

Using machine learning in the examination of dental X-rays to detect early tooth decay

Submission date 27/02/2020	Recruitment status No longer recruiting	<input type="checkbox"/> Prospectively registered <input type="checkbox"/> Protocol
Registration date 03/03/2020	Overall study status Completed	<input type="checkbox"/> Statistical analysis plan <input checked="" type="checkbox"/> Results
Last Edited 15/02/2021	Condition category Oral Health	<input type="checkbox"/> Individual participant data

Plain English summary of protocol

Background and study aims

The Manchester Imaging Limited software programme is designed to improve the detection rate of signs of dental disease from x-ray images and therefore diagnose dental diseases earlier than the current standard of care (visual detection by a General Dental Practitioner). This will empower patients to look after their teeth more effectively and potentially save money for the NHS by reducing the need for dental restorations and repairs.

The software will also provide a visual aid for the patient so that they know which of their teeth are under early dental decay or other types of dental disease. This could be more motivational for the patient than the dentist making general statements about frequent brushing and a sugar-free diet.

Previous research indicates that dentists are likely to miss early enamel tooth decay. The current standard care for early enamel decay is the application of fluoride in the form of high concentration toothpaste, varnishes and mouth rinse.

The software needs to be trained using digital images from the most common digital imaging systems used by dentists in the UK. It is thought that the more images that the software sees, the more accurate it will be at detecting dental disease.

The aim of this study is to provide data (in the form of anonymized digital images) by which the sponsor can improve the likelihood of the software programme working to a defined standard across the majority of commercially-available dental digital imaging systems in the UK.

Who can participate?

Patients over the age of 16 attending any of the participating centres where a dental x-ray would be taken as part of standard dental care

What does the study involve?

The study involves dental x-ray(s) images being taken. These will be anonymized for use in training the Manchester Imaging Limited software programme

What are the possible benefits and risks of participating?

There were no direct benefits to the study participants.

Bitewing radiographs (dental x-rays) are part of routine care. For participants taking part in this study, no extra bitewing radiographs will be taken. These procedures use ionizing radiation to form images of teeth and provide a dentist with other clinical information. Ionizing radiation can cause cell damage that may, after many years or decades, turn cancerous. As there is no additional ionizing radiation in this study compared to the normal standard of care, the chances of this happening are the same whether eligible participants take part in the study or not.

Where is the study run from?

9 dental practices in the Northwest of England

When is the study starting and how long is it expected to run for?

July 2018 to January 2020

Who is funding the study?

Manchester Imaging Limited (UK)

Who is the main contact?

Prof Hugh Devlin

hugh.devlin@manchester-imaging.com

Contact information

Type(s)

Scientific

Contact name

Prof Hugh Devlin

ORCID ID

<https://orcid.org/0000-0002-5120-747X>

Contact details

School of Medical Sciences
Faculty of Biology, Medicine & Health

The University of Manchester

Coupland III

Oxford Road

Manchester

United Kingdom

M13 9WL

+44 01612756849

hugh.devlin@manchester-imaging.com

Additional identifiers

Clinical Trials Information System (CTIS)

Nil known

Integrated Research Application System (IRAS)

248306

ClinicalTrials.gov (NCT)

Nil known

Protocol serial number

18/NI/0111, IRAS 248306

Study information

Scientific Title

Dental Digital Bitewing Radiograph Study: DDBRS

Acronym

DDBRS

Study objectives

The software uses machine learning to improve the detection of dental disease. The more images (anonymized digital bitewing radiographs (dental x-rays) from digital scanner systems commercially-available in the UK) that the software learns from, the better it becomes at detecting dental disease.

Ethics approval required

Old ethics approval format

Ethics approval(s)

Approved 12/06/2018, Office for Research Ethics Committees Northern Ireland (ORECNI) (Customer Care & Performance Directorate, Lissue Industrial Estate West, 5 Rathdown Walk, Moira Road, Lisburn, BT28 2RF; +44 028 9536 1400; www.orecni.hscni.net), ref: 18/NI/0111

Study design

Cross-sectional non-interventional study

Primary study design

Observational

Study type(s)

Diagnostic

Health condition(s) or problem(s) studied

Dental caries

Interventions

This study will collect anonymized digital bitewing radiographs from the patients of UK general dental practitioners (GDPs/dentists) as part of the normal standard of care to assist this learning process.

Participants were patients attending for their routine dental examination. No additional procedures or activities were carried in addition to the care normally provided to patients at that visit. There was no randomization of participants as there was no control arm to the study.

The Investigator/GDP obtained patient consent during the initial part of the dental consultation. A Patient Information Sheet was given, along with a Patient Consent Form. The potential participant had the opportunity to ask the GDP any questions. This is considered ideal as the GDP is also the Investigator at the study site so was well informed about the study.

An individual's capacity to consent was determined by their ability to:

- Understand what the taking of radiographs involves, its purpose and nature and why it is being proposed.
- Understand the benefits, risks and alternatives.
- Understand the consequences of not receiving the proposed treatment.
- Retain the information and be able to weigh up the pros and cons in order to arrive at a decision.
- Communicate the decision.

One copy of the Patient Consent Form was kept in the study file, one in the patient record and one handed to the patient. Potential participants were able to consider whether or not to take part in the study during their consultation. As the study involves normal standard of care, the decision whether or not to participate was given at any time during the potential participant's consultation.

Given the nature of the study, the timeframe from consent to the bitewing radiograph being entered into the study is negligible. It is therefore unnecessary to monitor ongoing capacity of the participant.

The patient's radiographs were then examined for dental disease by the dentists in the normal way and the findings communicated to the patient as part of their normal care. The GDP /Investigator uploaded images/DICOMs to a secure server; these images contain patient identifiable information (PII). Only the Investigator and 7i Group Ltd had access to these DICOMs. 7i Group will anonymize the images (remove any PII) and provide them to the Sponsor. Each image provided to the Sponsor was referenced by a unique ID number. 7i Group maintained a record that linked this unique identifier back to the study site, Investigator and patient. 7i Group destroyed all copies of DICOMs/digital images when the study finished. The Sponsor has kept the anonymized DICOMs.

Intervention Type

Not Specified

Primary outcome(s)

To receive the required number and required mix of digital images from the majority of manufacturers/models of commercially-available dental digital imaging systems in the UK

Key secondary outcome(s))

None

Completion date

17/01/2020

Eligibility

Key inclusion criteria

Study sites:

Use one of the dental digital imaging systems previously established as the most commonly used systems (in market research commissioned by the sponsor) at their dental practice.

Patients :

1. Bitewing radiograph clinically indicated as part of standard care
2. Informed consent to participation given

Participant type(s)

Health professional

Healthy volunteers allowed

No

Age group

Adult

Sex

All

Total final enrolment

1296

Key exclusion criteria

Patients:

Aged <16 years

Date of first enrolment

27/05/2018

Date of final enrolment

17/01/2020

Locations

Countries of recruitment

United Kingdom

England

Scotland

Study participating centre

King Dental & Associates

Council Buildings

Market Street
Carnforth
United Kingdom
LA5 9LB

Study participating centre
Hyde Dental Practice Ltd
203 Market Street
Hyde
United Kingdom
SK14 1HF

Study participating centre
New Mills Dental Practice
6 Union Road
New Mills
United Kingdom
SK22 3ES

Study participating centre
TSa Dental Care
5 Davies Road
West Bridgford
Nottingham
United Kingdom
NG2 5JE

Study participating centre
Inverurie Dental Care
22 North Street
Inverurie
United Kingdom
AB51 4QR

Study participating centre
Rudheath Dental Health Centre
144 Middlewich Rd.
Northwich
United Kingdom
CW9 7DS

Study participating centre
Aesthetics Dental Solutions
5 Station Square
Lytham
United Kingdom
FY8 5PA

Study participating centre
Gaskell Ave Dental
5 Gaskell Ave.
Knutsford
United Kingdom
WA16 ODA

Study participating centre
Brunner Court Dental
95 Witton St.
Northwich
United Kingdom
CW9 5DR

Sponsor information

Organisation
Manchester Imaging Ltd

Funder(s)

Funder type
Industry

Funder Name
Manchester Imaging Ltd

Results and Publications

Individual participant data (IPD) sharing plan

The datasets generated during and/or analysed during the current study are not expected to be made available due to the company wishing to maintain its commercial lead and development of intellectual property.

IPD sharing plan summary

Not expected to be made available

Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
HRA research summary			28/06/2023	No	No
Participant information sheet	Participant information sheet	11/11/2025	11/11/2025	No	Yes
Preprint results	non-peer-reviewed results in preprint	14/02/2021	15/02/2021	No	No