (56%) females and 415 (44%) males in this study. The ages ranged from 12 to 22 years.
Indextest	The eight stages of root development, and a dental development chart modified from Demirjian et al. The data were collected in two separate studies. In both studies all radiographs were digitized and coded to ensure that examiners were blind to sex, name, and age of subjects.
No of observers	Combined, the examiners included eight experienced forensic odontologists, one oral surgeon, and a physician. To test for inter-examiner reliability ten identical radiographs were given to all examiners in the North and South Texas studies. To test intra-examiner reliability, each examiner unknowingly re-evaluated 20 of their images.

Reference test	The age of subjects was verified by one of the following methods: birth certificates, Medicaid documentation, or birth date listed on the patient demographic information section of the subject's dental record.
Outcome, results	Demirijans stages
Comments	
Risk of bias	Moderate

Author **Year** **Country** **Ref nr**	Lee et al (9) 2010 Korea 2062
Study design	Retrospective cross-sectional study
Setting **Time period**	Dental Hospital of Yonsei University in Seoul, Korea. Unclear time period
Population Age, sex, ethnicity Sample	Korean 1030 males, 1057 females; 3–23 years of age
Indextest	Developmental stages of the mandibular third molar teeth were assessed according to the Demirjian et al. classification method.
No of observers	Two examiners, blinded
Reference test	According to record
Outcome, results	Demirijans stages
Comments	
Risk of bias	Low

Author **Year** **Country** **Ref nr**	Liu et al (10) 2018 China 2065
Study design	Retrospective cross-sectional study
Setting **Time period**	XiangYa stomatological Hospital Central South University in Hunan Province Time period: 2012−2016
Population Age, sex, ethnicity Sample	Han population, China 2519 patients (1190 males, 1329 females; 8−23 years of age)

Indextest	On the basis of Demirjian's eight-stage classification the mineralization of third molars was assessed at nine stages
No of observers	Two professional examiners evaluated the mineralization stages. In all, 500 orthopantomograms were selected randomly to test the assessment consistency between the two examiners.
Reference test	The chronological age was calculated from the birth date and the digital orthopantomograms date and converted to the age with two decimal places (according to record)
Outcome, results	Frequency of the modified Demirjian's stages of tooth 38 in both sex
Comments	
Risk of bias	Low

Author **Year** **Country** **Ref nr**	Li et al (11) 2012 China 2064
Study design	Retrospective cross-sectional study
Setting **Time period**	The radiographs were randomly chosen from the Department of Oral Radiology, West China College of Stomatology, Sichuan University, China From July 2009 to August 2010
Population Age, sex, ethnicity Sample	Chinese 989 males, 1089 females; 5–23 years; mean age 14; sd 5.3
Indextest	Developmental stages of the mandibular third molar teeth were assessed according to the Demirjian et al. classification method.
No of observers	Two blinded observers All digital radiographs were viewed on the same LCD monitor. Two well-trained examiners observed the radiographs after a period of mutual calibration without the knowledge of age and gender. Chi-square test and independent sample t-test were performed to evaluate the difference in the prevalence of third molars between gender groups and the mean age of each modified Demirjian's stage, respectively
Reference test	According to record
Outcome, results	Mean and standard deviations of age of the modified Demirjian's stages from 1 to H.
Comments	
Risk of bias	Low

Author **Year**	Lopez et al (12) 2013

Country **Ref nr**	Brazil 2068
Study design	Retrospective cross-sectional study
Setting **Time period**	The X-rays were collected at a private radiology practice in the City of São Paulo, Brazil, São Paulo Time period: 2010
Population Age, sex, ethnicity Sample	Brazilian (leucoderms) 379 females, 280 males; 15–23 years
Indextest	Developmental stages of the mandibular third molar teeth were assessed according to the Demirjian et al. classification method.
No of observers	Two observers. The analyzed teeth were classified using the described techniques by two examiners. To check the intra-examiner validity, 10% of the X-rays were re-analyzed by each examiner, using each technique
Reference test	According to record
Outcome, results	Frequency of stages of tooth formation, by sex and probability for tooth at each stage, according to the Demirjian classification method
Comments	
Risk of bias	Moderate

Author **Year** **Country** **Ref nr**	Mwesigwa et al (13) 2019 Uganda 75
Study design	Retrospective cross-sectional study
Setting **Time period**	Urban/peri-urban populations in Kampala. Time period was not specified.
Population Age, sex, ethnicity Sample	Dental records of 1021 Ugandans aged 10–22 years were assigned to two groups: reference (n=520) and test (n=501). The reference data was retrieved from a database of a previous bigger research project. The overall sample population comprised of 514/1021 (50.3%) males. The mean age (SD) was 15.8 (3.6) years. Test group: Female: N=245, mean age (SD) 15.7 (3.5) years Male: N=256, mean age (SD)15.7 (3.4) years.
Indextest	Developmental stages of the teeth were assessed according to the Demirjian et al. classification method. All the digital images were de-identified and saved in the JPEG format using a unique identifier number (UID) for future blinding of other data procedures.

No of observers	Two observers: a dental radiologist and a dentist, with 15- and 9-years' experience, respectively. For inter-observer and intra-observer agreement, 25% of randomly selected dental panoramic radiograph (PANs) were scored by both observers and another 25% were scored again after 2 months by observer CLM, respectively.
Reference test	Ugandans by ethnicity (self-report) with proof of their birth documentation.
Outcome, results	Predictive values, AUC
Comments	
Risk of bias	Moderate

Author **Year** **Country** **Ref nr**	Memorando (14) 2020 Philippines 2075
Study design	Retrospective cross-sectional study
Setting **Time period**	Paediatric Dentistry Division (PDD) of the Philippine Children's Medical Centre (PCMC) Time period: Between 2012-2017
Population Age, sex, ethnicity Sample	Filipino Population 9 to 23 years of age (215 males; 169 females; tot 384) Mean: 14.81 years 4.35 SD.
Indextest	Developmental stages of the mandibular third molar teeth were assessed according to the Demirjian et al. classification method. Vatech Pax-C Digital Panoramic X-ray Machine)
No of observers	Assistent researcher 1 (AR1, dentist) gave 100 randomly selected digital panoramic radiographs to the PI and Assistant Researcher 2 (AR2, dentist). The PI and AR2 separately assessed tooth #48 using the Modified Demirjian Scoring System18,19 viewed in a MacBook Air laptop with 100% brightness. Data were encoded in an MS Excel Sheet and were sent separately to AR1 for safekeeping. Data gathered were then sent to the statistician for analysis of inter-rater agreement through Cohen's Kappa.
Reference test	Chronologic age (CA) was encoded by subtracting the date of birth from the date the radiograph was taken. According to record.
Outcome, results	Age Distribution per Developmental Stage of Tooth #48
Comments	
Risk of bias	Moderate

Author **Year** **Country** **Ref nr**	Mohammed et al (15) 2014 South India 2080
Study design	Retrospective cross-sectional study
Setting **Time period**	Department of Oral Medicine and Radiology, GITAM Dental College and Hospital, Rushikonda, Visakhapatnam, India Time period not specified
Population Age, sex, ethnicity Sample	South Indian population. 330 subjects (165 males, 165 females) 9–20 years
Index test	Developmental stages of the mandibular third molar teeth were assessed according to the Demirjian et al. classification method.
No of observers	Two observers,
Reference test	According to record
Outcome, results	Assessment of dental age from third molar developmental stage
Comments	
Risk of bias	Moderate

Author **Year** **Country** **Ref nr**	Quispe (16) 2017 Peru 2094
Study design	Retrospective cross-sectional study
Setting **Time period**	School of Dentistry of the Scientific University of the South (UCSUR), Lima, Peru Time period: 2015
Population Age, sex, ethnicity Sample	Peruvians 208 (102 males and 106 females) aged 14–22 years.
Indextest	Developmental stages of the mandibular third molar teeth were assessed according to the Demirjian et al. classification method.
No of observers	A pilot test was conducted on 48 OPTs for each method in order to determine the sample size and to train and calibrate the measurements of the researcher (MMQM) in the Demirjian's stages and I3M with the Gold Standard. An intra-observer calibration was performed one week after, to test the accuracy with which the staging and measurements were

	performed by the same person.
Reference test	According to record - Data on sex, date of birth and date of the radiograph were collected for each patient. The chronological age of each subject was calculated as the difference between the birthdate and the date the radiograph was taken, the decimal age was recorded in Micro- soft Excel.
Outcome, results	Demirijans stages
Comments	
Risk of bias	Moderate

Author **Year** **Country** **Ref nr**	Qing et al (17) 2014 China 2093
Study design	Retrospective cross-sectional study
Setting **Time period**	Southwestern China taken at the Affiliated Hospital of Stomatology of Chongqing Medical University between the year 2008 and 2011
Population Age, sex, ethnicity Sample	Han ethnic group 1208 females and 984 males, collected from the individuals ranging from age of 8–25 year
Indextest	Developmental stages of the mandibular third molar teeth were assessed according to the Demirjian et al. classification method.
No of observers	Two observers were evaluated by two radiologists: 1100 cases by the first and 1092 cases by the second
Reference test	According record
Outcome, results	Chronological mineralization of third molars.
Comments	
Risk of bias	Moderate

Author **Year** **Country** **Ref nr**	Rougé-Maillart et al (18) 2011 France 2103
Study design	Retrospective cross-sectional study
Setting **Time period**	The dentistry and maxillofacial surgery department at Angers University Hospital Time period not specified
Population Age, sex, ethnicity Sample	French

	209 individuals, 115 female subjects aged from 11 to 26, and 94 male subjects aged from 12 to 24, with an average age of 15.8 years old
Indextest	Developmental stages of the mandibular third molar teeth were assessed according to the Demirjian et al. classification method.
No of observers	Two observers
Reference test	According to record
Outcome, results	Age distribution per stage for female/male subjects.
Comments	
Risk of bias	Moderate

Author **Year** **Country** **Ref nr**	Uys (19) 2017 South Africa 2127
Study design	Retrospective cross-sectional study
Setting **Time period**	School of Dentistry, University of Pretoria From 2013 to 2016
Population Age, sex, ethnicity Sample	South African - divided 705 White and 563 Black South African individuals aged between 15 and 25 years
Indextest	Developmental stages of the mandibular third molar teeth were assessed according to the Demirjian et al. classification method.
No of observers	All the examinations were carried out by the first author. One hundred and thirty randomly selected cases were reexamined by the first author to determine intra-examiner reliability. Fifty randomly selected cases were also re-examined by the second author to determine the level of inter-examiner reliability
Reference test	Known age and sex
Outcome, results	Age Distribution per Developmental Stage of Tooth #38
Comments	
Risk of bias	Moderate

Author **Year** **Country** **Ref nr**	Zeng et al (20) 2010 China 111
Study design	Retrospective cross-sectional study

Setting **Time period**	Radiology Department of the Affiliated Hospitals of Stomatology of Sun Yet-sen University From January 2008 to June 2009
Population Age, sex, ethnicity Sample	Han population China 3.100 people. The mean age was 15.96±4.73 years, including 1.200 male (mean age, 15.32±4.62) and 1.900 female (mean age, 16.35±4.76).
Indextest	Developmental stages of the mandibular third molar teeth were assessed according to the Demirjian et al. classification method. Digital orthopantomogram X-ray machine (Sirona, orthophos, Germany)
No of observers	Two observers The mineralization stages were evaluated by two radiologists, 1.600 cases by one radiologist and 1.500 cases by the other radiologist
Reference test	According to record
Outcome, results	Chronological mineralization age of 48/38
Comments	
Risk of bias	Moderate

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