HUMAN IDENTIFICATION

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Forensic sciences

HUMAN IDENTIFICATION

Definition:

- The determination of an individual, weather dead or alive, using certain physical characteristics
- relate a sample to:
  - Database
  - Single template
- It could be complete or partial

WHEN?

- Mass disasters
- Mass graves
- Homicides and suicides
- Absence of documents
- Unknown offender
- Criminal responsibility
- Identity theft

WHY?

- Human right
- For burial purposes
- Identification of offenders
- Insurance benefits to next of kin
- Age determination in criminal liability
- Interchange of newborn babies in hospitals

WHY?

- Personal identification
- Criminal identification
- Legal identification
- Civil identification

HUMAN IDENTIFICATION IN THE LIVING

By using:

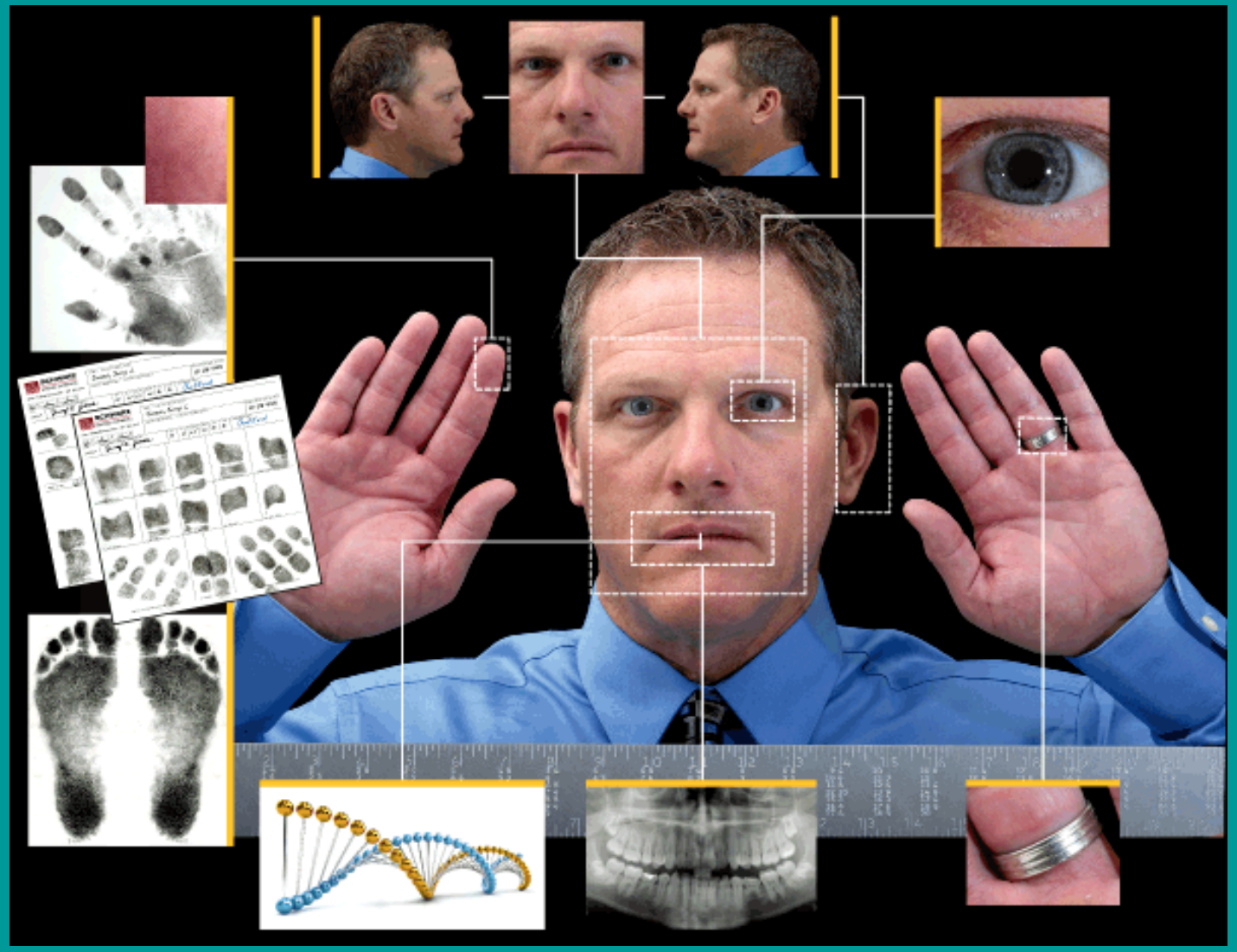
- Trace evidence
- Functions
- Age estimation

HUMAN IDENTIFICATION IN THE DEAD

The body may be:

- Fresh and intact
- Putrefying
- Mutilated or dismembered
- Charred
- Skeletonized

HOW?



HOW?

- Anthropomtry
- Descriptive
- Photographs
- Dactylograpghy “Fingerprints”

DACTYLOGRAPGHY

Definition:

It is the print of the patterns of epidermal ridges on finger tips on a surface

The method of identifying these prints is called *Dactyloscopy*

Characteristics:

- Unique to the individual
- The patterns remain unchanged throughout life

DACTYLOGRAPGHY

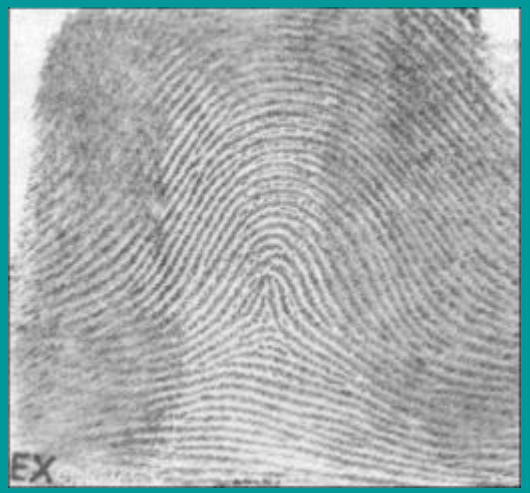
- Types of fingerprints:

Arch

Loop

Whorl

Tented arch



DACTYLOGRAPGHY

- When friction ridges come into contact with a surface that will take a print, material that is on the friction ridges such as the natural secretions of sweat from the eccrine glands, perspiration, oil, grease, ink or blood, will be transferred to the surface.

- Children's fingerprints are considerably more short-lived than adult fingerprints. The rapid disappearance of children's fingerprints was attributed to a lack of the more waxy oils that become present at the onset of puberty. The lighter fatty acids of children's fingerprints evaporate within a few hours

DACTYLOGRAPGHY

- Validity: the subjective nature of matching, despite a very low error rate, has made this forensic practice controversial

- Absence of fingerprints:
  - medical condition:
    - Adermatoglyphia
    - Some forms of ectodermal dysplasia
  - Medications:
    - The anti-cancer medication ”capecitabine”
    - Bee stings
- Age: the ridges get thicker; the height between the top of the ridge and the bottom of the furrow gets narrow, so there is less prominence
  - Mutilation:
    - Burning the fingertips, using acids
    - Plastic surgery

HOW?

- Anthropomtry
- Descriptive
- Photographs
- Dactylograpghy “Fingerprints”
- Hand prints

HAND PRINT

HOW?

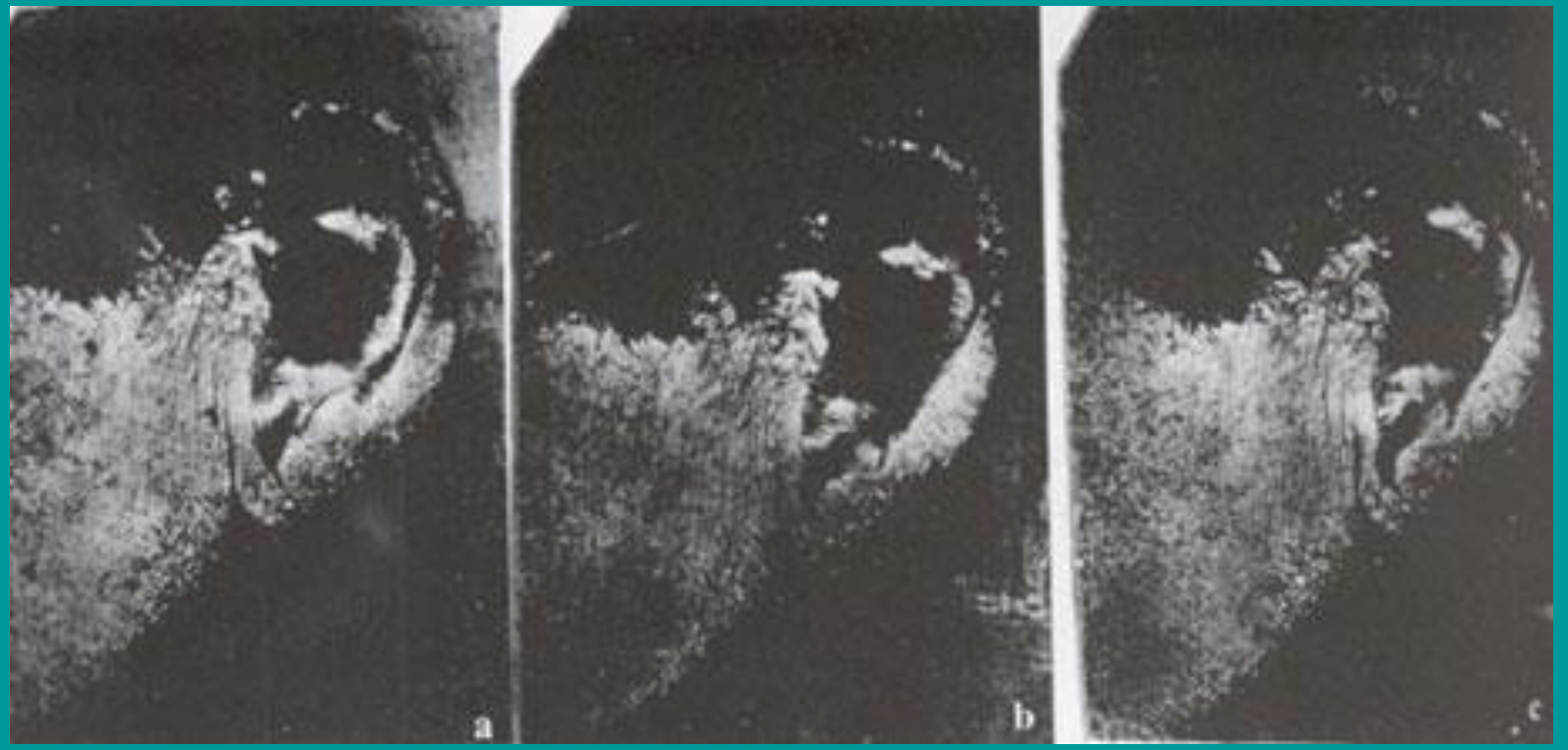
- Anthropomtry
- Descriptive
- Photographs
- Dactylograpghy “Fingerprints”
- Hand prints
- Foot prints

FOOT PRINT

HOW?

- Anthropomtry
- Descriptive
- Photographs
- Dactylograpghy “Fingerprints”
- Hand prints
- Foot prints
- Ear print

EAR PRINT



HOW?

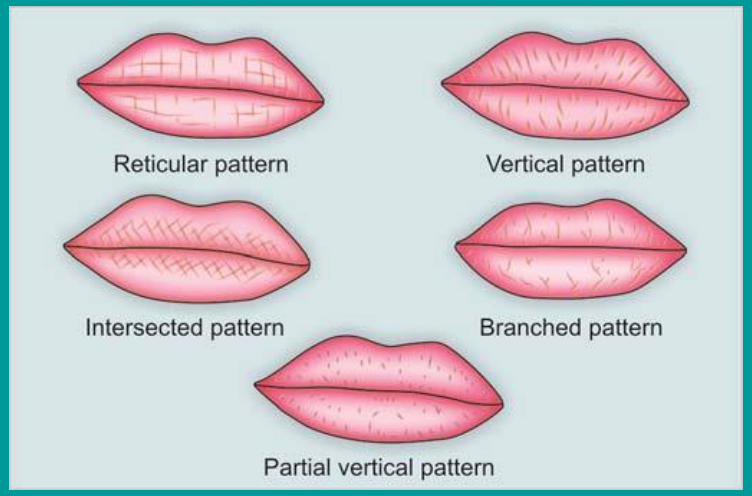
- Anthropomtry
- Descriptive
- Photographs
- Dactylograpghy “Fingerprints”
- Hand prints
- Foot prints
- Ear print
- Vein outline

VEIN OUTLINE

HOW?

- Anthropomtry
- Descriptive
- Photographs
- Dactylograpghy “Fingerprints”
- Hand prints
- Foot prints
- Ear print
- Vein outline
- Lip prints
- Bite marks

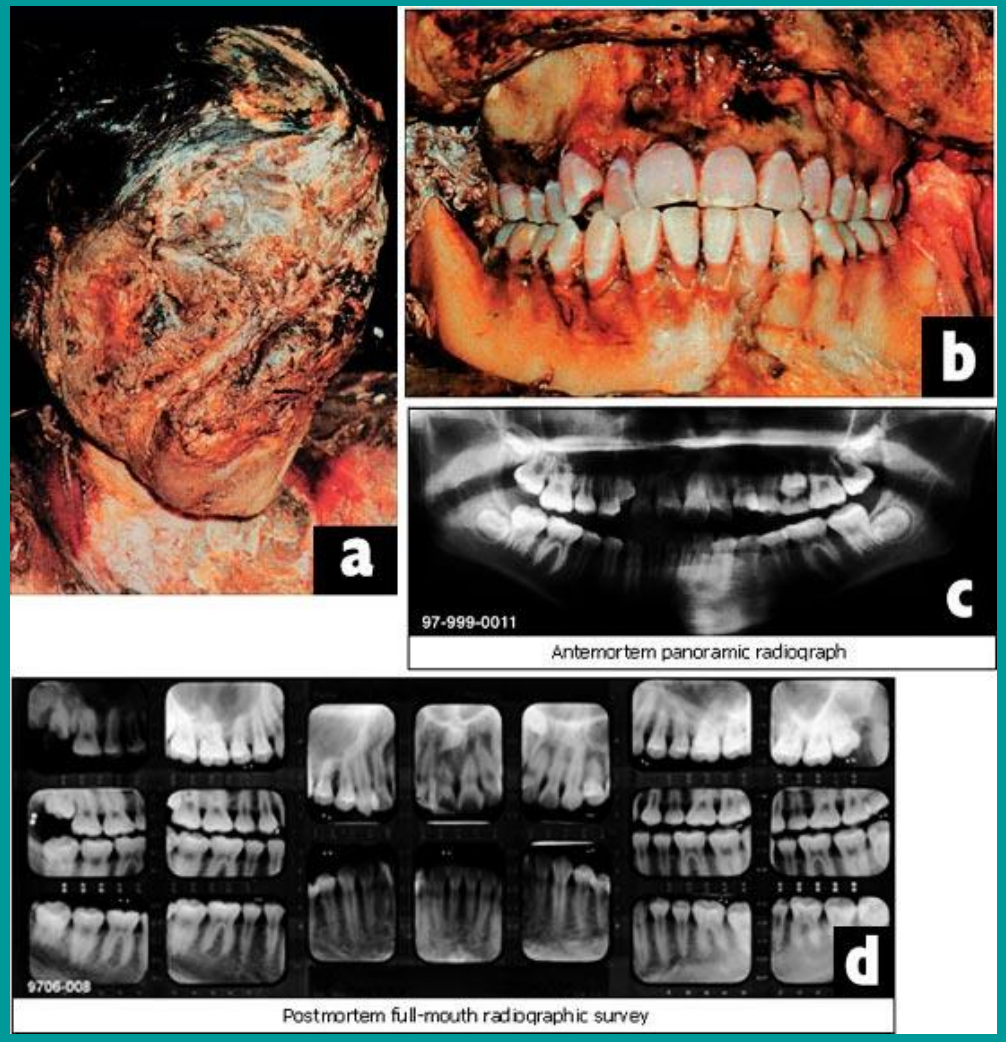
LIP PRINT AND BITE MARK



HOW?

- Anthropomtry
- Descriptive
- Photographs
- Dactylograpghy “Fingerprints”
- Hand prints
- Foot prints
- Ear print
- Vein outline
- Lip prints
- Bite marks
- Teeth

TEETH

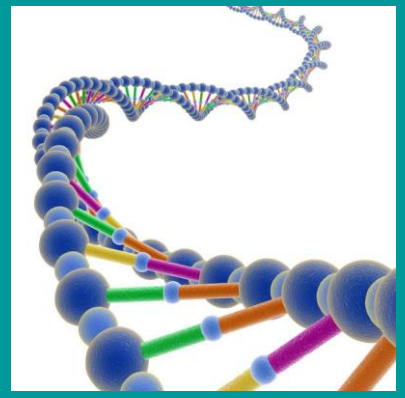

a
b
c
97-999-0011
Antemortem panoramic radiograph
d
9706-008
Postmortem full-mouth radiographic survey

HOW?

- Anthropomtry
- Descriptive
- Photographs
- Dactylograpghy “Fingerprints”
- Hand prints
- Foot prints
- Ear print
- Vein outline
- Lip prints
- Bite marks
- Teeth
- Voice recognition
- Gait
- Thermal print
- Iris recognition
- DNA

DNA

The molecule of DNA has two strands of sugar and phosphate molecules that are linked by combinations of four bases – adenine, thymine, cytosine and guanine – forming the double helix of DNA



Only about 10 per cent of the molecule is used for genetic coding (the active genes), the remainder being ‘silent’. In these silent zones, there are between 200 and 14 000 repeats of identical sequences of the four bases

DNA

The technique of determining the sequences is extremely complex, relying on cutting the DNA strands at predetermined points by the use of restriction enzymes. The fragments of DNA are separated using electrophoresis and the different fragments are then identified using a radioactive probe

From the presence of different bars in given positions, comparisons may be made with other samples, known or unknown – the classical forensic ‘comparison technique’

At least 2 identification markers should be noted by the doctor in all medico-legal cases

AGE ESTIMATION

Relate chronological age

To biological age

Using known specific maturating events

HOW TO ESTIMATE AGE

Select a feature of the developing individual that:

- Grows/matures over a long period of time
- Measurable stages
- Over a short period of time

Stable

Survives inhumation well

HOW TO ESTIMATE AGE

Stature/weight

Sexual maturation

Bone development

Dentition…

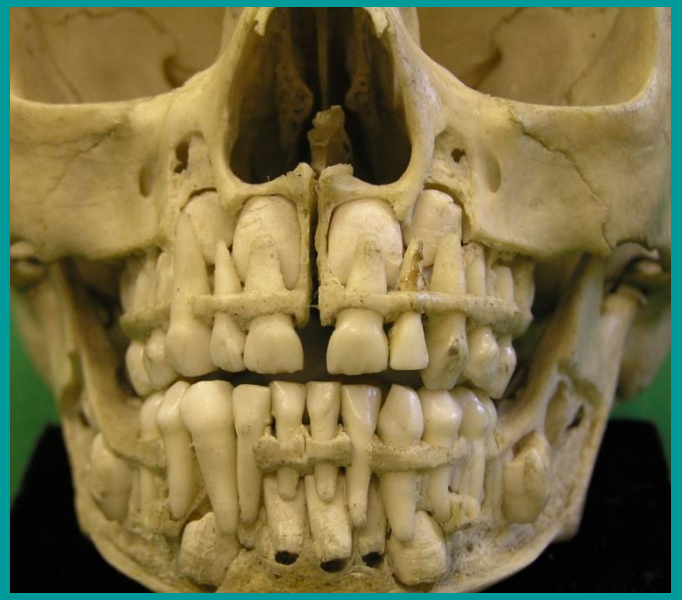
is the least influenced by environmental factors

and survives inhumation very well

DENTITION AND AGE

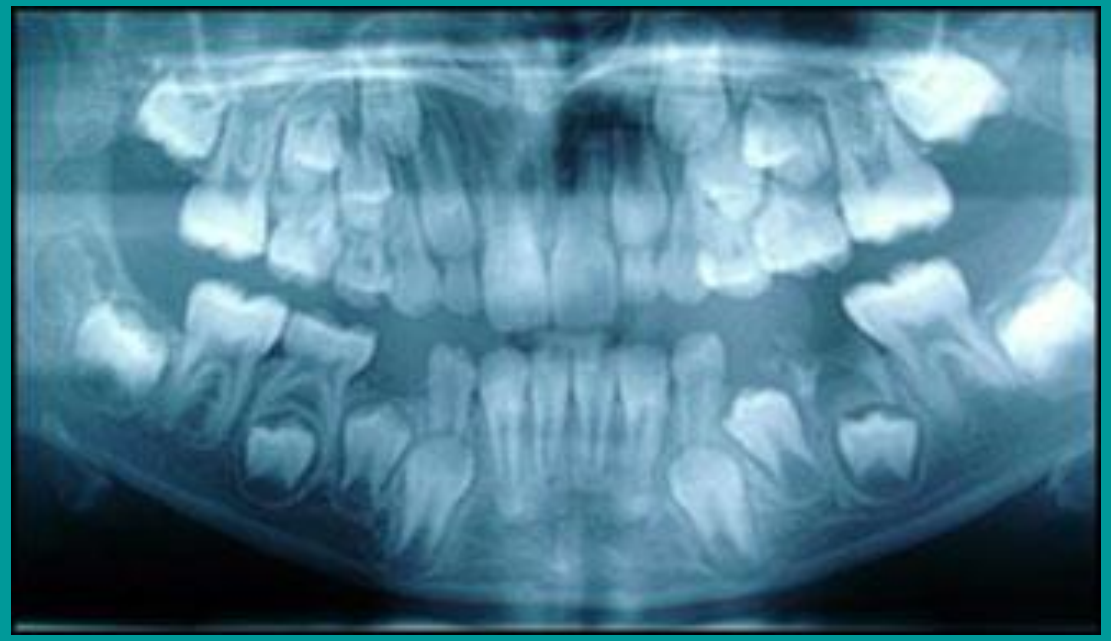
DENTITION AS AN ESTIMATE FOR AGE

- Deciduous/primary dentition
- Permanent dentition



TOOTH DEVELOPMENT

initial mineralization, crown completion, and completion of the root apex.



AIM OF MY RESEARCH

to develop a comprehensive evidence based atlas of tooth development and eruption for primary and permanent teeth from 28 weeks *in utero* through to maturity

THE DESIGN

Retrospective

Cross sectional study of:

- Known age-at-death skeletal remains (N 176)
- Radiographs of known age individuals (N 528)

Total 704

MATERIALS

Ages: 28 weeks *in utero* to less than 2 years (176 in total)

Maurice Stack's collection:
Hunterian Museum, Royal College of Surgeons of England

126 neonatal samples:

- 68 males
- 58 females

MATERIALS

Ages: 28 weeks *in utero* to less than 2 years (176 in total)

the Spitalfield's Collection:

Natural History Museum, London

50 infant remains:

- 15 males
- 31 females
- 4 unknown sex

MATERIALS

Ages: 2 years to 23 years (528 radiographs in total)

Archived

High quality dental panoramic radiographs:

each chronological year:

12 males

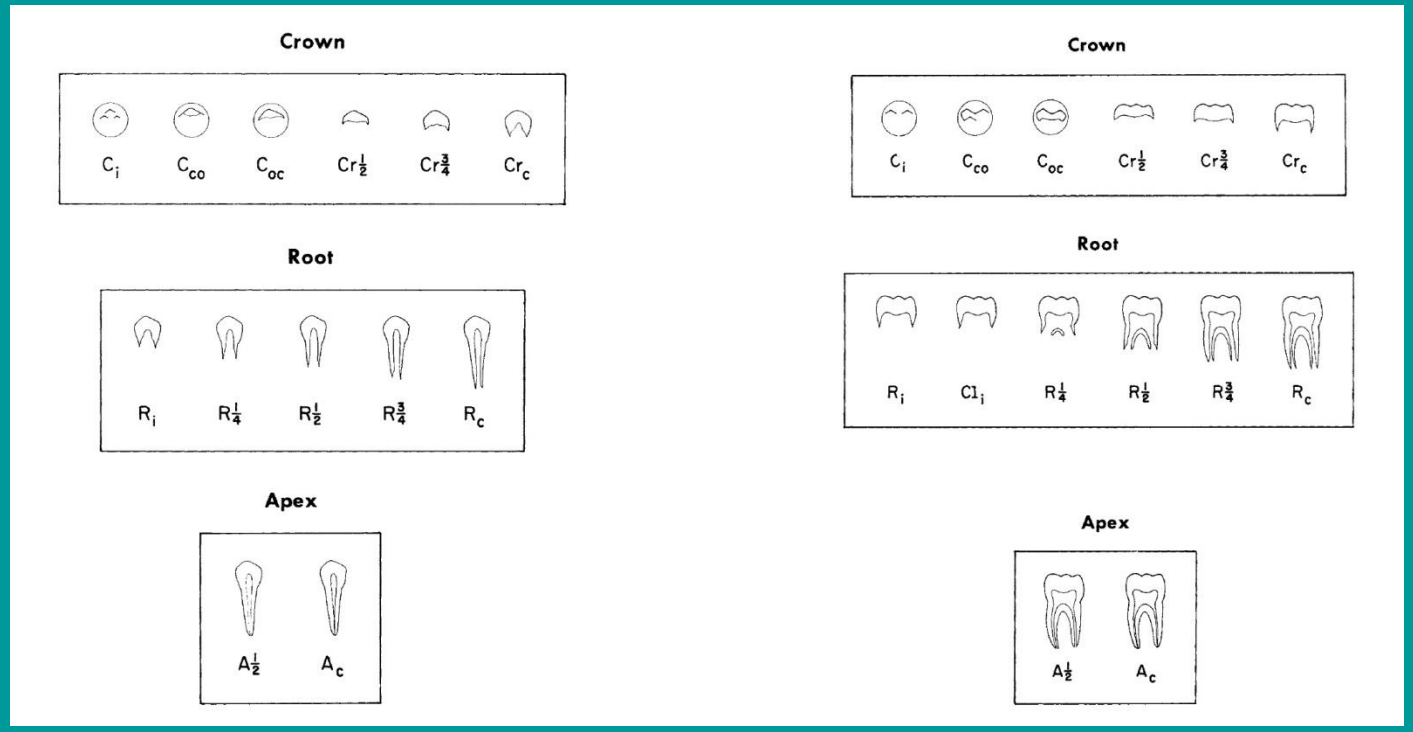
12 females

METHODS

Tooth development (crown and root):

Moorrees, Fanning and Hunt (1963).

Age Variation of Formation Stages for Ten Permanent Teeth. Journal of Dental Research 42: 1490–502



METHODS

Tooth eruption:

- Modified Bengston's stages

Relative to alveolar bone level

Data for each tooth in each age group for all 704 individuals were tabulated

DRAWINGS

Total
358 hand drawings

Computer finished illustration

Drawings

Ci: initial cusp formation

Cco: coalescence of cusps

Coc: cusp outline complete

Cr 1/2: crown half completed with dentine formation

Cr 3/4: crown three quarters complete

Crc: crown completed with defined pulp roof

Ri: initial root formation with diverge edges

R 1/4: root length less than crown length

R 1/2: root length equals crown length

R 3/4: root length more than crown length (three quarters of root length developed) with diverge ends

Rc: root length completed with parallel ends

A 1/2: apex closed (converge root ends) with wide PDL

Ac: apex closed with normal PDL width

METHODS

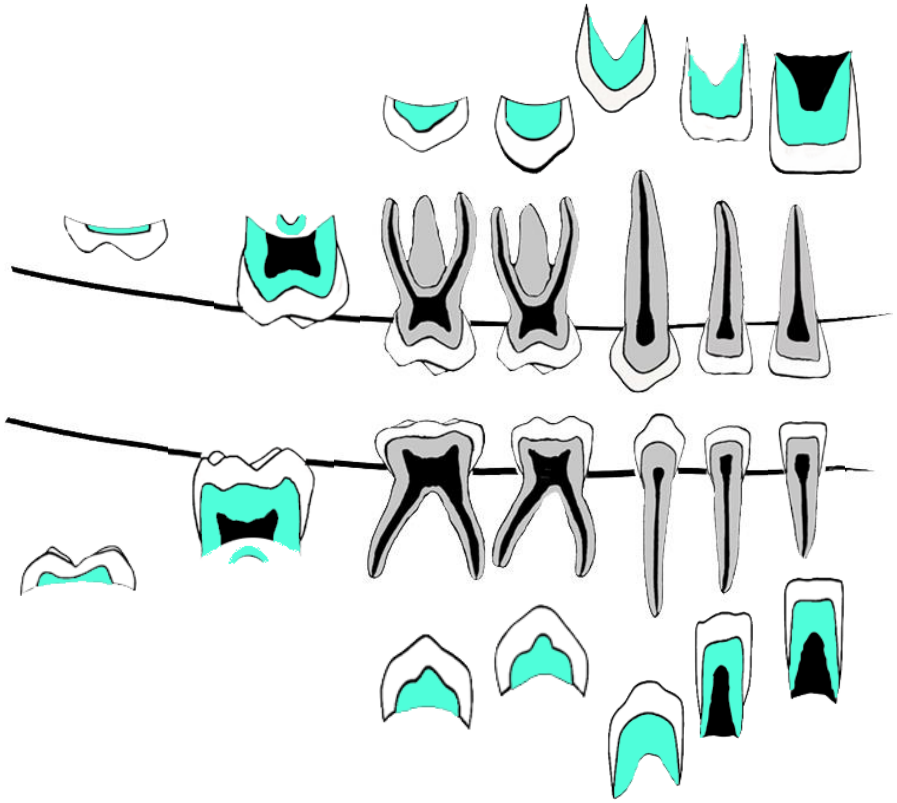
Data collection:

- Median identified for:
  - Each tooth stage in each age group

Intra observer error:

- staging was assessed twice at different occasions for:
  - 755 teeth (65 individuals)
  - (Kappa 0.85)

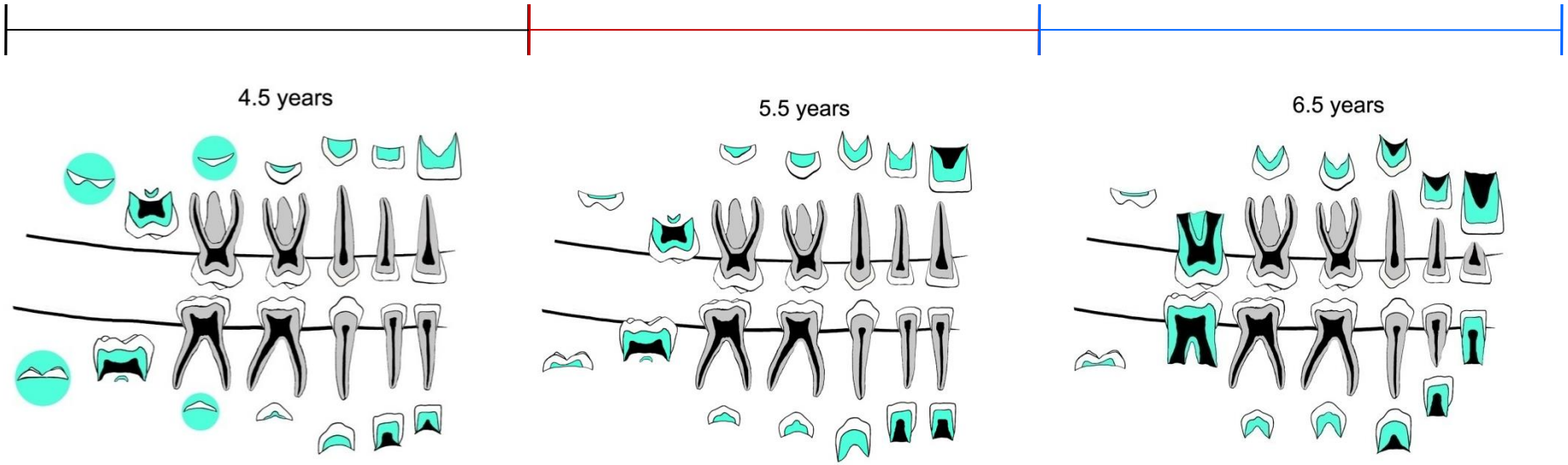
Diagrams

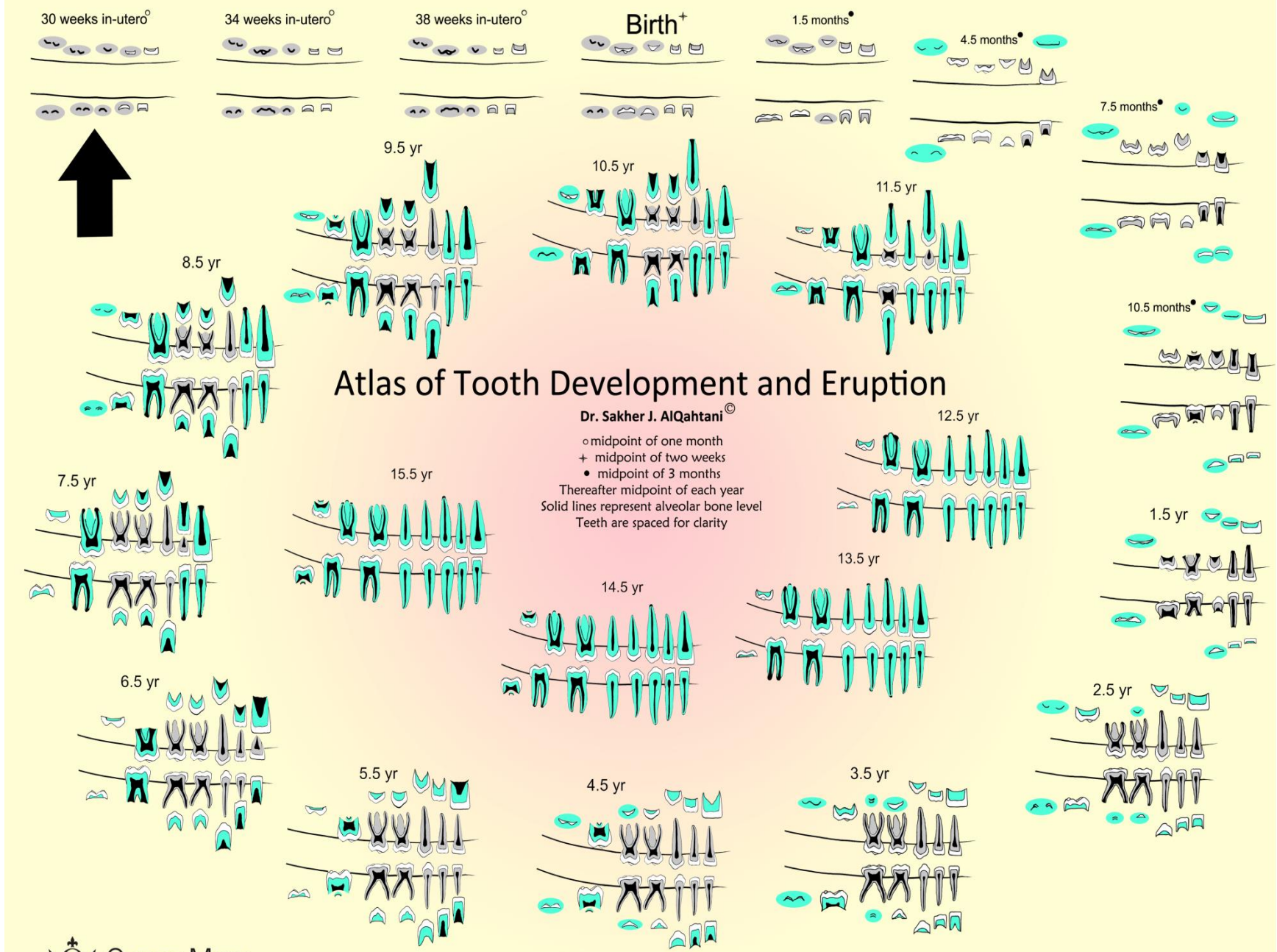


Median of 24 children

		A	B	C	D	E	1	2	3	4	5	6	7	8
	U	Ac	Ac	Ac	Ac	Ac	Ri	Crc	Crc	Cr ¾	Cr ½	R ¼	Cr ½	-
	L	Res ¼	Ac	Ac	Ac	Ac	R ¼	R ¼	Crc	Cr ¾	Cr ¾	R ¼	Cr ½	-
	U	4	4	4	4	4	1	1	1	1	1	2	1	-
	L	4	4	4	4	4	1	1	1	1	1	2	1	-

Diagrams





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The author would like to acknowledge the funding assistance of the Ministry of Higher Education, Saudi Arabia.

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Atlas of Tooth Development and Eruption

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Software app

Atlas of tooth development and eruption

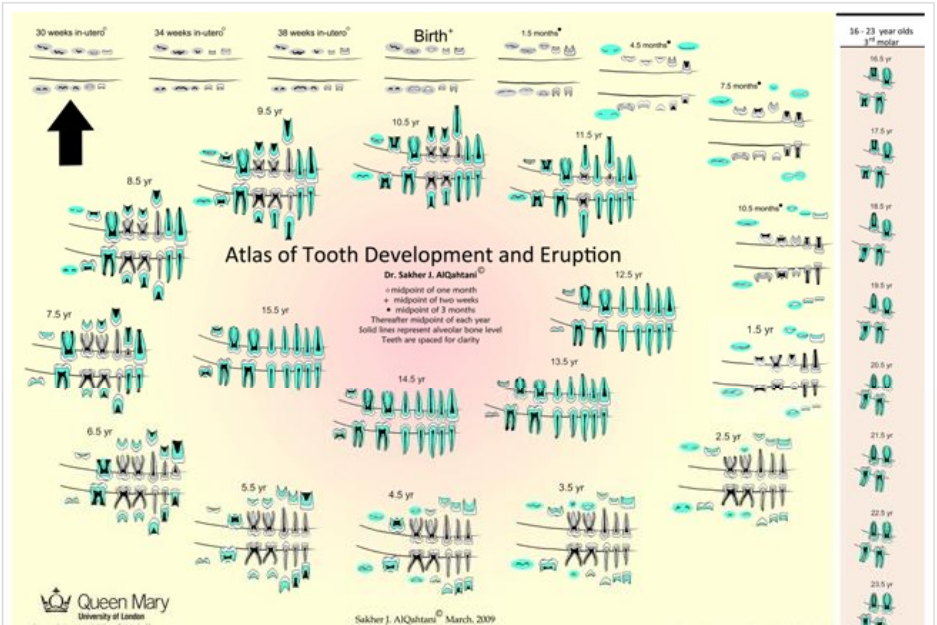
We have developed a comprehensive evidence based atlas to estimate age using both tooth development and alveolar eruption for individuals between 28 weeks in utero to 23 years; it shows a sequence of diagrams representing a continuum of developmental ages without gaps or overlaps [1].

Data was collected from developing teeth from 72 prenatal and 104 postnatal skeletal remains of known age-at-death were examined from collections held at the Royal College of Surgeons of England and the Natural History Museum, London, UK (M 91, F 72, unknown sex 13) [2,3]. Data were also collected from archived dental radiographs of living individuals (M 264, F 264) [4]. Median stage for tooth development and eruption for all age categories was used to construct the atlas. Tooth development was determined according to Moorrees, Fanning and Hunt [5,6] and eruption was assessed relative to the alveolar bone level [7,8] . Intra-examiner reproducibility was 0.85 calculated using Kappa on 755 teeth (65 individuals).

Diagrams were drawn to represent monthly dental development in the last trimester, 2 weeks around a full gestation (40 weeks) birth, quarterly development for the first year of life, and yearly development thereafter.

This atlas can be downloaded and used for teaching purposes or individual learning.

Electronic interactive software is now available to use for free



AMERICAN JOURNAL OF PHYSICAL ANTHROPOLOGY 142:481–490 (2010)

Brief Communication: The London Atlas of Human Tooth Development and Eruption

S.J. AlQahtani, M.P. Hector, and H.M. Liversidge*

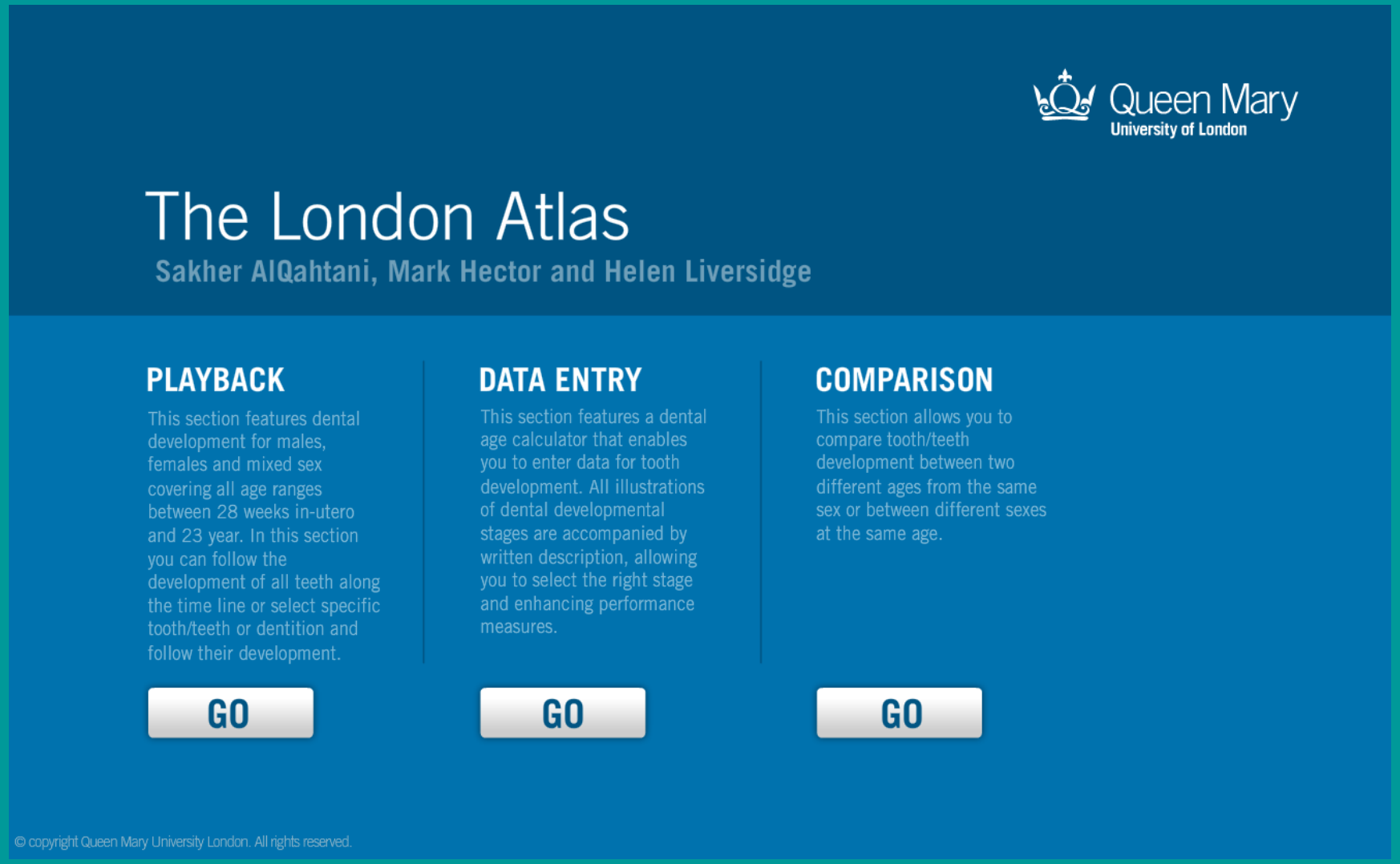
Institute of Dentistry, Barts and The London School of Medicine and Dentistry, Queen Mary University of London, London E1 2AD, UK

KEY WORDS dental; age; estimation; forensic; odontology

ABSTRACT The aim of this study was to develop a comprehensive evidence-based atlas to estimate age using both tooth development and alveolar eruption for human individuals between 28 weeks in utero and 23 years. This was a cross-sectional, retrospective study of archived material with the sample aged 2 years and older having a uniform age and sex distribution. Developing teeth from 72 prenatal and 104 postnatal skeletal remains of known age-at-death were examined from collections held at the Royal College of Surgeons of England and the Natural History Museum, London, UK (M 91, F 72, unknown sex 13). Data were also collected from dental radiographs of living individuals (M 264, F 264). Median stage for tooth development and eruption for all age categories was used to construct the atlas. Tooth development was determined according to Moorrees et al. (J Dent Res 42 (1963a) 490–502; Am J Phys Anthropol 21 (1963b) 205–213) and eruption was assessed relative to the alveolar bone level. Intraexaminer reproducibility calculated using Kappa on 150 teeth was 0.90 for 15 skeletal remains of age <2 years, and 0.81 from 605 teeth (50 radiographs). Age categories were monthly in the last trimester, 2 weeks perinatally, 3-month intervals during the first year, and at every year thereafter. Results show that tooth formation is least variable in infancy and most variable after the age of 16 years for the development of the third molar. Am J Phys Anthropol 142:481–490, 2010.

TAKING THINGS FORWARD

THE LONDON ATLAS SOFTWARE PROGRAM



Atlas of Tooth Development and Eruption

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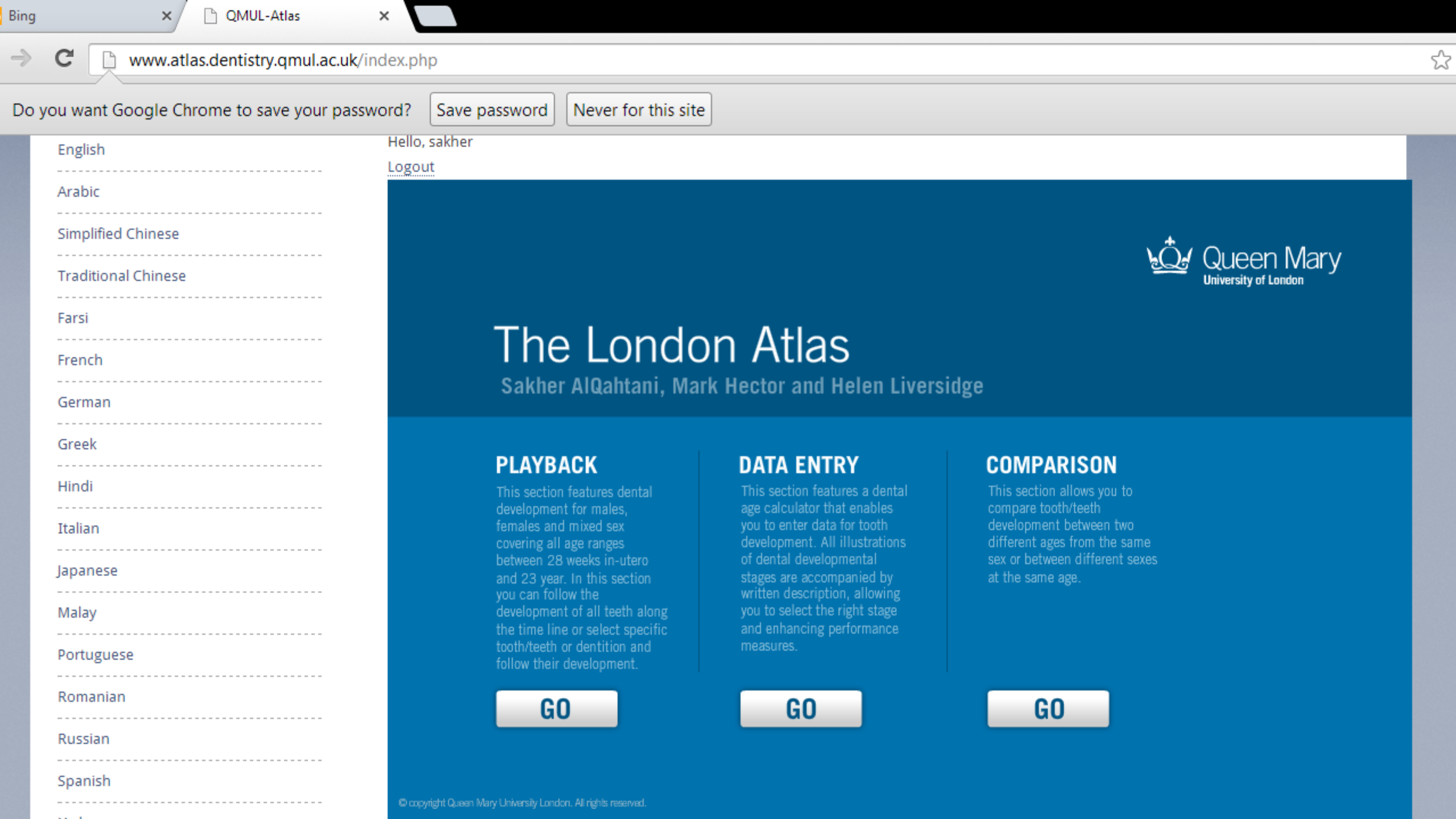
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The London Atlas
Sakher AlQahtani, Mark Hector and Helen Liversidge
PLAYBACK
This section features dental development for males, females and mixed sex covering all age ranges between 28 weeks in-utero and 23 year. In this section you can follow the development of all teeth along the time line or select specific tooth/teeth or dentition and follow their development.
GO
DATA ENTRY
This section features a dental age calculator that enables you to enter data for tooth development. All illustrations of dental developmental stages are accompanied by written description, allowing you to select the right stage and enhancing performance measures.
GO
COMPARISON
This section allows you to compare tooth/teeth development between two different ages from the same sex or between different sexes at the same age.
GO
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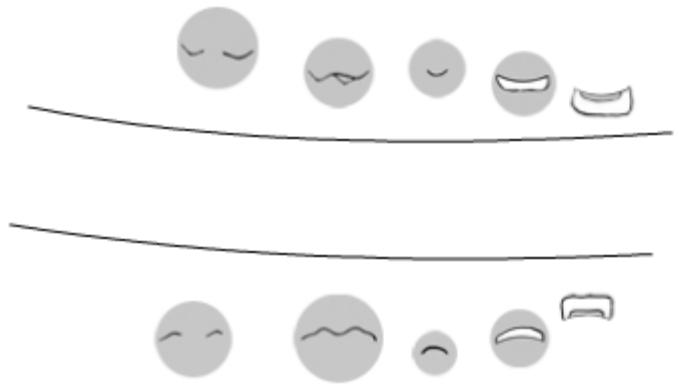
HOME | PLAYBACK MODE | DATA ENTRY MODE | COMPARISON MODE | QUIZ | FAQ | GUIDE | HELP

Male | Mixed | Female

38 Weeks (in-utero)
Birth
1.5 Months
4.5 Months
7.5 Months
10.5 Months
1.5 Years



Display Deciduous
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30 weeks

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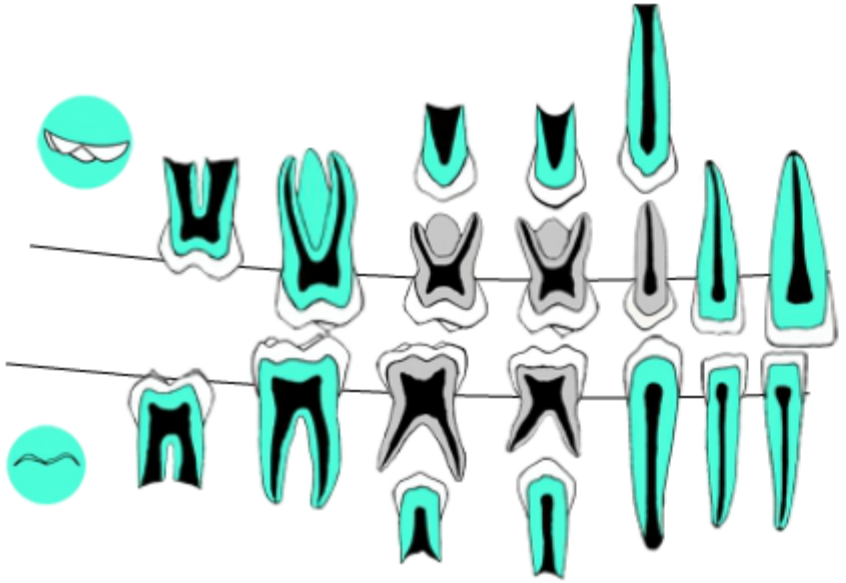
Male | Mixed | Female

7.5 Years
8.5 Years
9.5 Years
10.5 Years
11.5 Years
12.5 Years
13.5 Years



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10.5 Years

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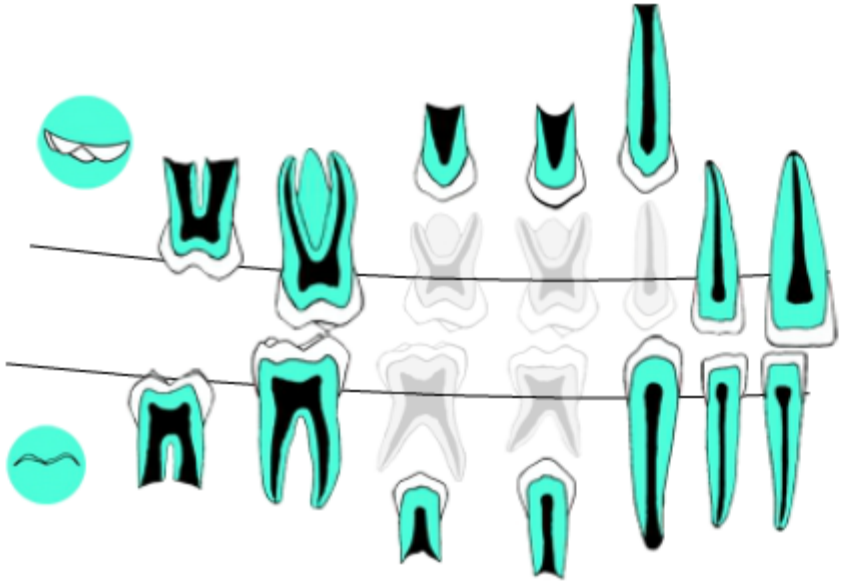

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10.5 Years

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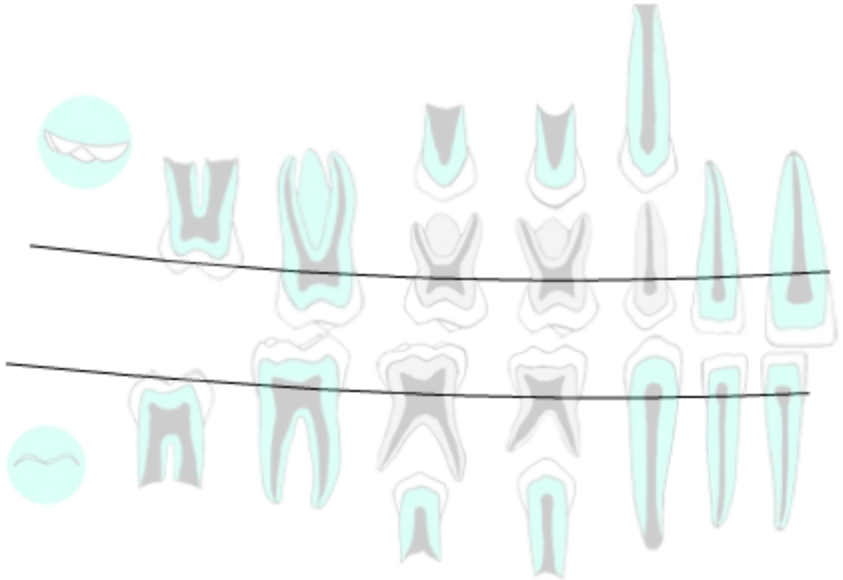

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10.5 Years

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Male | Mixed | Female

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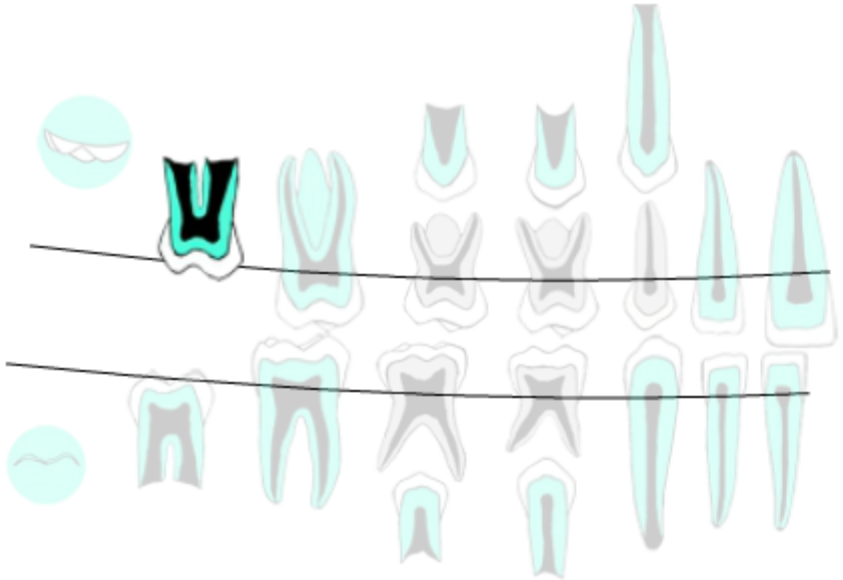
13.5 Years



Display Deciduous
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10.5 Years

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Male | Mixed | Female

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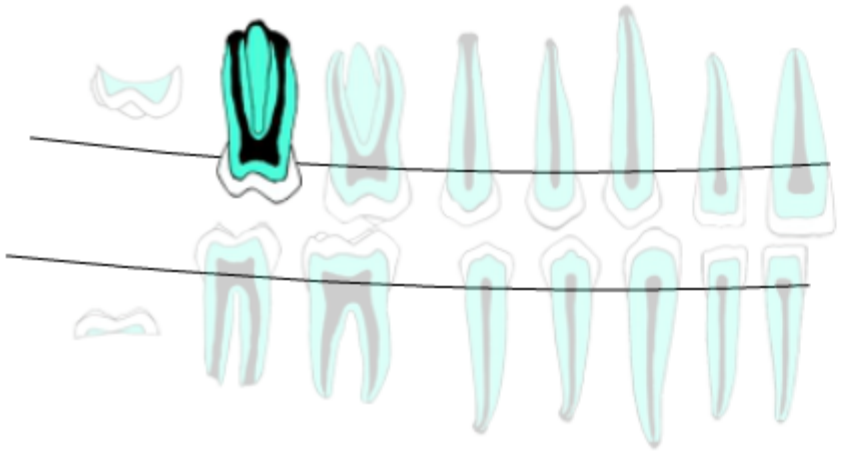
11.5 Years
12.5 Years
13.5 Years
14.5 Years
15.5 Years



Display Deciduous
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Display Bone

12.5 Years

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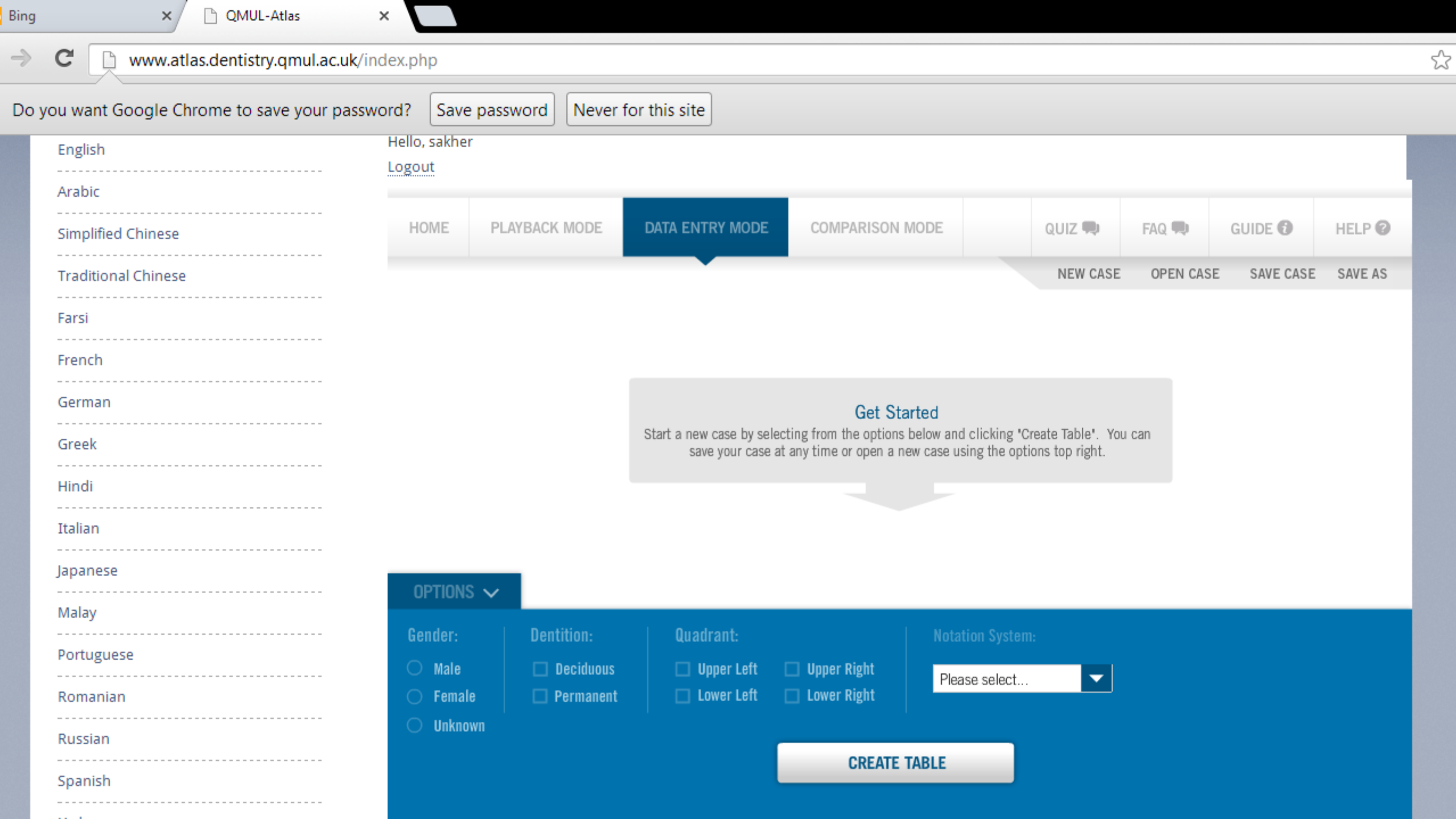
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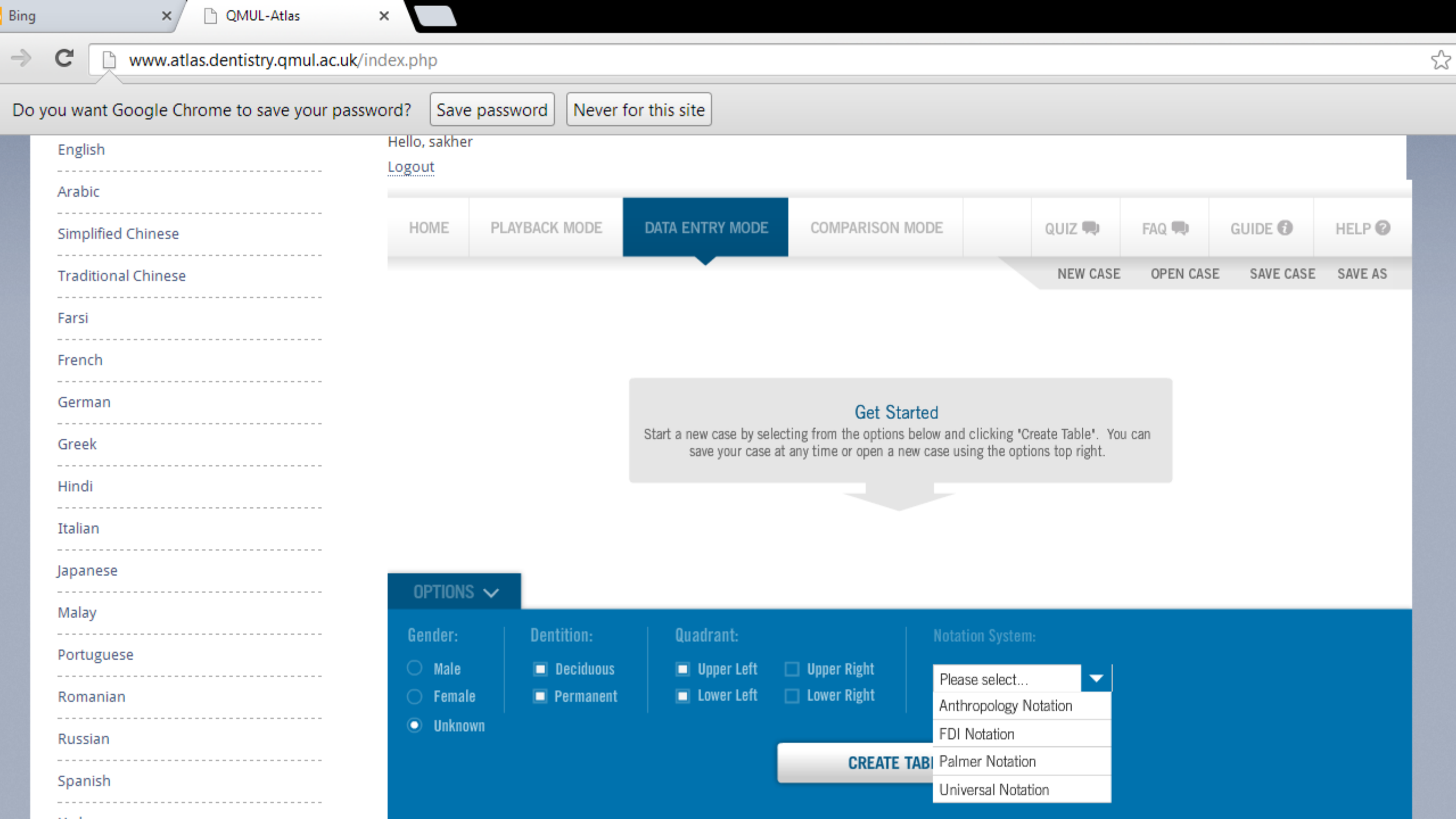
PLAYBACK MODE
DATA ENTRY MODE
COMPARISON MODE
QUIZ
FAQ
GUIDE
HELP
NEW CASE
OPEN CASE
SAVE CASE
SAVE AS
Get Started
Start a new case by selecting from the options below and clicking "Create Table". You can save your case at any time or open a new case using the options top right.
OPTIONS
Gender:
Male
Female
Unknown
Dentition:
Deciduous
Permanent
Quadrant:
Upper Left
Upper Right
Lower Left
Lower Right
Notation System:
Please select...
CREATE TABLE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Quadrant:
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Lower Left
Lower Right
Notation System:
Please select...
Anthropology Notation
FDI Notation
Palmer Notation
Universal Notation
CREATE TABL

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NEW CASE | OPEN CASE | SAVE CASE | SAVE AS

Unknown gender

No matches found

	Jaw	DECIDUOUS TEETH					PERMANENT TEETH							
Development	Upper Left	i1	i2	C'	m1	m2	I1	I2	C'	PM1	PM2	M1	M2	M3
	Lower Left	i1	i2	C,	m1	m2	I1	I2	C,	PM1	PM2	M1	M2	M3
Eruption	Upper Left	i1	i2	C'	m1	m2	I1	I2	C'	PM1	PM2	M1	M2	M3
	Lower Left	i1	i2	C,	m1	m2	I1	I2	C,	PM1	PM2	M1	M2	M3

ERASER TOOL | UNDO | CLEAR TABLE X

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Unknown gende

TOOTH SELECTOR CLOSE X

M1

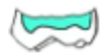
Multi Root

Ci: initial cusp formation

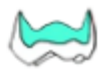
Cco: coalescence of cusps

Coc: cusp outline complete

Cr 1/2: crown half completed with dentine formation



Cr 3/4: crown three quarters complete



Crc: crown completed with defined pulp roof

Ri: initial root formation with diverge edges

R 1/4: root length less than crown length with furcation area visible.

R 1/2: root length equals crown length

R 3/4: root length more than crown length (three quarters of root length developed) with diverge ends

Rc: root length completed with parallel ends

A 1/2: apex closed (converge root ends) with wide PDL

Ac: apex closed with normal PDL width

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NEW CASE | OPEN CASE | SAVE CASE | SAVE AS

Unknown gender

1 close match

	Jaw	DECIDUOUS TEETH					PERMANENT TEETH							
Development	Upper Left	i1	i2	C'	m1	m2	I1	I2	C'	PM1	PM2	M1	M2	M3
												R 1/2		
	Lower Left	i1	i2	C,	m1	m2	I1	I2	C,	PM1	PM2	M1	M2	M3
Eruption	Upper Left	i1	i2	C'	m1	m2	I1	I2	C'	PM1	PM2	M1	M2	M3
	Lower Left	i1	i2	C,	m1	m2	I1	I2	C,	PM1	PM2	M1	M2	M3

6.5 Years

VIEW DIAGRAMS

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NEW CASE | OPEN CASE | SAVE CASE | SAVE AS

Unknown gender

1 close match

	Jaw	DECIDUOUS TEETH					PERMANENT TEETH							
Development	Upper Left	i1	i2	C'	m1	m2	I1	I2	C'	PM1	PM2	M1	M2	M3
												R 1/2		
	Lower Left	i1	i2	C,	m1	m2	I1	I2	C,	PM1	PM2	M1	M2	M3
Eruption	Upper Left	i1	i2	C'	m1	m2	I1	I2	C'	PM1	PM2	M1	M2	M3
	Lower Left	i1	i2	C,	m1	m2	I1	I2	C,	PM1	PM2	M1	M2	M3

6.5 Years

VIEW DIAGRAMS

ERASER TOOL | UNDO | CLEAR TABLE X

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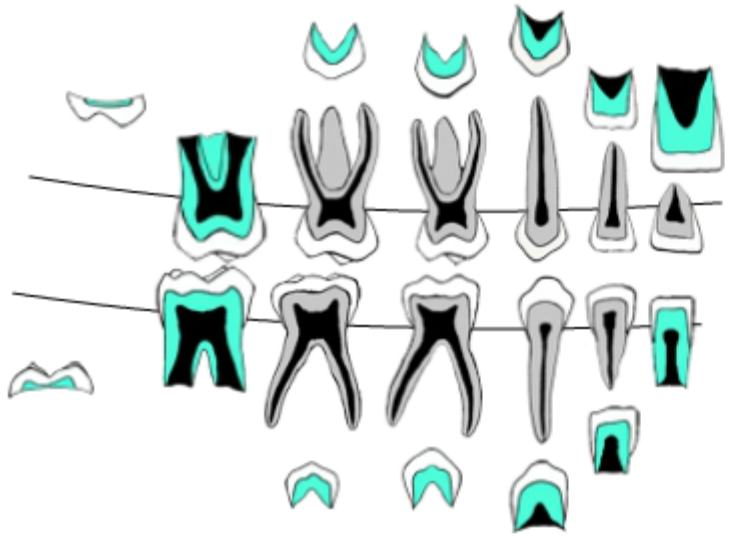
NEW CASE | OPEN CASE | SAVE CASE | SAVE AS

1 close match

6.5 Years



NEW WINDOW

CREATE REPORT

BACK TO DATA ENTRY

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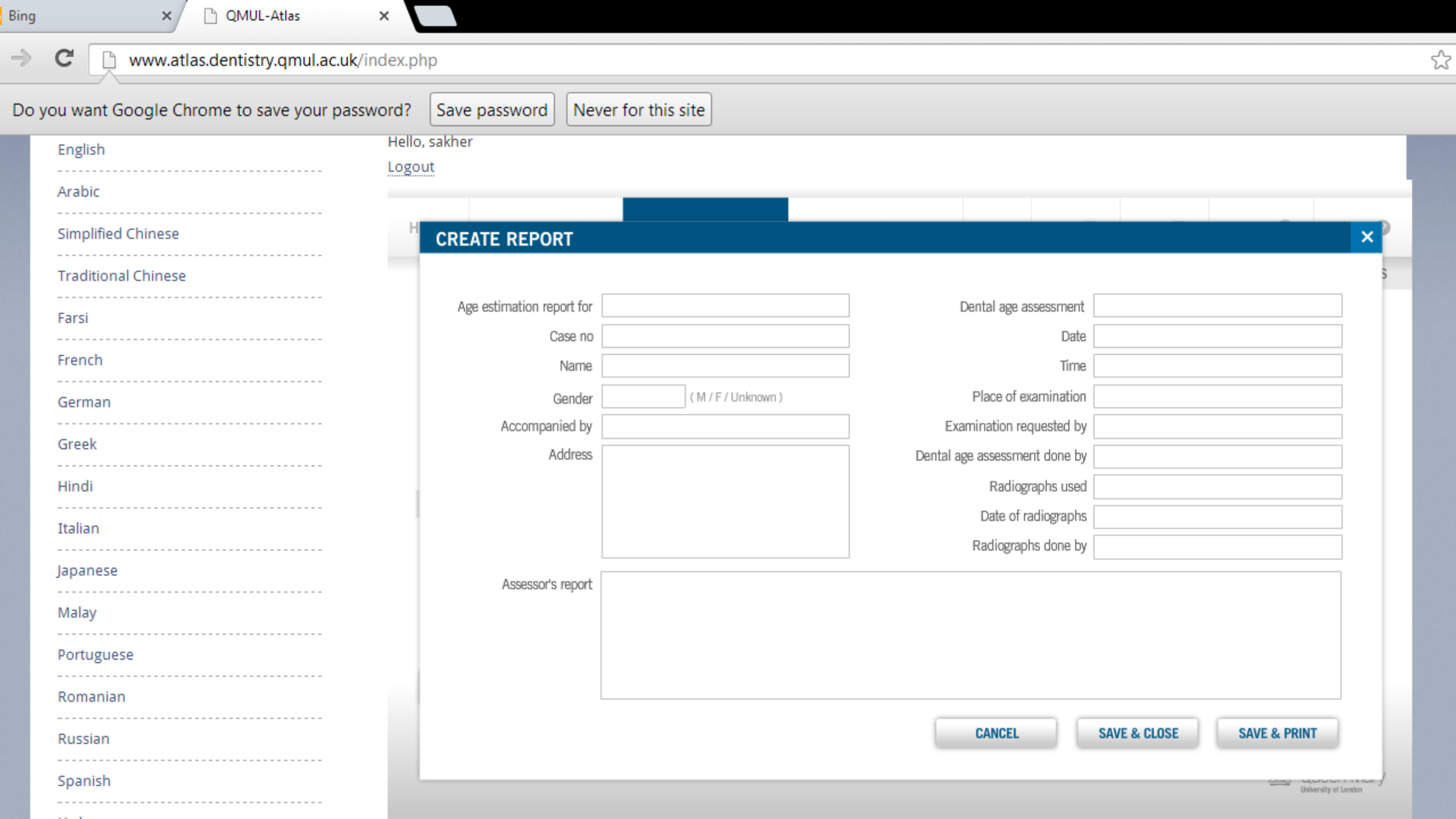
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CREATE REPORT
Age estimation report for
Case no
Name
Gender
(M / F / Unknown)
Accompanied by
Address
Dental age assessment
Date
Time
Place of examination
Examination requested by
Dental age assessment done by
Radiographs used
Date of radiographs
Radiographs done by
Assessor's report
CANCEL
SAVE & CLOSE
SAVE & PRINT

AGE ESTIMATION FROM BONES

- Foetus and young infant: Look at the appearance of ossification centers in growing cartilage (complete by 5 years)

- Child to young adult: Look at fusion of the epiphyses (secondary ossification centers (up to 25 years)

- Adult > 25 years: Look at wear and tear changes in teeth and bones.

FACIAL RECONSTRUCTION

Thank you for listening