



OMFS
IMPATH

Yearbook 2022

TABLE OF CONTENTS

1. Preface	7
2. Team	13
A. Staff	19
B. Researchers	23
C. Visiting professors	39
D. Visiting researchers	43
E. Administrative coordinator	55
3. Research	57
A. Projects	59
B. Awards	61
C. Publications	63
- International peer-reviewed publications	63
- Book (chapter) publications	72
- Other publications	73
D. Chairs	75
E. Doctoral thesis defenses	77
4. Lecturing	83
A. Scientific contributions at congresses	85
- Oral presentations	85
- Poster presentations	91
B. Invited lectures	109
5. 3D lab	115
A. Team	119
B. Projects	123
C. Publications	125
- International peer-reviewed publications	125
- Book (chapter) publications	128

1

Preface

OMFS-IMPACT research group has been established in 2013. It is a multidisciplinary research group with core activities in imaging and 3D applications in OMFS and in dentistry, in orthognathic surgery and in trigeminal nerve pathology.

We have seen our research group steadily growing and advancing, leading to an increased research output and a leading international role in the field. The actual PhD portfolio contains 39 PhDs defended and 21 PhDs ongoing. No less than 50 multidisciplinary research team members contribute to the output of the group: 4 engineers, 12 maxillofacial surgeons, 3 biomedical researchers, 1 orthodontist, 1 endodontist, 1 periodontist, 2 paediatric dentists, 5 dentomaxillofacial radiologists, 3 restorative dentists, 15 specialized dentists and 1 administrative coordinator.

Survival depends on funding: 7 research chairs whereof 3 with a 6-years duration are an essential part to allow a break-even balance sheet. In total the group has published over 800 manuscripts in peer reviewed international journals. There are several critical success factors allowing for this output.

The physical proximity of the research group to the clinical maxillofacial imaging centre and maxillofacial surgical department, including the 3D-facility is mandatory to allow for continuous interaction and implementation of translational research into daily clinical practice. If projects fail, it is either on funding, either on administrative, regulatory or legal hurdles, which increasingly mark the European culture of research. Once these obstacles are surmounted, the researchers enter an environment in which high quality material offerings are available, together with opportunities to develop and grow. Professor Jacobs adds to this an energizing culture of appreciation and being valued for who our members are, nurturing warm social relationships and camaraderie and establishing a sense of mutual accountability at the same time as the necessary individual performance. Each researcher understands how his/her part of research fits into a broader picture. This allows every member of the team to be part of a meaningful story, usually at a critical phase in their life.

Numerous international team members reach top positions at their university, strengthening this feeling of meaning and purpose. Human capital remains a university's strength, both short term and long term. International exchange of human capital in all directions based on trust between nations is a foundation for progress and development.



2

Team

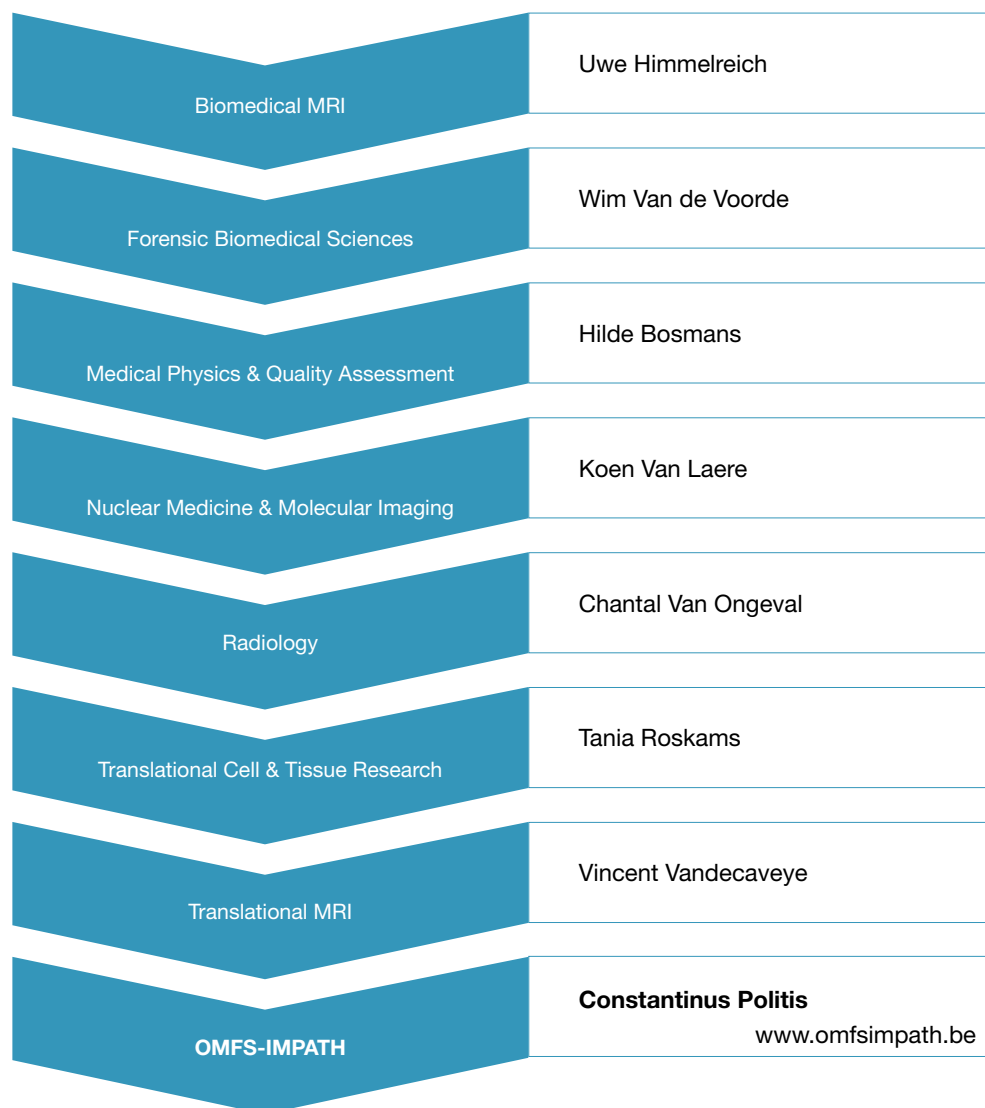
- A. STAFF
- B. RESEARCHERS
- C. VISITING PROFESSORS
- D. VISITING RESEARCHERS
- E. ADMINISTRATIVE COORDINATOR

The OMFS-IMPACT research group is an international multidisciplinary team of 50 MSc, PhD and postdoctoral researchers and clinicians. The multidisciplinary team is composed of maxillofacial surgeons, paediatric dentists, orthodontists, dentomaxillofacial radiologists, endodontists, biomedical scientists, and engineers. Research is ultimately aimed to develop and validate surgical tools and image-based solutions to advance in oromaxillofacial surgery, as such to strive for an optimized treatment outcome while minimizing peri- and postsurgical risks.

The team produces high quality research output, with more than 100 publications with over 100 citations each. The total amount of citations is 20 000 and the average impact factor for articles published in the 5 highest ranked journals is above 20. In 2022, 5 PhD students successfully defended their thesis.

For updates on research of the omfsimpath team, see www.omfsimpath.be.

DEPARTMENT OF IMAGING & PATHOLOGY - HEAD: PROF. TANIA ROSKAMS



Tania ROSKAMS



Tania Roskams obtained her medical degree in 1989 at the University of Leuven. She specialized in Pathology (University of Leuven) and obtained her PhD in liver pathology in Leuven and Oklahoma University, USA. In 1996 she became head of the Liver Research Unit, in 2002 of the Research group Translational Research and Pathology and in 2015 Head of the Department of Imaging & Pathology. She was nominated Professor in pathology in 2002. From 2007-2009 she was visiting professor at the University of Utrecht. In the clinical department she is responsible for hepatobiliary, pancreas and gastrointestinal pathology. Her main interest is liver research with special emphasis on liver progenitor cells and their role in regeneration and carcinogenesis.

Peter VERMAELEN



Peter Vermaelen obtained his degree in Medical Laboratory Technology in 1994 and gained experience in different clinical and research topics. In 2000, he joined the pre-clinical unit of the Nuclear Medicine & Molecular Imaging research group and was co-founder of the Molecular Small Animal Imaging Center (MoSAIC). Since 2012, he is as department manager responsible for the financial and personnel administration of the Department of Imaging & Pathology.

A. STAFF

Constantinus POLITIS

Constantinus Politis is Oral and Maxillofacial Surgeon. He is currently Full Professor and Chairperson of the Department of Oral and Maxillofacial Surgery at Leuven University Hospitals, KULeuven, Belgium. He is an invited Lecturer at the EHSAL in Brussels. He graduated at the Catholic University of Leuven in medicine (MD, summa cum laude), in dentistry (DDS, magna cum laude). He specialized in oral and maxillofacial surgery at the Catholic University of Leuven. Postgraduate training was additionally followed in Arnhem (Stoelinga), Aachen (Koberg), Copenhagen (Pindborg), Göteborg (Bränemark) and San Francisco (Marx). He holds an honorary professorship at the Fourth Medical Military University of Xi'an, China. He also holds a master degree in management (MM) from the Applied Economic Sciences at the University of Hasselt and a master degree in Hospital Management (MHM) from the Catholic University of Leuven. He became a recognition as medical specialist in management of health care data and is now member of the National Council of Hospital Facilities. He is Vice-President of the Professional Union of Belgian Oral and Maxillofacial Surgeons. He is President of the Belgian Royal Scientific Society of Oral and Maxillofacial Surgery. He is acknowledged trainer of OMFS trainees. He defended his doctor's thesis on the subject of complications of orthognathic surgery (PhD). His professional field of interest is in orthognathic and orthodontic surgery and trigeminal nerve dysfunction. Clinical research projects include prevention and repair of iatrogenic trigeminal nerve injury, transplantation of teeth and orthognathic surgery. He has been granted membership of the Belgian Royal Academy of Medicine.
Researchgate: https://www.researchgate.net/profile/Constantinus_Politis2

Reinhilde JACOBS

Reinhilde Jacobs is dentist, Doctor in Dental Sciences (PhD University of Leuven), periodontologist (KU Leuven) and Master in Dental Radiology (University of London). She is full professor at the University of Leuven and visiting professor at Karolinska Institutet, Stockholm, Sweden and the Dalian Medical University in China. R. Jacobs is heading the omfs impath research group of the KU Leuven (omfsimpath.be) and the clinical center of dentomaxillofacial radiology (UZleuven). She is Secretary General of the International Association of DentoMaxilloFacial Radiology. She is section editor of 5 journals (Journal of Dentistry, Clinical Oral Investigations, International Journal of Oral Implantology, European Journal of Radiology and Oral Radiology). She has received the D

Collen Research Travel Award (1994), a postdoctoral fellowship of the European Commission (1994-95), the IADR Young Investigators Award (1998) and the Belgian Joachim Award in Odontostomatology (1999). In 2013, she received a Dr Honoris Causa at the "Iuliu Hatieganu" University of Medicine and Pharmacy in Cluj-Napoca. She is involved in many multidisciplinary and interuniversity research collaborations, with a specific focus on imaging research, artificial intelligence and bioprinting. She has been actively participating in 5 European projects and is (co-)author of 5 books and more than 560 publications in peer-reviewed journals besides multiple invited lectures and publications in other journals or books. Scopus (2023): h:74

Michel BILA

Michel Bila is a maxillofacial surgeon and researcher in the University Hospital of Leuven since 2016. He is currently a faculty member at the University Hospitals Leuven where he specializes in the treatment of oral cancer and reconstruction. With a passion for advancing the field, Dr. Bila is pursuing a PhD in neoadjuvant immunotherapy. His expertise in the field is evidenced by his teaching and research activities, which are focused on improving outcomes for patients with head and neck cancer. He received his medical degree from the University of Antwerp in 2009 with a master's thesis on retinal straylight before and after implementation of the bag in the lens IOL. He received his dental degree from the Catholic University of Leuven in 2012. During his residency, he was fortunate to have the

opportunity to train at a number of prestigious institutions, including the University of Leuven in Belgium, University of Antwerp in Belgium and UCLH in London UK.

Ruxandra Gabriela COROPCIUC

Ruxandra Gabriela Coropciuc graduated as double qualified (MD, DDS) Oral and Maxillofacial Surgeon from the University of Medicine and Pharmacy Carol Davila, Bucharest in 2013. She was trained in the Clinical Hospital of Oral and Maxillofacial Surgery, Bucharest and at Leuven University Hospitals. She joined the Department of Maxillofacial Surgery at the UZ Leuven Belgium in 2013. Her PhD research is focused on bisphosphonate-related osteonecrosis of the jaw bone. Her clinical field of interest is in oral implantology, salivary gland pathology and head and neck oncology and reconstruction. Being multilingually talented with backgrounds in Canada, Romania and Belgium allow her to easily address patients in Dutch, English, French or Romanian.

Jan MEEUS

Jan Meeus obtained his dental and his medical degree at KU Leuven in 2011 and 2016 respectively. Ever since he graduated, he started working in a private practice, where he focuses on implant placement. Besides this, he further specialised to become an Oral and Maxillofacial Surgeon. He has been working as a surgeon at the University Hospital in Leuven, as well as in the Hospital ZOL in Genk. Currently, he is Clinical Staff Member at UZ Leuven in Oral and Maxillofacial Surgery. In his clinical work, he focuses on special dental implants with bone grafting in upper and lower jaws, oral implants, implantology, poor prosthetic fit due to jawbone problems, dento-alveolar surgery, and preprosthetic surgery.

Robin WILLAERT

Prof. Dr. Robin Willaert finished his medical and dental studies at the Faculty of Medicine in Leuven University with the highest distinction. He successfully obtained his Board Certification in Oral and Maxillofacial Surgery in 2018. He is Clinical Staff Member in Oral and Maxillofacial Surgery at UZ Leuven since 2020. His clinical focus is Head and Neck Oncology and maxillofacial reconstruction using 3D technology. His PhD research covered orbital imaging and reconstruction surgery and was successfully defended in January 2021. He further specialized in Head and Neck Oncology in different centres in Australia, Scotland, South-Africa and different Asian Centres. In 2022, he was appointed as Professor at the Department of Imaging and Pathology at the Faculty of Medicine, KU Leuven.

B. RESEARCHERS

Khalid Ayidh ALQAHTANI

Khalid Ayidh Alqahtani was born on 21 August, 1992. He achieved his Bachelor of Dental Surgery (BDS) degree from Prince Sattam Bin Abdulaziz University, Al-Kharj, Saudi Arabia in the year 2016. He worked as a demonstrator in the department of Oral and Maxillofacial Radiology at Prince Sattam Bin Abdulaziz University from the year 2016 to 2018. Currently, he is a postgraduate student in the field of Advanced Medical Imaging and a PhD candidate under the supervision of Prof. Reinhilde Jacobs at the OMFS-IMPATh Research Group, KU Leuven. His main focus of research involves three-dimensional assessment of root resorption in orthognathic surgery.

Oliver DA COSTA SENIOR

Oliver da Costa Senior is a PhD candidate at the OMFS-IMPATh research group at the University of Leuven under promotorship of Prof. dr. Constantinus Politis, Prof. dr. Reinhilde Jacobs and Dr. Ir. Eman Shaheen. He graduated at the Catholic University of Leuven in Medicine in June 2018. Currently, he is an Oral and Maxillofacial trainee at the department of Oral and Maxillofacial Surgery at the University Hospitals of Leuven. His research is focused on the three-dimensional planning, follow-up and complications of orthognathic surgery with special interest in Segmental Maxillary Osteotomy and Surgical Assisted Rapid Palatal Expansion (SARPE).

Karla DE FARIA VASCONCELOS

Karla de Faria Vasconcelos is dentist (2006), Doctor in Dental Radiology (2015; PhD at State University of Campinas - Brazil, with one year of external internship at KU Leuven - Belgium), Master in Dentistry (2010; Federal University of Goiás - Brazil) and Specialist in Oral Radiology (2012; University of Campinas). She has worked as Radiologist, in private radiology clinics, and as a Collaborator Professor of Graduate Program of Dentistry from the Federal University of Goiás at the Discipline of "Imaging Diagnostic". She performed postdoctoral research at Dental Radiology Department, Piracicaba, Brazil (Prof. dr. Francisco Haiter-Neto) and OMFS-IMPACT research group, Leuven, Belgium (Prof. dr. Reinhilde Jacobs), with a FAPESP fellowship (2015-2017). In 2018 she obtained the diploma of Postgraduate Studies in Advanced Medical Imaging at KU Leuven, Leuven, Belgium. Until the beginning of 2022, she worked as postdoctoral researcher in the OMFS-IMPACT Research Group, under the supervision of Prof. dr. Reinhilde Jacobs and Prof. dr. Politis Constantinus. She has been involved in interuniversity research collaborations, with a specific focus on digital radiography, cone beam computed tomography, micro and nano-CT.

Kathia DUBRON

Kathia Dubron is a PhD candidate at the OMFS-IMPACT-research group at the University of Leuven under promotorship of Prof. dr. R. Willaert, Prof. dr. Constantinus Politis, Prof. dr. Reinhilde Jacobs and Dr. Ir. Eman Shaheen. She received her Medical Degree (MD) in 2017 and master's degree in Management (MM) in 2019 from the Catholic University of Leuven. Currently, she is an Oral and Maxillofacial surgery trainee at the University Hospitals of Leuven. Her research is focused on virtual planning of zygomatico-orbital complex fractures, with special interest in the implementation of extended reality.

Bahaa ELGARBA

Bahaaeldeen Mohamed Abdalazeem Elgarba was born in Riyadh, Saudi Arabia, in 1990. He obtained his bachelor's degree in Dentistry at Tanta University in Egypt, between 2007 and 2012, followed by an internship for a year at Tanta University Hospitals. He worked as a General Dentist at the Egyptian Ministry of Health for one year (2014). Afterwards, he became a resident and research assistant at the Department of Prosthodontics at Tanta University, besides working in his private clinic. Between 2016 and 2019, he obtained his master's degree in Prosthetic Dentistry at Tanta University. Since 2020, he has been an assistant lecturer and researcher in the Department of Prosthodontics at the Faculty of Dentistry at Tanta University. His specialization is Prosthetic and Implant Dentistry. In 2021, he came to Leuven as a Ph.D. researcher at OMFS-IMPACT. His research project focuses on the automation of dental implant planning and virtual implant patient creation.

Mostafa EZELDEEN

Mostafa EzEldeen obtained his Bachelor of Dental Medicine and Surgery (2007) from Mansoura University, Egypt. He then moved to Belgium to obtain his Master in Dentistry, Summa cum laude, at the KU Leuven, Belgium. Further, he obtained the Master of Oral Health Research (2010) at the KU Leuven and a specialization in Paediatric Dentistry and Special Dental care (2012) at the KU Leuven. In 2013, he obtained the diploma of Postgraduate studies in Advanced Medical Imaging at the KU Leuven. He obtained his PhD in 2021 titled "Dental tissue regeneration in children: can we mimic nature?". He is now a Post-doctoral fellow at the OMFS-IMPACT research group at the KU Leuven, in addition to practicing as a Paediatric dentist in private practice and UZ Leuven (Department of Dentistry, Paediatric Dentistry and Special Dental Care). His research topics are situated at the interface of clinic, immune-modulation, and biomaterials engineering, aiming to develop novel therapies for dental tissue loss in children and adolescents. The research focuses on assessing the healing patterns in teeth and bone after regenerative processes using Cone Beam Computed Tomography (CBCT), development of reliable teeth segmentation methods utilizing Artificial Intelligence, CBCT-guided tooth autotransplantation, 3D (bio)printing and chemokine-mediated dental tissue regeneration. He has received the 1st place research award from the International Association of Dental Traumatology (2014), Journal of Endodontics Award (2016) for the best article in the category of clinical research, and the Belgian Albert Joachim Award in the Odontostomatology (2018), Journal of Endodontics Award (2022) for the best article in the category of Regenerative Endodontics. He has 30 international peer-reviewed papers, and 4 book chapters.

Yifei GU



Gu Yifei was born on April 17th, 1992. She achieved her degree in Bachelor of Medicine from West China college of Stomatology, Sichuan University, Chengdu, Sichuan, China (2010 - 2015). After that, she continued to obtain her degree in Master of Dental Medicine, majored in oral implantation, from West China college of Stomatology, Sichuan University, Chengdu, Sichuan, China, under the guidance of Professor Mo Anchun (2015-2018). During her Masters, she worked on the impact of non-steroid anti-inflammatory drugs on implant osseointegration, as well as the digital workflow in implant dentistry. She started working as a PhD candidate (OMFS-IMPATh research group, KU Leuven) from 2018, with Prof. dr. Constantinus Politis and Prof. dr. Reinhilde Jacobs as

her promoters. Her research topic for PhD is related to tissue engineering for bone defect reconstruction by using biomimetic calcium phosphate/BMP-2 coated 3D printed implants.

Una IVKOVIĆ



Una Ivković obtained her Bachelor's and Master's degree in Biomedical Sciences, Magna Cum Laude, from KU Leuven, Belgium. As part of her master's thesis, she performed research abroad at Karolinska Institute, Department of Dental Medicine in Stockholm, Sweden (Erasmus+ Scholarship) from September 2021 until February 2022. There, she performed research on in vitro validation studies of scaffold applications within dental research. Moreover, she followed a two-week internship at Université de Paris – Department of Dental Surgery in Paris, France where she was acquainted with imaging methods within dental research. Currently, she is a Ph.D. researcher for the OMFS-IMPATh research group under supervision of Prof. Dr. Reinhilde Jacobs (KU Leuven, Belgium), Prof. Dr. Ir. Arn

Mignon (KU Leuven, Belgium) and Dr. Mostafa EzEldeen (KU Leuven, Belgium). Her research topics focus primarily on Tissue Engineering and Regenerative Medicine and the application potential of polymer-based biomaterials within dentistry, with the aim to tackle dental pulp injuries in children and adolescents in a sustained manner. Next to her scientific activities within the group, she is also responsible for maintaining the social media of the research group (Instagram/LinkedIn).

Thanatchaporn JINDANIL



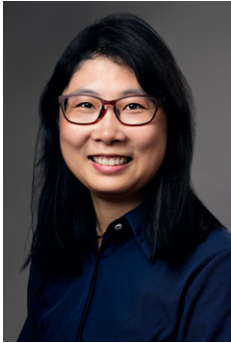
Thanatchaporn Jindanil was born in Bangkok, Thailand, in 1995. She studied her bachelor degree in Dentistry at Chulalongkorn University between 2014 and 2019. After working as a teacher assistant in Department of Radiology, Faculty of Dentistry, Chulalongkorn University, she enrolled in the Postgraduate Studies in Advanced Medical Imaging at KU Leuven (2022- 2023). She is currently working on a project called: "AI-tool on the detection of mandibular and incisive canal and virtual patient creation." After graduation, she will start a PhD in Biomedical sciences in the KU Leuven under the advice of Prof. dr. Reinhilde Jacobs.

Pierre LAHOUD



Pierre Lahoud is a dentist, Doctor in Dental Surgery with Postgraduate Training in Advanced Medical Imaging. He concluded a clinical internship at UC Louvain in 2018 (Erasmus+ Scholarship) and performed his pre-doctoral research at the OMFS-IMPATh Research Group (KU Leuven, Belgium), focusing on artificial intelligence driven segmentation for tooth auto-transplantation - graduating Magna Cum Laude in July 2020. He is currently a Clinical Resident in Periodontology and Implant Surgery (KU Leuven, Belgium) and a Ph. D. Researcher (OMFS-IMPATh Research Group, KU Leuven, Belgium) under the promotership of Prof. Dr. Reinhilde Jacobs (KU Leuven, Belgium), Em. Prof. Dr. Marc Quirynen (KU Leuven, Belgium) and Prof. Dr. Michael Bornstein (Universität Basel, Switzerland).

He is also a consultant for trans-alveolar dental transplantations (Department of Oral and Maxillofacial Surgery, University Hospitals Leuven, Belgium). His research topics focus primarily on Artificial Intelligence-driven planning for treatments and surgeries in the oral and maxillofacial region, periodontology and implantology. He is the recipient of the First Prize - IADMFR Maxillofacial Research Award 2021 (Gwangju, South Korea) and is co-recipient of the Journal of Endodontics Award (2022) in the category of Regenerative Endodontics (Chicago, IL, USA).

Jiqing LI

Jiqing Li was born on April 15th, 1991. She achieved her degree in Bachelor of Dental Medicine from School of Stomatology, Shandong University, Jinan, China (2009-2014). She obtained her Master of Dental Medicine degree in Oral and Maxillofacial Surgery from West China College of Stomatology, Sichuan University, Chengdu, China, under the guidance of Professor Jihua Li and Professor Jing Hu (2014-2017). During her Masters, she worked on the effect of hyaluronidase on skin necrosis caused by hyaluronic acid. After her graduation, she worked as a general dentist at West China Hospital of Stomatology, Chengdu, China (2017-2018). Currently, she is a PhD candidate in OMFS-IMPATh research group, KU Leuven, with Prof. dr. Reinhilde Jacobs as her promoter. She is studying the effect of systemic diseases on patients undergoing orthognathic surgery.

Hongyang MA

Hongyang Ma born on August 8th, 1991, obtained his Bachelor of Dental Medicine and Surgery from Harbin Medical University and Master degree of Oral and Maxillofacial Surgery in the Department of Oral and Cranio-maxillofacial Surgery, Ninth People's Hospital, Shanghai Jiao Tong University School of Medicine. Until mid-2022, he was a PhD candidate (OMFS-IMPATh, KU Leuven, Belgium) with Prof. Dr. Reinhilde Jacobs as his promoter and Prof. Dr. Constantinus Politis as his co-promoter. His research topic for PhD was the "Long-term follow-up and computer-assisted surgery in oral and maxillofacial reconstruction".

Joeri MEYNS

Dr. Joeri Meyns has a degree as a Medical doctor, Dentist and Maxillofacial surgeon. After obtaining his degree as a maxillofacial surgeon in 2011 he was a staff member at the Academic Hospital Maastricht (MUMC) for almost 4 years, where he further specialised in oral oncology and reconstructive surgery. He is Medical Head of the department of Oral and Maxillofacial Surgery at Ziekenhuis Oost-Limburg (ZOL) in Genk. His main speciality is orthognathic surgery and oncology. His PhD research is growth modification of the face in children.

Catalina MORENO RABIE

Catalina Moreno Rabie was born in Concepción, Chile, in 1992. She obtained her bachelor's and master's degree in dentistry in 2016 at the Universidad de los Andes, Chile. During her final year of dentistry, she completed a clinical and research internship at KU Leuven, where she studied anatomical variations in the retromolar area on CBCT. Between 2017 and 2018 she worked as a general dentist in Chile. Within this period she also completed a course in dental emergency management organized by the emergency unit of the Barros Luco Trudeau health care complex and the University of Chile. In 2019, she obtained her diploma in the Postgraduate studies in Advanced Medical Imaging at KU Leuven (2018- 2019, summa cum laude), the thesis topic was on guided endodontics under the supervision of Andrés Torres and prof. Reinhilde Jacobs. Currently, Catalina is working as a doctoral researcher in biomedical sciences at the KU Leuven under the tutelage of prof. dr. Reinhilde Jacobs. Specifically, her thesis topic investigates the effects of antiresorptive drugs on the jaw bones, possible risk factors for the development of medication-related osteonecrosis of the jaws (MRONJ), and the prognostic risk factors for this pathology. In September 2021, she was awarded the second prize in the Robert Frank Senior Clinical Science Award (CED-IADR/NOF Oral Health Research Congress, Brussels, Belgium).

Nermin MORGAN

Nermin Morgan was born on September 20th, 1990. She obtained her degree in Bachelor of Dental Surgery (B.D.S) from the Faculty of Dentistry, Mansoura University, Egypt (2007-2012). After her graduation she worked there as a teaching assistant in the department of Oral radiology and Diagnostic sciences (2013-2018). Meanwhile She was awarded her master's degree of Oral Diagnosis and Radiology (2017). During the same year she became a radiology specialist at Ministry of health, Cairo, Egypt. Her research work has focused on Cone Beam CT (CBCT), and its different clinical applications in maxillofacial region. Currently, she is a PhD Candidate in OMFS-IMPATh research group, KU Leuven, with Prof. dr. Reinhilde Jacobs as her promoter.

Flavia PREDA

Flavia Preda has graduated as a Dentist (2012) and as an Orthodontics Specialist (2015) in Bucharest-Romania. Since 2017 she has been practicing orthodontics in a private dental clinic in Belgium. Starting with 2019 she is a visiting Orthodontics Consultant in the cleft facility at Marie S. Curie Children's Hospital in Bucharest-Romania. Currently, she is a part-time Ph.D. student in the OMFS-IMPATh research group at KU Leuven under the supervision of Prof. Dr. Reinhilde Jacobs with the main research interest 3D supported and AI-enhanced diagnosis and treatment planning for Orthodontics.

Mehdi SALAR AMOLI

Mehdi is a PhD candidate at OMFS-IMPATh in collaboration with Faculty of Engineering Technology working under supervision of Prof. Veerle Bloemen and Prof. Reinhilde Jacobs. He studied biomaterials and tissue engineering for bachelor's at Amirkabir University of Technology in Iran working on multiphasic chitosan scaffolds for cartilage regeneration. He obtained his master's degree at Imperial College London in biomaterials and tissue engineering and worked under supervision of Prof. Molly Stevens and Dr. Ioanna Mylonaki on developing non-viral methods for nucleic acid delivery to the cells. He is currently working on development of methods for regeneration of dentin-pulp region through bio printing cell encapsulated materials.

Eman SHAHEEN

Eman (Emmy) Shaheen was born on July 12th, 1982 in Giza, Egypt. She graduated with honor from the faculty of Computer Sciences and Information Technology (2003), Cairo University, Egypt where she also worked as a teaching assistant from 2003 till 2007 with major in Image Processing. Meanwhile, she obtained her Master's Degree in Video Processing (2007) from Cairo University. In 2008, she joined the team of Medical Physics where she finished with distinction her pre-doctoral studies about mammography and breast cancer (2009) in Biomedical Sciences at the KU Leuven, Belgium. She was granted a PhD scholarship from the OPTIMAM project (UK) in 2010 to develop, simulate and validate 3D models of breast lesions and tools to optimize the performance of breast tomosynthesis. She obtained her doctoral degree in 2014, KU Leuven, Belgium. In the same year, she started working in the department of Maxillofacial surgery, University hospitals Leuven (Belgium) with Prof. dr. Constantinus Politis as clinical engineer with focus on 3D planning of orthognathic surgeries. Next to the patient related work, she is part of the research group of the OMFS-IMPATh research group (KU Leuven, Belgium) where she supervises students, supports different research projects related to 3D printing and 3D simulations. She is also collaborating with Materialise (Leuven, Belgium) as consultant to improve the CMF software for orthognathic surgeries next to other research related projects.

Maximiliaan SMEETS

Maximiliaan Smeets graduated from the Catholic University of Leuven in June 2018 as a Medical Doctor and is now an active Oral and Maxillofacial trainee at the University Hospital of Leuven. His research interests include oral oncology and Oral and Maxillofacial Surgery in general. Since 2020 Maximiliaan Smeets is a PhD candidate at the OMFS-IMPATh Research Group, and he focuses on the onset, etiology, and treatment of persistent trismus after oral oncology treatment. His research is mentored by Prof. dr. Constantinus Politis, Prof. dr. Reinhilde Jacobs, dr. Michel Bila, and Jeroen Van Dessel.

Yi SUN

Yi Sun obtained his PhD in Biomedical Sciences, Master of Medical imaging and Bachelor in Electronic Engineering. Since 2007, he worked in the field of computer assisted surgery planning, with focus on oral and maxillofacial surgery. Currently he is responsible for the 3D surgical simulation team in the department of oral and maxillofacial surgery (UZ Leuven). In the past years, he and the team members developed several computer assisted surgical applications in dental implant placement, cranio-maxillofacial reconstruction and patient specific implant design. He has published more than 50 articles in peer-reviewed journals and has contributed three book chapters. His research interests are 1) Computer assisted reconstruction of large bone defects in cranio-maxillofacial region; 2) statistic shape modelling to design patient specific implant.

Isti Rahayu SURYANI

Isti Rahayu Suryani was born on November 20th, 1980. She obtained her Doctor of Dental Medicine (2006) from Faculty of Dentistry, UGM-Indonesia, Master of Biomedical Engineering (2012) from Graduate School of UGM-Indonesia and Specialist in Oral Radiology (2016) from Padjajaran University-Indonesia. She has worked as lecturer in Departement of Dentomaxillofacial Radiology, Faculty of Dentistry, UGM and also as Oral Radiologist at UGM Dental Hospital. Currently, she is a PhD candidate in OMFS-IMPATh research group, KU Leuven, starting December 2019 with Professor Reinhilde Jacobs as her promotor. Her research focus on Imaging of Medication-related osteonecrosis of the jaw.

Kostas SYRIOPOULOS

Kostas Syriopoulos is dentist specialized in oral and maxillofacial radiology. He graduated as dentist from the University of Athens, Greece. He has a MSc degree (University of London) as well as a PhD degree (VU, Amsterdam) in Dental Radiology. He had an internship in the Dept. of Oral Radiology (Stellenbosch University, Cape Town). Further, he received the diploma in Health Physics level 3 (TU Delft). In the Netherlands Level 3 is a higher expert level of health physics, necessary for supervising in radionuclide laboratories or working in a medical profession with higher risk or responsibility, like clinical physics and nuclear medicine. From 2001 to 2016 he was a staff-member in the department of Dentomaxillofacial Radiology, ACTA, Amsterdam. Since February 2015 he has been a staff member in the Department of Imaging & Pathology, KU Leuven. His main professional interests are Diagnostic Radiology, Radiography Education and Radiation Protection.

Els TIJSKENS

Els Tijskens graduated as a dentist in 1984 at KU Leuven. She has been working as an endodontist since 2000, and has a second line practice for paediatric endodontics and traumata. In 2011 she obtained a license to use N2O-sedation, which she is applying on indication. She is a Certified Member of the European Society for Endodontology (ESE), Fellow of the International Association for Dental Traumatology (IADT), founding board member and past President of the Flemish Society for Endodontology (FSfE vzw). She has been lecturing to GP's at NIVVT for more than a decade. She is involved in reading the CBCT images at UZLeuven, and has been teaching Medical Imaging at UCLL opleiding Mondzorgkunde until August 2019.

Andres TORRES

Andres Torres was born on July 4th, 1988 in Bogota, Colombia. He obtained his degree as General Dentist in 2012 from the University of Los Andes, Santiago, Chile. During the training in Dentistry, he participated twice in a research internship on CBCT in Endodontics at the KU Leuven, Leuven, Belgium, led by Professor Reinhilde Jacobs. In March 2014 he achieved the equivalence of foreign diploma "Titulo de Cirujano Dentista" with the Flemish degree of "Master of Science in Dentistry". In 2015 he obtained the diploma of Postgraduate studies in Advance Medical Imaging at the KU Leuven, Leuven, Belgium. Further, he obtained a specialization degree in Endodontics in July 2017, under the guidance of Professor Paul Lambrechts at the KU Leuven, Leuven, Belgium. He works as an

Endodontic specialist in private practice. He is instructor of the Endodontic postgraduate at KU Leuven, Leuven, Belgium and visiting instructor of the Endodontic postgraduate at KI, Stockholm, Sweden. Currently he is a PhD candidate (OMFS-IMPATh research group, KU Leuven, Belgium) with Professor Reinhilde Jacobs as his promoter and Professor Paul Lambrechts as his co-promoter. His research topics are: 3-Dimensional Guided Endodontics, 3-Dimensional Assessment of Apical Radiolucencies, Characterisation of Root and Canal Morphology and Maxillary Sinus and Endodontics.

Frédéric VAN DER CRUYSSSEN

Frédéric Van der Cruyssen was born in Waregem, Belgium on January 23th 1992. He received his medical degree magna cum laude from the Catholic University of Leuven in June 2017 with a master's thesis on trigeminal nerve physiology and his dental degree at the same university in 2020. In 2019 he commenced his PhD project at the OMFS-IMPATh research group under promotorship of Prof. dr. Reinhilde Jacobs, Prof. dr. Constantinus Politis, Prof. dr. Jan Casselman and Prof. dr. Tara Renton (Oral Surgery, King's College, London, UK). In 2020 he started his oral and maxillofacial surgery residency at the University Hospitals Leuven. In 2021 he obtained a master's degree in healthcare policy and management at the Catholic University of Leuven. Currently, he is a third-year oral

and maxillofacial resident at the ETZ Elisabeth Hospital, Tilburg, The Netherlands.

Jeroen VAN DESSEL

Jeroen Van Dessel holds a Master in Biomedical Sciences and a Master in Advanced Medical Imaging from KU Leuven. As FWO-aspirant he achieved his PhD in Biomedical Sciences at the KU Leuven. He is active in the field of dentomaxillofacial radiology within the Department of Oral and Maxillofacial Surgery at the UZ Leuven and the OMFS-IMPATh research group at the KU Leuven. He also coordinates the Institute for Oral and Maxillofacial Surgery Education and Training (www.iomfcot.be). He is visiting professor at the Department of Surgery, Stomatology, Pathology and Radiology of the Dentistry Faculty at the University of São Paulo in Bauru (Brazil). He is a board member of the European Academy of DentoMaxilloFacial Radiology (EADMFR). Jeroen received the COB

Oral Research Award (2013), EADMFR Oral Research Award (2012; 2014), the EUNETHYDIS Sagvolden Award (2015), the EADMFR Research Fellowship (2016), the ECNP Junior Research Award (2018) and OMFS-IMPATh Young Talent Award (2019). As a visiting researcher, he has been associated with the University of São Paulo (Brazil), Pontificia Universidade Catolica do Parana (Brazil) and Karolinska Institute (Sweden).

Jonas VER BERNE

Jonas Ver Berne is an Oral and Maxillofacial Surgery trainee at the University Hospitals of Leuven. He graduated as a Medical Doctor from the Catholic University of Leuven in 2020 with a master's thesis in oral pathology under promotorship of Prof. dr. Constantinus Politis, Prof. dr. Reinhilde Jacobs, and Prof. dr. Erich Raubenheimer. During his medical education he did several internships at the OMFS-IMPACT research group, and was involved in research on the relationship between systemic diseases and orthognathic surgery. Currently, his research is focused on the use of Artificial Intelligence in oral and maxillofacial radiology.

Pieter-Jan VERHELST

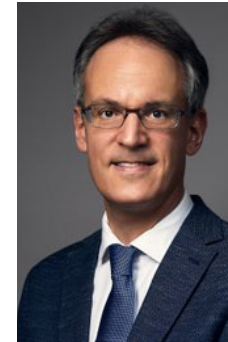
Dr. Pieter-Jan Verhelst is an Oral & Maxillofacial Surgery Resident at the University Hospitals of Leuven (Belgium) with a special interest in orthognathic, craniofacial and cleft surgery. In 2017 he obtained his medical degree (KU Leuven, magna cum laude) with a thesis on the free fibula flap in craniomaxillofacial reconstructions and in 2020 he obtained his dental medicine degree (KU Leuven, magna cum laude) with a thesis on 3D volumetric analysis of the jaw joint. He was trained at the University Hospitals of Leuven (Belgium) and the Rijnstate Hospital Arnhem (Netherlands). He is part of the Cleft Lip and Palate Team at the University Hospitals of Leuven. Dr. Verhelst is a PhD candidate within the OMFS-IMPACT research group at KU Leuven, supervised by Prof. Dr. Reinhilde Jacobs,

Prof. Dr. Constantinus Politis and Prof. Dr. Hilde Peeters. His research focuses on orthognathic, craniofacial and cleft surgery, condylar resorption, 3D craniofacial phenotyping and associated genetic abnormalities.

Xiaotong WANG

Xiaotong Wang received her degrees in both Bachelor and Master of Dental Medicine from Harbin Medical University, China. After her graduation, she worked as an Oral and Maxillofacial Surgeon in the First Affiliated Hospital of Harbin Medical University. Currently, she is a PhD candidate at OMFS-IMPACT research group with Prof. dr. Reinhilde Jacobs as her promotor. Her research is focused on Digital dentistry: development of AI-driven prediction and CBCT-based biomodels.

C. VISITING PROFESSORS

Michael BORNSTEIN

Michael Bornstein has been appointed in January 2020 as professor and chair of the Department of Oral Health & Medicine at the University Center for Dental Medicine Basel (UZH) of the University of Basel, Switzerland. Since April 2020 he is also head of "research" and member of the executive board at the UZH. He obtained his dental degree (1998) and thesis (Dr. med. dent., 2001) at the University of Basel. He continued with a specialisation in oral surgery and stomatology in Basel (1998-1999, Prof. Dr. J. Th. Lambrecht) and Bern (2000-2002, Prof. Dr. D. Buser). In 2004, he was visiting assistant professor at the Department of Periodontics (Prof. Dr. D. Cochran) at the University of Texas Health Science Center at San Antonio, USA, with a grant from the Swiss National Science Foundation. From 2007-2014 he was head of the Section of Dental Radiology and Stomatology, University of Bern. In 2009, he obtained the Habilitation (Privatdozent / PhD) and in 2014 he became Associate Professor in the field of „Oral Surgery and Stomatology“. From 2016-2019 he has been Clinical Professor in Oral and Maxillofacial Radiology at the Faculty of Dentistry, The University of Hong Kong, Hong Kong SAR, China. In December 2018 he is been appointed as Associate Dean of "Research and Innovation" of the Faculty of Dentistry. He currently is a Visiting Professor at the OMFS-IMPACT Research Group, Department of Imaging and Pathology, University of Leuven, Belgium, and since January 2020 a Honorary Professor of the Faculty of Dentistry, The University of Hong Kong. His fields of research include cone beam computed tomography (CBCT) in clinical dental practice, diagnostic imaging, stomatology/oral medicine, GBR procedures and dental implants. He has published over 210 original articles, and is the author / co-author of numerous case reports, review articles, and book chapters.

Krisztian NAGY

Krisztian Nagy is a Maxillofacial Surgeon with special interest and experience in cleft surgery. He has been working as the co-ordinator and leading surgeon of the Cleft Care Centre, at the 1st Department of Paediatrics, Semmelweis University, Budapest, Hungary. He has been also working as a Consultant Maxillofacial Surgeon, in AZ St-Jan Bruges-Oostende Hospital, Belgium since March 2012. He became Fellow of the European Board of Oro-Maxillofacial Surgery & Head and Neck Surgery (FEBOMS) in September 2012. He is currently Guest Professor at Leuven University, KU Leuven, Belgium. He graduated at the Semmelweis University Budapest, Hungary in medicine (MD, summa cum laude) and in dentistry (DDS, magna cum laude). He specialized in oral and Maxillofacial surgery

at the Semmelweis University, at the KU Leuven and in AZ Sint Jan in Bruges, Belgium. His postgraduate training was additionally followed by clinical experiences in Bruges, Minden, Vienna, Wellington, Zürich and Taipei. He is now member of the European Association for Cranio-Maxillofacial Surgery (EACMFS), the European Academy of Facial Plastic Surgery (EAFPS) and the CranioMaxillofacial Section, Arbeitsgemeinschaft für Osteosynthesefragen (AO). He is acknowledged PhD tutor of 3 PhD students. He defended his doctoral thesis on the subject of "Objective methods for evaluation of surgical outcomes in cleft lip and palate surgery" (PhD). His professional field of interest is in orthognathic, cleft and craniofacial surgery.

Claudia NOFFKE

Claudia grew up and matriculated in Germany. She obtained her under-graduate training as a Dentist at the University of Pretoria and managed her own private practice for several years. She completed her postgraduate training in Maxillofacial and Oral Radiology in 1992 and served as Lecturer in the Departments of Radiology and Diagnostics, University of Pretoria, and Oral Pathology at the Medical University of Southern Africa where she was appointed as Head of Maxillofacial and Oral Radiology in June 2001, a position from which she retired as a Full Professor in 2016. She participated actively in 46 international congresses and refresher courses and authored or co-authored an equal number of scientific papers in peer-reviewed journals. She is on the editorial boards of several

distinguished journals in her field of expertise including the Radiology Section of the Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology (Triple "O") and the Journal of Chinese Clinical Medicine. She recently co-edited the proceedings of the 2017 21st Congress of the International Association of Dentomaxillofacial Radiology in Kaohsiung, Taiwan. In recognition for her role as reviewer for Triple "O" she received the Lincoln Manson-Hing Award for distinguished service in Scientific Review from the American Academy of Oral and Maxillofacial Radiology and Elsevier Publisher. Claudia supervised- and served as external examiner for several Master's and PhD degrees. She is currently on the Board of Directors and Regional Director (Africa) of the IADMFR and appointed since May 2018 as Guest Professor in the Department of Imaging & Pathology at the KU of Leuven. Her field expertise include ethics and legislation pertaining to radiation protection, fibro osseous disease and the radiological interpretation of gnathial tumours and cysts.

Erich RAUBENHEIMER

After receiving a MChD degree in Oral Pathology at the University of Pretoria, Erich Raubenheimer joined Medunsa in 1982 as Head of Oral Pathology and Acting Head of Anatomical Pathology. During the first years of appointment at this fledgling health sciences University he was responsible for the histopathology services rendered to the medical- and dental hospitals and regional community clinics. He obtained a PhD, DSc, FCP (SA) and CBCT certification with the American Academy of Oral and Maxillofacial Radiology, supervised 7 PhD degrees and a large number of Master's degrees. His research interests are in head and neck diseases and pathology of mineralized tissues, particularly the diagnosis of metabolic diseases of bone. Erich authored 139 papers in peer reviewed scientific journals (eight of which were on invitation) and contributed to three chapters of

the 4th edition of the World Health Organizations' book on head and neck tumours. He was key note speaker at five international conferences and presented 99 invited scientific talks to specialist groups. Erich has a passion for the African elephant and regularly presents talks to interesting societies based on his scientific work on ivory and experience as an elephant tracker in Africa. Erich is presently employed as a senior consultant at Ampath, a large pathology practice in South Africa, holds an extraordinary professorship at the University of Pretoria and a guest professorship at KU Leuven. He is married to Claudia, a remarkable woman who blessed him with four successful children.

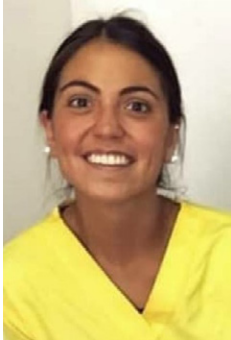
D. VISITING RESEARCHERS

Saleem ALI

Saleem Saleh Ali was born in Riyadh, Saudi Arabia, in 1985. He achieved his bachelor's degree in Oral and Dental Medicine and Surgery in 2008 at the University of Jordan. In Jordan, he started working as a general dentist in a private clinic for 2 years. In 2010, he joined the Royal Medical Services and worked as a general dentist between 2010 and 2013. From 2013 to 2017, he worked in the army as a restorative dentistry resident. In 2019, he achieved the Jordanian board in restorative dentistry as a specialist, after which he became a specialist in restorative dentistry in the Jordan Army Forces. He is now joining the OMFS-IMPATh research group at KU Leuven for further research.

Soroush BASERI SAADI

Soroush Baseri Saadi received an Associate's degree in the field of General Electronics from "Shamsipour Technical College/University" in Tehran, in 2005. In 2009, he graduated as a Bachelor of Science from "Islamic Azad University (IAU) - South Tehran Branch", Iran, in Electrical Engineering-Electronics. After graduation, he did his military service in the Army University of Medical Sciences as Second Lieutenant Officer in charge of a Biomedical Engineering team. Then he was employed in the Kian hospital as a Biomedical Engineer to design, maintain and operate with medical equipment. In July 2016, he graduated as a Master of Science in Biomedical Engineering from Vrije Universiteit Brussel. During his master education, he extensively worked on several Biomedical Image Processing and Biomechanical Simulation projects. At the same time, in order to maintain his living cost, he used his skills to work part-time. To gain work experience in a more advanced degree after graduation, he again cooperated with the Kian Hospital as a R&D member, designer of medical equipment and Surgical Navigation Engineer. After that, he was invited to work as a software developer, R&D member and designer of medical apparatus for a manufacturer of biomedical equipment, Dentus Co. However, since he has always had an interest to be a researcher, and to continue his education to a more advanced level and work in an academic environment, he never stopped advancing his skills in Medical Image Processing. He is highly interested in research positions in the fields of designing medical equipment, Biomedical Image Processing and Deep Learning.

Isadora CABELLO SALAZAR

Isadora Cabello Salazar was born in Concepción, Chile, in 1993. She studied her bachelor and master's degree in Dentistry at the Universidad del Desarrollo in Chile between 2012 and 2018. In 2018, she was trained in facial rejuvenation treatments in the Chilean Academy of Orofacial Aesthetics. After working as a general dentist and doing aesthetic treatments for almost 3 years, she started (2021) a postgraduate specialty program in Oral and Maxillofacial Radiology at the Universidad de los Andes, Chile. During her current specialty studies, she is doing an internship at the KU Leuven under the tutelage of Prof. dr. Reinhilde Jacobs. Specifically helping PhD student Catalina Moreno Rabie in an investigation of the effects of antiresorptive medications on the jaw bones and the potential risk factors to developing Medication-related osteonecrosis of the Jaws (MRONJ).

David CONTRERAS DIEZ DE MEDINA

David Contreras Diez de Medina was born in Santiago, Chile, in 1994. He studied his bachelor and master's degree in Dentistry at the Universidad Andres Bello in Chile between 2013 and 2019. He worked two years in public Hospitals and private sectors as a dentist, also receiving a diploma in maxillofacial growth and development in Orthodontics. While working there, he started (2021) a postgraduate specialty program in Oral and Maxillofacial Radiology at the Universidad de los Andes, Chile. During his current specialty studies, he is doing an internship at the KU Leuven under the tutelage of Prof. dr. Reinhilde Jacobs, specifically helping PhD student Catalina Moreno Rabie in an investigation of the effects of antiresorptive medications on the jaw bones and the potential risk factors to developing Medication-related osteonecrosis of the Jaws (MRONJ).

Sara ELSONBATY

Sara Elsonbaty was born in Egypt, in 1994. She obtained her bachelor's degree in Dentistry at Tanta university in Egypt in 2017, followed by an internship year at Tanta university and hospitals of ministry of health in 2018. After that, she started to work in a private clinic. Since 2019, she has been working as a general dentist at the Egyptian ministry of health. In 2022, she came to Leuven as a post graduate student in the advanced medical imaging program.

Hessam FAGHIHIAN

Hessam Faghihian obtained his Doctor of Dental Surgery (D.D.S.) degree from Isfahan University of Medical Sciences, Isfahan, Iran, in 2019. He is now studying master's in biomedical sciences at KU Leuven, working on biomechanical computational modeling of oral and maxillofacial tissues under the guidance of Prof. Dr. Reinhilde Jacobs and Dr. Mostafa EzEldeen at OMFS-IMPATh as part of his master's thesis.

Rocharles FONTENELE

Rocharles Fontenele was born in Jaguaretama, Brazil, in 1995. He obtained his dental degree in 2016 at the Federal University of Ceara, Brazil. In 2018, he obtained his master's degree in Oral Radiology at the University of Campinas, Brazil. Currently, he is a PhD candidate in Oral Radiology at the University of Campinas under the supervision of Prof. Dr. Deborah Queiroz Freitas. He was granted a scholarship by Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (Brazilian government) to collaborate with the OMFS-Impath research group, under the supervision of Prof. Dr. Reinhilde Jacobs, for one year as part of his doctorate.

Fernando FORTES PICOLI

Fernando Fortes Picoli is dentist, Doctoral Course Student in Dentistry (Federal University of Goias, Brazil), has master degree in Dentistry (Federal University of Goias, Brazil), he is also Specialist in Orthodontics and Forensic Odontology. Since 2010 he has been working as Forensic Expert at Scientific Police of Goias (Brazil) and has expertise in violent death crime scene exams (more than 2 years working as a Crime Scene Investigator), Forensic Ballistics (had worked for more than 5 years at the Ballistics Crime Lab in firearms and ammunition exams) and Forensic Dentist (since 2018 has been working at the Goiania's forensic morgue). In the field of Forensic Odontology, the main skills are related to human identification, human traumatology (pathology of trauma, especially firearms wounds) and human age estimation (doctoral research project ongoing). He has experience with the use of computed tomography and radiography for Forensic Odontology purposes. He is (co) author of 1 book and almost 30 publications in peer-reviewed journals.

Santiago GARCIA LARRAIN

Santiago García Larrain was born in Santiago, Chile, in 1994. He studied his bachelor and master's degree in Dentistry at the Universidad de los Andes in Chile between 2013 and 2019. He worked almost two years in the Regional Department of the Ministry of Health, in charge of Covid-19 PCR and Antigen testing strategy. While working there, he started (2021) a postgraduate specialty program in Oral and Maxillofacial Radiology at the Universidad de los Andes, Chile. During his current specialty studies, he is doing an internship at the KU Leuven under the tutelage of Prof. dr. Reinhilde Jacobs, specifically helping PhD student Catalina Moreno Rabie in an investigation of the effects of antiresorptive medications on the jaw bones and the potential risk factors to developing Medication-related osteonecrosis of the Jaws (MRONJ); and Dr. Sergio Lins in the development of AI software that recognizes mandibular incisive canal in Cone-Beam CT.

Maurício GERHARDT

Maurício Gerhardt was born in Porto Alegre, Brazil, in 1990. He obtained his dental degree in 2012 and his Master in Prosthodontics (2018) from the Pontifical Catholic University of Rio Grande do Sul, Brazil. Currently, he is a PhD candidate in prosthodontics at the same university under the supervision of Prof. Dr. Rosemary Shinkai. He was granted a scholarship from the Brazilian government (CAPES) to collaborate with the OMFS-Impath research group, under the supervision of Prof. Dr. Reinhilde Jacobs, for one year as part of his doctorate.

Omid JAZIL

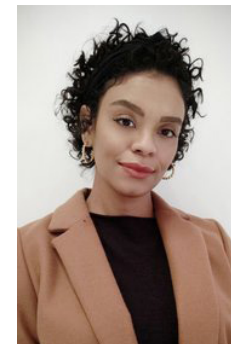
Omid Jazil received his degree -cum laude- in civil engineering technology in September 2020 from the University of Antwerp. In June 2022 he also obtained the certificate of honourstudent after following a honoursprogram of two years at OMFS-IMPATh under promotorship of prof. dr. Reinhilde Jacobs. Currently he is studying for his master's in dentistry. His research topics focus primarily on artificial Intelligence and growth modification of the face in children.

Sergio LINS DE AZEVEDO VAZ

Sergio Lins de Azevedo Vaz obtained his PhD in Oral Radiology from University of Campinas (UNICAMP) in 2013. Since then, he has been working as a DMFR professor and researcher at Federal University of Espírito Santo, where he also serves as the head of the Dental Sciences MSc Program. He is also assigned as a collaborator researcher at UNICAMP, as the Regional Director for Latin America and as a member of the Education Committee at the International Association of DentoMaxilloFacial Radiology. He worked at OMFS-IMPATh as a Visiting Scholar from May 2022 to August 2022, acting on projects related to Artificial Intelligence under the supervision of Prof. Reinhilde Jacobs.

Fernanda NOGUEIRA REIS

Fernanda Nogueira Reis was born in Rio de Janeiro, Brazil, in 1992. She is a dentist (Federal University of Rio de Janeiro-2016), Specialist in Oral Radiology (Federal University of Rio de Janeiro-2018), Master in Bucco-Dental Biology with emphasis in Forensic Dentistry (University of Campinas- 2019), and Ph.D. candidate in Oral Radiology at the University of Campinas with Prof. Dr. Cinthia Tabchoury as her promotor. She was granted a scholarship by the Brazilian government to do part of her Ph.D. in the OMFS-IMPATh research group under the supervision of Prof. Dr. Reinhilde Jacobs. Her research topic for Ph.D. is related to the use of Artificial Intelligence for Orthodontic and Orthognathic applications.

Nicolly OLIVEIRA SANTOS

Nicolly Oliveira Santos was born on February 20th, 1993 in Sao Paulo, Brazil. She graduated as a dentist at University Center Nove de Julho (2011 - 2015) and achieved her Master degree in Oral Radiology at University of Campinas (2017 - 2019). During her Master, she worked with fractal dimension analysis of bone and digital imaging. Currently, she is a PhD candidate in Oral Radiology at University of Campinas and was granted by the Brazilian government to do an internship in the OMFS-IMPATh research group, to develop part of her thesis under the supervision of Prof. Dr. Reinhilde Jacobs. Her research topic for PhD is related to the diagnosis of cysts and tumours in panoramic and cone beam computed tomography images by Artificial Intelligence.

Ranida PONBUDDHICHAI

Ranida Ponbuddhichai was born in Bangkok, Thailand, in 1986. She studied for her bachelor's degree in Dentistry (D.D.S.) at the faculty of dentistry, Srinakharinwirot University, Bangkok between 2004 and 2010. Then, in 2014 she graduated with a higher graduate diploma in dentistry, majoring in Pediatric Dentistry at the faculty of dentistry, Mahidol university. In 2019, she graduated diploma in Mental health (CBT; Cognitive Behavioral Therapy) from the Faculty of Medicine, Chulalongkorn university. Regarding her work experiences, she works for the government as a dentist in Rayong hospital and also several private dental clinics and hospitals. She also attended a volunteer project as a CBT therapist at Chulalongkorn university. Currently, she started to broaden her horizons, she enrolled in the Postgraduate Studies in Advanced Medical Imaging at KU Leuven (2022- 2023).

Sonya RADI

Sonya Radi was born in 1998 in Teheran, Iran. She studied her bachelor in Biomedical Sciences at KU Leuven between 2018 – 2021. She started her master thesis in September 2022 at Karolinska Institutet in Stockholm, Sweden, where she performed research regarding the development of a dynamic alveolar bone model in vitro. Currently, she is performing the second part of her thesis at OMFS-IMPATh under the tutelage of professor Jacobs, Dr. EzEldeen, and Dr. Xu.

Sohaib SHUJAAT

Sohaib Shujaat was born on November 29th, 1985. He achieved his degree in Bachelor of Dental Surgery (B.D.S) from Lahore Medical and Dental College, Lahore, Pakistan (2004 - 2008). After his graduation, he worked as an Internee in all clinical departments of dentistry at Lahore Medical and Dental College, Lahore, Pakistan (2009-2010). He obtained his Master of Science (MSc. Dent Sci) degree in Oral and Maxillofacial Surgery (360 credits) with merit from Glasgow Dental School and Hospital, University of Glasgow, Glasgow, United Kingdom, under the guidance of Professor Ashraf Ayoub (2010-2012). During his Masters, he worked on 4-Dimensional facial soft tissue changes in oncology patients. From March 2013 till September 2017, he worked as a Lecturer in the

Department of Oral and Maxillofacial Surgery and Course Director of Internal Medicine and Comprehensive Patient Management (CPM) for dental students at Imam AbdulRahman Bin Faisal University (Formerly University of Dammam), Dammam, Kingdom of Saudi Arabia. At the same instance, he served as a Specialist (Registrar) in the Department of Oral and Maxillofacial Surgery, King Fahd Hospital of the University. He obtained his PhD in Oral and Maxillofacial Surgery (2017-2021) under the supervision of with Professor Reinhilde Jacobs and Professor Constantinus Politis. His research topic during PhD was related to relapse of orthognathic surgical procedures. Currently he is appointed as Assistant Professor in Oral and Maxillofacial Surgery, King Saud bin Abdulaziz University for Health Sciences, Riyadh, Saudi Arabia and acting as a co-supervisor for PhD students at OMFS-IMPATh Research Group, KU Leuven, Leuven, Belgium.

Abdullah SWAITY

Abdullah Yousif Swaity was born in Abu Dhabi, United Arab Emirates, in 1987. He achieved his bachelor's degree in Oral and Dental Medicine and Surgery in 2009 at the Misr University for Science and Technology in Egypt. Afterwards, he started working as a general dentist in private clinics for 2 years. In 2011, he joined the Royal Medical Services and worked as a general dentist between 2011 and 2014. From 2014 to 2018 he worked in the army as a prosthodontic resident. In 2020, he achieved the Jordanian board in Prosthodontics to become a specialist, after which he become a prosthodontic specialist in the army as well. He is now joining the OMFS-IMPATh research group at KU Leuven to do further research.

Femke VANDEPUT

Femke Vandeput, born in Belgium, in 1999. She studied her bachelor in Biomedical Sciences at the University of Hasselt and performed a bachelor's thesis at Biomed in 2021. She completes her master's degree in Biomedical sciences at KU Leuven. She performs her master thesis about the risk factors and treatment prognosis of medication-related osteonecrosis of the jaws (MRONJ), supporting the research of Catalina Moreno Rabie under tutelage of prof. Jacobs.

Luiz Eduardo Marinho VIEIRA

Luiz Eduardo was born on June 27th, 1993 in Princesa Isabel, Paraíba, Brazil. He obtained his degree as General Dentist in 2016 from the Federal University of Campina Grande, Patos, Paraíba, Brazil. After working as a General Dentist from 2016 to 2017 in the Brazilian Unified Health System (SUS), he obtained his degree of "Master in Dentistry" in 2019 from the State University of Paraíba, Campina Grande, Paraíba, Brazil. He is currently a PhD student in Oral Radiology at Piracicaba Dental School, University of Campinas, Piracicaba, São Paulo, Brazil, under the advice of Professor Matheus L. Oliveira and participates in the OMFS-IMPACT research group under the advice of Professor Reinhilde Jacobs at KU Leuven, Leuven, Belgium. His research topics are: digital radiography, cone beam computed tomography, intraoral scanning and infrared thermography.

Lianyi (Amy) XU

Lianyi Xu obtained her Bachelor's degree in Stomatology from Huazhong University of Science and Technology and accepted a 1-year medical residency training in Tongji Hospital. In 2010, she became a Ph.D. candidate in the Ninth People's Hospital, affiliated with Shanghai Jiao Tong University. Her mentor was Prof. Xinquan Jiang. Since 2016, she worked as a prosthodontist and implantologist in the Stomatology Center of Tongji Hospital, Tongji Medical College, Huazhong University of Science and Technology. Dr. Xu focused her study on the field of tissue regeneration as well as dental implant early osseointegration in the oral and maxillofacial region. More recently she has broadened her horizon to immunology reaction and tried to explain the balance between hard/soft tissue

formation and immunological/inflammatory response in the processes of re-osseointegration and periodontal apparatus re-establishment following regenerative treatment of peri-implantitis and periodontitis.

E. ADMINISTRATIVE COORDINATOR

Nele VANLOOCKE



Nele Vanlooche is currently working as the administrative coordinator for the OMFS-IMPACT research group at the Department of Imaging and Pathology, KU Leuven. She has a Master's Degree in Western Literature and has a professional commercial background as well as experience as an all-round project coordinator.

3

Research

A. PROJECTS

B. AWARDS

C. PUBLICATIONS

- International peer-reviewed publications
- Book (chapter) publications
- Other publications

D. CHAIRS

E. DOCTORAL THESIS DEFENSES

A. PROJECTS

NATIONAL FUNDING

M3-OBSERVATORIUM

Epidemiological study on the surgical removal of third molars.

In samenwerking met Vlaams Ziekenhuisnetwerk KU Leuven



VLAIO

AIPLANT

CBCT-based Automated Implant PLANning for single implant Treatments



FWO

TOOTH AUTOTRANSPLANTATION

The development and clinical application of CBCT-based tooth auto transplantation.



TREASURE

Dentomaxillofacial paediatric imaging: an investigation towards low dose radiation induced risks



EXTRACT-NOAC

Use of new oral anticoagulants in oral surgery



PRIMORDIAL

An artificial intelligence (AI) driven prediction model to detect risk factors for medication-related osteonecrosis of the jaws.



INTERNAL FUNDING

CRANIVAL

Departmental grant BEPAT

KU LEUVEN

BOF CELSA/18/038

Harmonization of the use of cone-beam computed tomography for developmental disorders in the maxillofacial region.

KU LEUVEN

BOF C24/18/068

De ontwikkeling van beeldvorming-gebaseerde bioprinttechnieken voor volledig tand- en bot-regeneratie in de dentoalveolaire regio

KU LEUVEN

BOF C24/18/065

Beeldkwaliteitsoptimalisatie van dentale cone-beam CT

KU LEUVEN

INTERNATIONAL FUNDING

NZ ROYAL SOCIETY CATALYST FUND

Digital Dentistry Collaboration



INDUSTRIAL FUNDING

BETCON

Beste behandeling voor kaaknecrose



B. AWARDS

December 2022

SCIENTIFIC RESEARCH AWARD
IN RECOGNITION FOR SCIENTIFIC CONTRIBUTIONS
IN RELATION TO CBCT RESEARCH



Reinhilde Jacobs

December 2022

2022 INTERNATIONAL POSTDOCTORAL EXCHANGE
FELLOWSHIP PROGRAM
TALENT-INTRODUCTION PROGRAM



PEKING UNIVERSITY
SCHOOL OF STOMATOLOGY

Hongyang Ma

October 2022

SECOND PRIZE SCIENTIFIC FORUM
13TH CONGRESS OF THE BRAZILIAN ASSOCIATION
OF ORAL RADIOLOGY AND DIAGNOSTIC IMAGING



Oliveira Santos N, Fortes Picoli F,
Niclaes L, van Gerve A, Lahoud P,
Jacobs R, Groppo F C

October 2022

SECOND PRIZE SCIENTIFIC POSTER
13TH CONGRESS OF THE BRAZILIAN ASSOCIATION
OF ORAL RADIOLOGY AND DIAGNOSTIC IMAGING



Cavalcante Fontenele R, Fortes Picoli F,
Pinto J C, Coudyzer W, de Faria
Vasconcelos K, Farias Gomes A,
Jacobs R

August 2022

HONORABLE MENTION
SCIENTIFIC REVIEWER AWARD 2021-2022
OMR section of Oral Surgery Oral Pathology Oral
Medicine Oral Radiology (OOOO)



Reinhilde Jacobs

July 2022
SCIENTIFIC PAPER AWARD ON 3D ASSESSMENT OF SEGMENTED
LE FORT I OSTEOTOMY PLANNING AND FOLLOW-UP
LUTV LEUVEN

**da Costa Senior O, Vaes L, Mulier D,
Jacobs R, Politis C, Shaheen E**



June 2022
FIRST ORAL PRIZE
EADMFR RESEARCH AWARD 2022

**Nermin Morgan,
Fernanda Nogueira Reis**



June 2022
SECOND POSTER PRIZE
EADMFR RESEARCH AWARD 2022

**Fernando Fortes Picoli,
Rochard Fontenele**



March 2022
JOURNAL OF ENDODONTICS AWARDS
REGENERATIVE ENDODONTICS CATEGORY

**Meschi N, Ezeldeen M, Torres Garcia A,
Lahoud P, Van Gorp G, Coucke W,
Jacobs R, Vandamme K, Teughels W,
Lambrechts P**



C. PUBLICATIONS

INTERNATIONAL PEER-REVIEWED PUBLICATIONS

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- Van Cleemput, T., Hendrikx, S., Politis, C., & Spaey, Y. (2022). Leukocyte- and Platelet-Rich Fibrin: A New Method for Scalp Defect Reconstruction. *DERMATOLOGIC SURGERY*, 48(2), 261-262. doi:10.1097/DSS.0000000000003325
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- Van Gorp, G., Lambrechts, M., Jacobs, R., & Declerck, D. (2022) Impact of case complexity on paediatric dentists' ability to radiographically diagnose traumatic dental injuries. *DENTAL TRAUMATOLOGY*, 38(6), 450-456. doi:10.1111/edt.12785
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- van Luijn, R., Baan, F., Shaheen, E., Bergé, S., Politis, C., Maal, T., Xi, T. (2022). Three-dimensional analysis of condylar remodeling and skeletal relapse following LeFort-I osteotomy: A one-year follow-up bicenter study. *J CRANIOMAXILLOFAC SURG.* 2022 Jan;50(1):40-45. doi: 10.1016/j.jcms.2021.09.021. Epub 2021 Oct 4. PMID: 34654618.
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- Wanderley, V. A., Leite, A. F., Vasconcelos, K. D. F., Pauwels, R., Mueller-Garcia, F., Becker, K., . . . Jacobs, R. (2022). Impact of metal artefacts on subjective perception of image quality of 13 CBCT devices. *CLINICAL ORAL INVESTIGATIONS*, 26(6), 4457-4466. doi:10.1007/s00784-022-04409-w
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- Zhong, S., Shi, Q., Van Dessel, J., Gu, Y., Sun, Y., Yang, S., & Politis, C. (2022). Biomechanical validation of structural optimized patient-specific mandibular reconstruction plate orienting additive manufacturing. *COMPUTER METHODS AND PROGRAMS IN BIOMEDICINE*, 224, 17 pages. doi:10.1016/j.cmpb.2022.107023

BOOK (CHAPTER) PUBLICATIONS

- Nagy, K., Gulyás, G. (ed.).
Facial developmental disorders. *PLASTIC SURGERY*. Kossuth Kiadó Zrt.
Hardcover (to be published)
eBook (to be published)
- Shaheen, E., Politis, C., Sun, Y., Lei, T. (2022) Navigation in Orthognathic Surgery.
NAVIGATION IN ORAL AND MAXILLOFACIAL SURGERY (pp 51-60). Springer.
Hardcover 978-3-031-06222-3
eBook N 978-3-031-06223-0

OTHER PUBLICATIONS

- Beckers, R., Govaerts, D., Desmedt, M., Maleux, G., Combes, F., Politis, C. (2022). Extraorale vasculaire anomalieën van de hoofd-halsregio. *TIJDSCHRIFT VOOR GENEESKUNDE JAARGANG 2022* 78(7) pp.597-609 doi.org/10.47671/TVG.77.21.011
- Jacobs, R., Fortin, T. (2022). Les différents niveaux de doses et la qualité d'images en CBCT. *CLINIC*, 43(419), 791-801.
- Lahoud, P., Lauwers, W., Wyatt, J., Ducret, M., Valette, S., Quirynen, M., . . . Ezeldeen, M. (2022). CBCT-based biomechanical models for the study of tooth auto-transplantation outcomes. *JOURNAL OF DENTAL RESEARCH*. Marseille, France: SAGE Publications.
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- Merken, K., Zhang, G., Shaheen, E., Jacobs, R., Politis, C., Bosmans, H. (2022). Implementation, validation and application of a tool for the assessment of the modulation transfer function and noise power spectrum of dental CBCT scanners. *PROC. SPIE 11312, MEDICAL IMAGING 2020: PHYSICS OF MEDICAL IMAGING*, 113122T; <https://doi.org/10.1117/12.2549569>
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D. CHAIRS



*ANTHOGYR-STRAUMANN CHAIR FOR ORAL
AND MAXILLOFACIAL SURGERY
3 YEARS (01.09.2018-30.11.2024)*

The purpose of the Chair is prevention and treatment of neuropathic pain following dento-aveolar and dental implant surgery. Professor Politis is the chair holder and professor Jacobs is the co-chair holder.



*NOBEL BIO CARE CHAIR FOR ORAL AND
MAXILLOFACIAL SURGERY
YEARLY (01.10.2013 - 31.12.2022)*

To support the research concerning the damage of the inferior alveolar nerve during mandibular surgery.



*THE ALEAMED & KLS MARTIN CHAIR FOR
OMFS
3 YEARS (01.08.2019 - 31.07.2025)*

To support research in the field of trigeminal neuropathy in OMFS.

E. DOCTORAL THESIS DEFENSES

OMFS-IMPATh SUPERVISED PhDs

Gu, Y. (2022).

3D-Printed Porous Metallic Scaffold For Maxillofacial Bone Reconstruction.

Ma, H. (2022).

Long-term follow-up and computer-assisted surgery in oral and maxillofacial reconstruction.

Morgan, N. G. A. I. (2022).

Artificial intelligence for segmentation of midfacial structures on cbct images.

Shi, Q. (2022).

Laser Additive Manufacturing of Titanium Customised Implants: Structure Design, Material Process and Performance Optimisation

OMFS-IMPATh COSUPERVISED PhDs

Tarce, M. (2022).

Digital Technologies For Improving Oral Implant Outcome.

Yifei Gu

3D-Printed Porous Metallic Scaffold For Maxillofacial Bone Reconstruction.



Yifei Gu achieved her Bachelor of Medicine and Master of Dental Medicine degrees from West China College of Stomatology, Sichuan University, Chengdu, Sichuan, China (2010 - 2018). She started working as a Ph.D. candidate (OMFS-IMPATh, KU Leuven) in 2018, with Prof. Constantinus Politis, Prof. Reinhilde Jacobs, and Dr. Yi Sun as her (co-)promoters. The research topic for her Ph.D. is related to bone tissue engineering with biomimetic calcium phosphate/BMP-2 coated 3D printed titanium scaffold and biodegradable WE43 alloy scaffold.

Bone tissue engineering is a potentially effective treatment for maxillofacial bone defects. This doctoral thesis aims to fabricate metal scaffolds that are suitable for bone tissue engineering and evaluate the scaffolds' osteogenic ability in animal models. Both the BMP-2 integrated biomimetic CaP-coated Ti-based porous scaffold and the biodegradable WE43 porous scaffold exhibited good osteogenic properties. Translating lab-made methods into clinically relevant products will require a joint effort of clinicians and engineers.

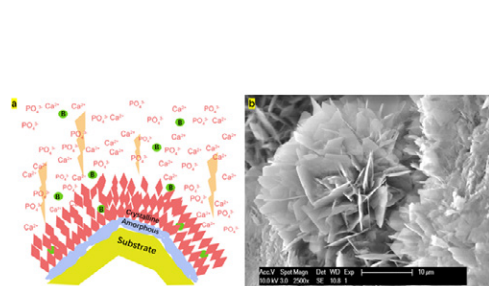
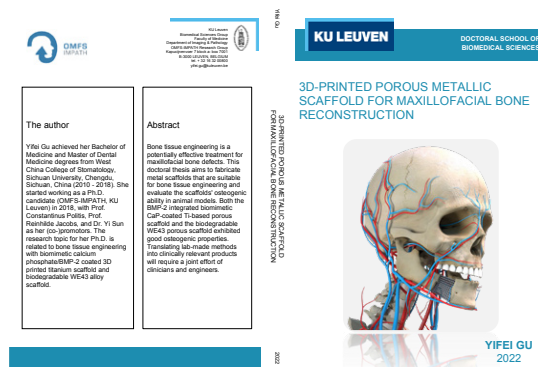
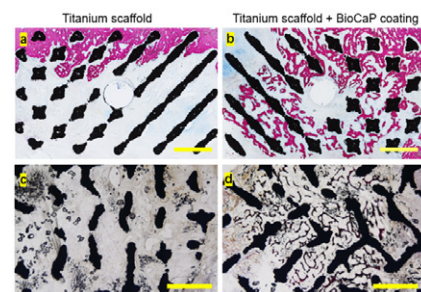


Illustration of the BMP-2 integrated biomimetic CaP coating. a, the coating is composed of the substrate layer, the amorphous CaP layer, the crystalline CaP layer and the integrated BMP-2 molecules (B); b, the coating under SEM examination: the surface of the coating is composed of needle/plate-like, nano-scaled CaP crystallites.



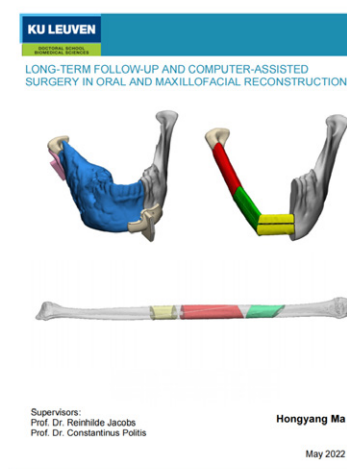
Bone regeneration results of the titanium scaffold and the scaffold with BMP-2 integrated biomimetic CaP coating in the mandibular bone defects (a-b) and muscle pouches (c-d) of beagle dogs.

Hongyang Ma

Long-term follow-up and computer-assisted surgery in oral and maxillofacial reconstruction.



Hongyang Ma born on August 8th, 1991, obtained his Bachelor of Dental Medicine and Surgery from Harbin Medical University and Master degree of Oral and Maxillofacial Surgery in the Department of Oral and Cranio-maxillofacial Surgery, Ninth People's Hospital, Shanghai Jiao Tong University School of Medicine. Currently, he is a PhD candidate (OMFS-IMPATh, KU Leuven, Belgium) with Prof. Dr. Reinhilde Jacobs as his promoter and Prof. Dr. Constantinus Politis as his co-promoter. His research topic for PhD is the "Long-term follow-up and computer-assisted surgery in oral and maxillofacial reconstruction".



Reconstructive maxillofacial surgery following tumor resection, trauma, osteonecrosis, and other infectious diseases is vital for restoring facial aesthetics, function, oral rehabilitation and improving the patient's quality of life (QOL). With the advent of computer-assisted surgery (CAS) and three-dimensional (3D) printing, the reconstructive surgical accuracy and patient- and surgery-related outcomes have significantly improved. Additionally, CAS has also played a vital role in improving oral rehabilitation by increasing the predictability of replacing missing teeth with both first- and second-stage dental implant placement in the grafted region. Thereby, making CAS an indispensable tool for reconstructive surgery.

An 80-year-old female oral cancer patient after CAS. Virtual surgical planning (A). Computer-assisted surgical templates design (B). Preoperational preparation and 3D model printing (C). Computer-assisted surgery performance (D). An 80-year-old female oral cancer patient after CAS. Virtual surgical planning (A). Computer-assisted surgical templates design (B). Preoperational preparation and 3D model printing (C). Computer-assisted surgery performance (D).

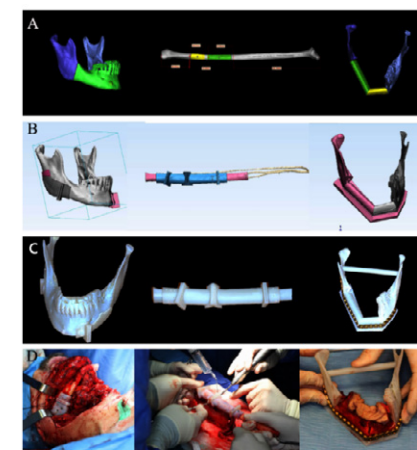


Figure 2. An 80-year-old female oral cancer patient after CAS. Virtual surgical planning (A), computer-assisted surgical templates design (B), preoperational preparation and 3D model printing (C), and computer-assisted surgery performance (D).

Nermin Morgan

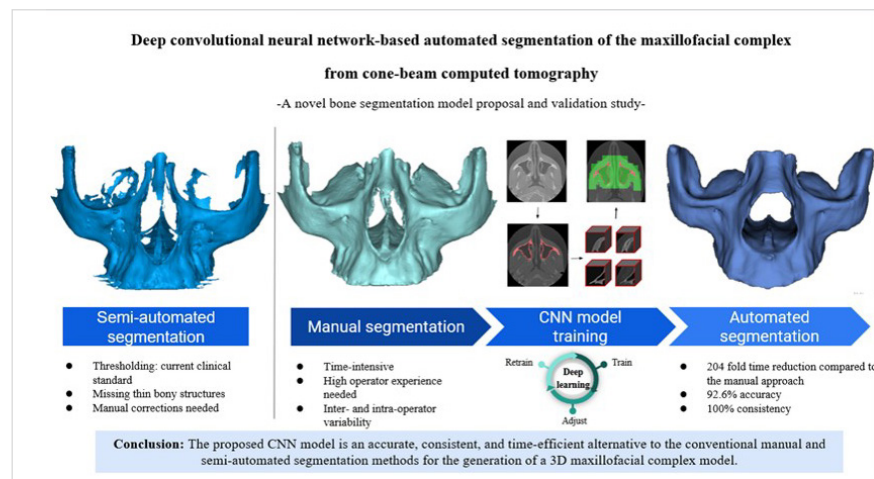
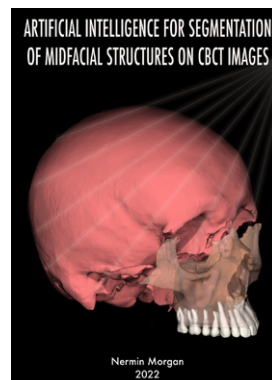
Artificial intelligence for segmentation of midfacial structures on CBCT images.



The author of this PhD manuscript, Nermin Morgan, obtained her degree in Bachelor of Dental Surgery (B.D.S.) from the Faculty of Dentistry, Mansoura University, Egypt (2007–2012), followed by an internship year at the faculty clinics. After her graduation, she worked there as a teaching assistant in the department of Oral radiology and Diagnostic sciences (2013–2019). Meanwhile, she has earned her master's degree of Oral Diagnosis and Radiology (2017). The same year, she became a radiology specialist at the Ministry of Health in Cairo, Egypt. Her research work has focused on Cone Beam CT (CBCT) and its different clinical applications in the maxillofacial region. From June 2019 till December 2022, she was a PhD researcher in the OMFS-IMPATh research group, with Prof. Dr. Reinhilde Jacobs as her

scientific promoter. The research topic for her PhD was focused towards automated segmentation of midfacial structures on CBCT images and its applications in clinical practice. During her PhD studies, she also achieved her degree in Postgraduate studies in advanced medical imaging at KU Leuven, Belgium.

The first and most essential step in the majority of digital dental workflows is image segmentation in order to generate 3D models of the dentomaxillofacial structures; any flaw in this step would contribute towards the accumulation of error in the later steps. This doctoral thesis aimed, firstly, to develop a CNN-based deep learning tool for automated 3D segmentation of the midfacial structures on CBCT images. Secondly, to incorporate these automated virtual 3D models in clinical applications to assess their performance in the digital workflow. The outcomes of this thesis showed that the CNN models could act as a plausible alternative to conventional manual and semi-automated segmentation approaches and have the ability to improve the final treatment outcome and further enhance the level of patient care.

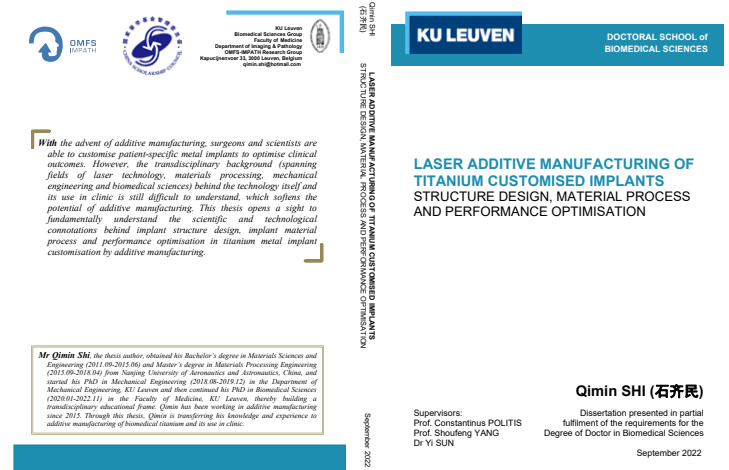


Qimin Shi

Laser Additive Manufacturing of Titanium Customised Implants: Structure Design, Material Process and Performance Optimisation



Mr Qimin Shi, the thesis author, obtained his Bachelor's degree in Materials Sciences and Engineering (2011.09-2015.06) and Master's degree in Materials Processing Engineering (2015.09-2018.04) from Nanjing University of Aeronautics and Astronautics, China, and started his PhD in Mechanical Engineering (2018.08-2019.12) in the Department of Mechanical Engineering, KU Leuven and then continued his PhD in Biomedical Sciences (2020.01-2022.11) in the Faculty of Medicine, KU Leuven, thereby building a transdisciplinary educational frame. Qimin has been working in additive manufacturing since 2015. Through this thesis, Qimin is transferring his knowledge and experience to additive manufacturing of biomedical titanium and its use in clinic.



With the advent of additive manufacturing, surgeons and scientists are able to customise patient-specific metal implants to optimise clinical outcomes. However, the transdisciplinary background (spanning fields of laser technology, materials processing, mechanical engineering and biomedical sciences) behind the technology itself and its use in clinic is still difficult to understand, which softens the potential of additive manufacturing. This thesis opens a sight to fundamentally understand the scientific and technological connotations behind implant structure design, implant material process and performance optimisation in titanium metal implant customisation by additive manufacturing

Mihai Tarce

Digital technologies for improving oral implant outcome



Dr Tarce is a periodontist and software engineer. He is currently clinical assistant professor of Periodontology & Implant Dentistry at The University of Hong Kong. Dr Tarce completed his postgraduate (2021) and PhD (2022) training at KU Leuven in Belgium and has since been appointed visiting professor of Periodontology & Oral Microbiology at the same university. In 2015 he was the recipient of the ITI scholarship at the Centre for Oral Clinical Research, Queen Mary University of London, where he is currently an Honorary Clinical Research Fellow. He has previously worked as a consultant in the Periodontology department at University Hospitals Leuven, Belgium and before that at the San Paolo university hospital in Milan, Italy.

Digital technologies are pervading all aspects of modern dentistry, including implant dentistry, and are causing a noticeable change in treatment options and outcomes. Technologies include, among others, imaging modalities used for diagnosis and treatment planning, virtual planning and computer-aided design, as well as various online tools. The field is quickly evolving, and research is sometimes lagging behind clinical applications. More evidence regarding these technologies may broaden their applicability and improve their predictability, allowing for more targeted, patient-specific treatments, potentially reducing the invasiveness of procedures, as well as preventing unnecessary interventions.

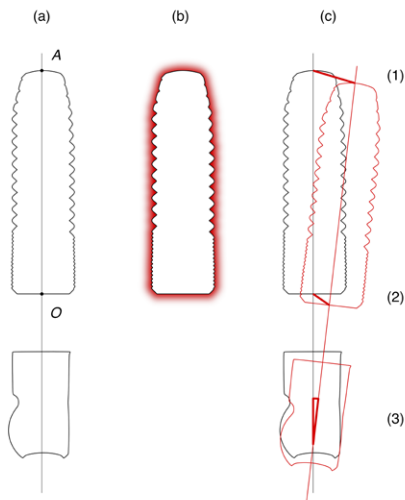
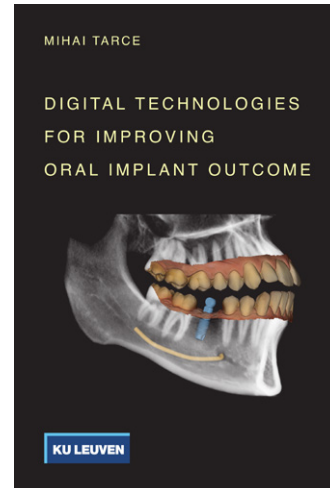


Illustration of the sources of measurement error when determining implant position: blooming artifacts when using CBCT scans (b), and deviation in intraoral scan body registration (c). Measurements were defined as deviation at implant apex (1), deviation at implant shoulder (2) and deviation angle (3), based on previous work by Van Assche et al. (2012).

4

Lecturing

A. SCIENTIFIC CONTRIBUTIONS AT CONGRESSES

- Oral presentations
- Poster presentations

B. INVITED LECTURES

A. SCIENTIFIC CONTRIBUTIONS AT CONGRESSES

ORAL PRESENTATIONS

- Aerden, T., Bila, M., Willaert, R., Coropciuc, R., Schoenaers, J., Vranckx, J., Matricali, G., Politis, C. (2022)
Donor-site morbidity after fibula free flap harvesting.
KBVSMFH Spring Meeting, 19 March 2022, Sheraton, Brussels, Belgium
- Aerden, T., Regeer, J., Bila, M., Willaert, R., Coropciuc, R., Meeus, J., Politis, C. (2022)
The evidence behind multidisciplinary team meetings in head and neck oncology: patient and pathology selection.
KBVSMFH Autumn Meeting, 26 November 2022, Sheraton, Brussels, Belgium
- Brijs, K., Coropciuc, R., Dormaar, T., Legrand, P., Bila, M., Willaert, R., Segers, C., Politis, C. (2022)
Bisphosphonates and monoclonal antibodies in oral pathology in children.
KBVSMFH Spring Meeting, 19 March 2022, Sheraton, Brussels, Belgium
- da Costa Senior, O., Moors, W., Willaert, R., Bila, M., Coropciuc, R., Politis, C. (2022)
Relapse following segmented Le Fort I osteotomy.
KBVSMFH Spring Meeting, 19 March 2022, Sheraton, Brussels, Belgium
- de-Azevedo-Vaz, S. L., Mota, V. P. d., Braga, M. S., Loss, A. A., Rosetti, E. P. (2022)
Misfit detection at the implant-abutment interface in the esthetic region: implications of radiographic technique and misfit magnitude
XVIII European Congress of DentoMaxilloFacial Radiology, 8-10 June 2022, Lublin, Poland
- De Moor, A., Willaert, R., Bila, M., Coropciuc, R., Meeus, J., Politis, C. (2022)
Volume-outcome relationships in surgical procedures
KBVSMFH Autumn Meeting, 26 November 2022, Sheraton, Brussels, Belgium
- El Bachaoui, S., Willaert, R., Bila, M., Coropciuc, R., Politis, C. (2022)
Ophthalmologic complications after midfacial trauma and reconstructive surgery: a 10-year retrospective analysis.
KBVSMFH Spring Meeting, 19 March 2022, Sheraton, Brussels, Belgium
- Fontenele, R. C., Gerhardt, M. D. N., Picoli, F. F., Van Gerven, A., Nomidis, S., Willems, H., Freitas, D. Q., Jacobs, R. (2022)
Artificial intelligence driven tool for automated maxillary alveolar bone segmentation on cone-beam computed tomography
XVIII European Congress of DentoMaxilloFacial Radiology, 8-10 June 2022, Lublin, Poland
- Fontenele, R. C., Gerhardt, M. D. N., Picoli, F. F., Van Gerven, A., Willems, H., Freitas, D. Q., Jacobs, R. (2022)
Segmentação do osso alveolar maxilar baseado em redes neurais convolucionais
13° National Congress of the Oral Radiology Brazilian Association (CONABRO), 26-28 October 2022, Goiânia-Goiás, Brazil
- Gabriel Gava Sauchuk, J., Rosado, L., Clara Rodrigues Pinheiro, M., Oliveira Santos, N., Jacobs, R., Cavallini Cavenago, B., Teles Rodrigues, C. (2022)
Influência de artefatos em Tomografia computadorizada de feixe cônico de canais obturados com istmo.
14° Congresso Internacional da Sociedade Brasileira de Endodontia – SBENDO, 16 November 2022, University of São Paulo, Brazil

ORAL PRESENTATIONS

- Gaêta-Araujo, H., Ferreira Leite, A., Faria Vasconcelos, K., Jacobs, R., Oliveira-Santos, C. (2022)
Avaliação de preditores radiográficos para ocorrência de MRONJ
13° National Congress of the Oral Radiology Brazilian Association (CONABRO), 26-28 October 2022, Goiânia-Goiás, Brazil
- Garip, M., Coropciuc, R., Beuselinck, B., Willaert, R., Bila, M., Meeus, J., Jacobs, R., Politis, C. (2022)
Risk of medication-related osteonecrosis of the jaw (MRONJ) after dental extractions in patients receiving bone-modifying agents: a retrospective study of 240 patients.
KBVSMFH Spring Meeting, 19 March 2022, Sheraton, Brussels, Belgium
- Geusens, J., Bila, M., Coropciuc, R., Willaert, R., Meeus, J., Politis, C. (2022)
Surgery for oral cavity cancer: Who's in charge?
KBVSMFH Autumn Meeting, 26 November 2022, Sheraton, Brussels, Belgium
- Govaers, L., da Costa Senior, O., Mulier, D., Shaheen, E., Jacobs, R., Politis, C. (2022)
Indications and challenges of revision orthognathic surgery – a case series.
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Automated detection of mandibular canal and its anterior loop by deep learning.
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Implant supported facial epitheses: clinical decisions, surgical workflow and pitfalls
Symposium Het aangezicht en zijn reconstructie, 22 April 2022, Maastricht UMC, The Netherlands

POSTER PRESENTATIONS

Elgarba, B. (2022)

Fast and accurate deep learning driven model for automated dental implant segmentation on CBCT
EAO congress, 29 September – 1 October 2022, Geneva, Switzerland

PO-137

BASIC RESEARCH

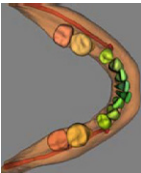
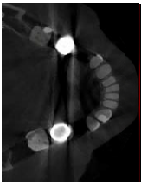


Abstract

CBCT-based implant planning depends on the accuracy of converting the image data into an integrated virtual 3D model. This process requires optimal segmentation of hard anatomical structures, which is often time consuming. Furthermore, image segmentation is often affected by artifacts from high-density objects, such as implants and crowns.

Clinical significance: The developed cloud-based AI-driven tool could offer a solution for presurgical planning of CBCT images, suffering from artifacts caused by available implant rehabilitations.

Key-words: Artificial intelligence, Machine learning, Computer neural networks, Three-dimensional imaging, Deep learning, Dental implant, Implant dentistry.



Background and Aim

Background: CBCT images and intrascan scans are used for building the 3D virtual patient during implant planning, there are many obstacles which are facing accurate segmentation of real patients' data¹. One of the crucial obstacles is the blooming effect from high density objects (titanium and zirconium) which may compromise the actual size of the bone next to the implant impact the actual size of anatomical structures².

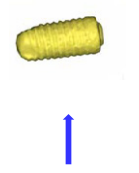
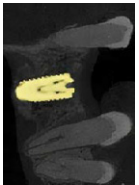
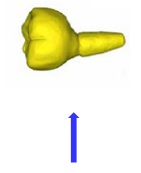
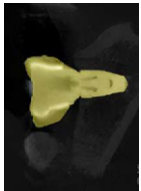
Aim: Is to build up a CNN prediction model for automatic segmentation of implant features and crowns or abutments, which is mainly to eliminate the effect of the artifacts from the metal bodies in the CBCT ((tissue, abutment, and crown) in cases where implants are already present in the neighboring of the planning site.

Fast and accurate deep learning driven model for automated dental implant segmentation on CBCT
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^bDepartment of Prosthodontics, Tanta University, Tanta, Egypt. ^cDepartment of Oral and Maxillofacial Surgery, University Hospitals Leuven, Leuven, Belgium. ^dDepartment of Dental Medicine, Karolinska Institute, Stockholm, Sweden



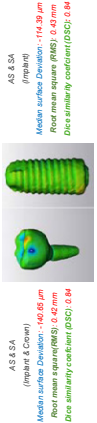
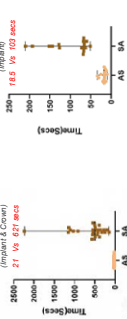
Methods and Materials

A total of 320 CBCT scans obtained from patients needing additional implant placement were recruited for development, training, and validation of a novel deep learning tool for automated implant and crown/abutment segmentation³. These CBCT scans were further divided into two groups depending on the presence of an intra-oral scan (IOS); group 1 (200 CBCT scans) with IOS scans and group 2 (120 CBCT scans) without IOS scans. For both groups, training relied on expert-based manual segmentation of available implants and supra-structures using Mimics (version 24.0, Materialise N.V., Leuven, Belgium). When IOS was present (group 1), segmentation was done following CBCT and IOS registration. After training of the cloud-based platform (Visual Patient Creator, www.elgarba.com), validation was performed randomly on unseen scans (80 CBCT scans with implants and/or supra-structures in place). Voxel level and surface-based annotations used for assessment of segmentation accuracy⁴.



Results

The cloud-based artificial intelligent (AI) tool allowed achieving a fast (<30s) and accurate blooming-free segmentation of existing implants and crowns on presurgical CBCT image data, irrespective of different shapes and densities of the existing implant rehabilitations.



Conclusion

Fast, precise, and artifact-free segmentation of the existing implants and crowns simultaneous with AI-based segmentation of jaws, teeth, nerve and maxillary sinus allowed uncompromised planning of additional implants on CBCT images.

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Presented at



Elgarba, B. (2022)

Novel deep learning-driven model for virtual dental implant patient creation from CBCT images
Oral Health Sciences Department Day KU Leuven, 22 November 2022, GC Europe, Heverlee, Belgium

KU LEUVEN

Bahaaeldeen M. Elgarba^{a,b}, Stijn Van Aelst^a, Abdullah Swaity^a, Reinhilde Jacobs^{a,d}

Novel deep learning-driven model for virtual dental implant patient creation from CBCT images

Objectives

Is to develop and validate a cloud-based tool for automated segmentation of dental implants and supra-structures on CBCT to allow accurate and time-efficient elimination of artifacts caused by implant rehabilitations (Fig. 1).

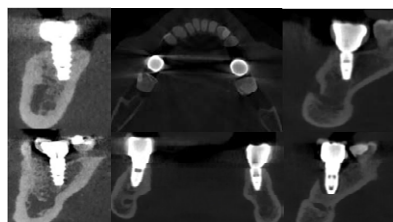


Fig. 1: Shows different implants with artifacts in different sections.

Clinical significance

The developed AI cloud tool could offer a solution for the presurgical planning of CBCT-images, without misleading measurements of buccal and cortex bone. It can aid in the diagnosis and future treatment plans of peri-implantitis and implant failure cases (Fig. 2).

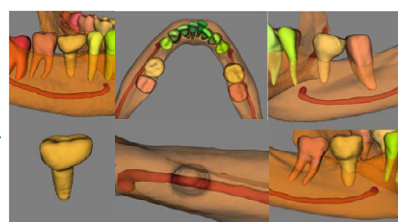
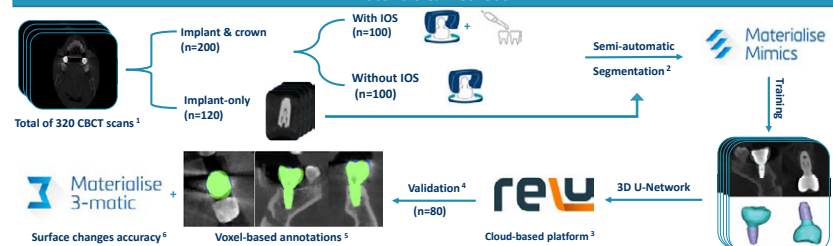


Fig. 2: Shows the clinical applicability of implant and crown segmentation.

Materials & Methods



Results

The cloud-based AI tool allowed for achieving a fast (<30s) and accurate blooming-free segmentation (DSC=84%) of existing implants and crowns on presurgical CBCT image data, irrespective of different shapes and densities of the existing implant rehabilitation (Fig. 3&Table 1).

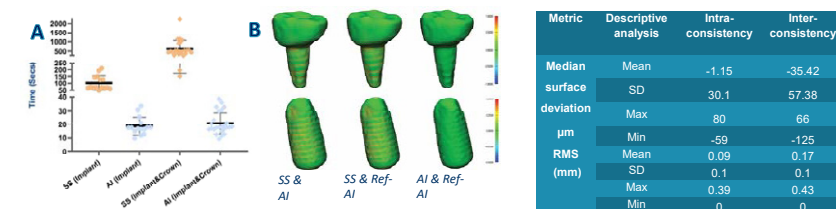


Fig. 3: Shows segmentations time comparison (A) between semi-automatic SS & AI and surface change analyses (B) between SS, AI, and refined-AI segmentations.

Conclusion

Fast, precise, and artifact-free segmentation of the existing implants and crowns simultaneous with AI-based segmentation of jaws, teeth, nerve, and maxillary sinus allowed uncompromised planning of additional implants on CBCT images.

^a OMFS IMPATH Research Group, Department of Imaging and Pathology, Faculty of Medicine, KU Leuven, & Department of Oral and Maxillofacial Surgery, University Hospitals Leuven, Belgium, Leuven, Belgium; ^b Department of Prosthodontics, Tanta University, Tanta, Egypt; ^c Department of Dental Medicine, Karolinska Institute, Stockholm, Sweden; ^d NewTom Vgi Evo and 3D Accutomo 170 CBCT machines; ^e Mimics (Version 24.0, Materialise NV, Leuven, Belgium); ^f https://creator.research; ^g Mimics software (version 23.0, Materialise NV, Leuven, Belgium); ^h MeVisLab (version 3.5.0, MeVis Research, Bremen, Germany); ⁱ 3-Matic software (version 15.0, Materialise NV, Leuven, Belgium).

Fontenele, R. C., Picoli, F. F., Pinto, J. C., Coudyzer, W., de Faria Vasconcelos, K. (2022)
Viabilidade da tomografia computadorizada de contagem fótons para avaliação endodôntica
13º National Congress of the Oral Radiology Brazilian Association (CONABRO),
26-28 October 2022, Goiânia-Goiás, Brazil



PP725258 – VIABILIDADE DA TOMOGRAFIA
COMPUTADORIZADA DE CONTAGEM FÓTONS PARA
AVALIAÇÃO ENDODÔNTICA

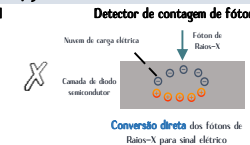
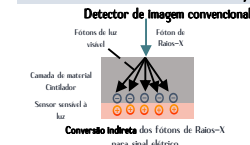
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INTRODUÇÃO / JUSTIFICATIVA



OBJETIVO

Avaliar a performance da tomografia computadorizada de contagem de fótons (TCCF) em comparação com dois aparelhos de tomografia computadorizada de feixe cônico (TCCF) para visualização de tarefas endodônticas desafiadoras

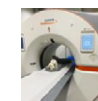
MATERIAIS E MÉTODOS

Estudo aprovado pelo Comitê de Ética em pesquisa da Universidade Católica de Leuven (Número de Protocolo – NHO19 2019-09-03)

1 Fantoma e Aquisição das imagens



Micro-TC Industrial
Molar inferior
(Delta apical, istmo e Trincas radiculares)
Pré-molar inferior
(Canal radicular estreito)



TCCF
0,200 mm voxel: 8 x 8 cm
FOV: 120 kVp: 64 mfs;
0,85 mSv Dose Efetiva

TCCF – Accutomo 3D
Protocolo alta-resolução (FR):
0,08 mm voxel: 4 x 4 cm FOV;
90 kVp: 154 mfs: 0,04 mSv
Dose efetiva:
Protocolo padrão: 0,125 mm
voxel: 8 x 8 cm FOV: 90 kVp:
154 mfs: 0,13 mSv Dose efetiva

TCCF – NewTom Vgi
a) Protocolo FR: 0,100 mm voxel: 5
x 5 cm FOV: 110 kVp: 24,96 mfs;
0,01 mSv Dose efetiva
b) Protocolo Padrão: 0,125 mm
voxel: 8 x 8 cm FOV: 110 kVp: 20,96
mfs: 0,03 mSv Dose efetiva

2 Avaliação das imagens

05 diferentes reconstruções multiplanares foram selecionadas para cada tarefa avaliada totalizando 100 reconstruções de imagem (5 reconstruções x 4 tarefas avaliadas x 5 aparelhos)

5 reconstruções de imagem selecionadas ao mesmo nível nas diferentes modalidades de imagem testadas

3 Radiologistas Odontólogos deram um escore para cada uma das reconstruções aleatoriamente dispostas:
1 – Imagem apropriada;
2 – Imagem aceitável;
3 – Imagem inapropriada
Reavaliação após 30 dias

RESULTADOS

Concordância intra- (0,83 – 0,91) e interoperador (0,82 – 0,95) quase perfeita

Tabella 2. Valores de moda quanto à capacidade de visualização das estruturas de interesse endodôntico

Tarefa de avaliação	FR					Padrão	
	Referência	TCCF	Accutomo	NewTom	Accutomo	NewTom	
Delta	1+	2-3	1+	3	2	2-3	
Canal estreito	1+	1+	1+	2	2	2	
Istmo	1+	1+	1+	1-2+	2-3	3	
Tarefas agrupadas	1+	1+	1+	2	2	2	
Trincas	1+	2	1+	3	3	3	

* Indica similaridade estatística com a imagem de referência

CONCLUSÃO

A TCCF e o aparelho Accutomo 3D no protocolo FR apresentaram similar performance à imagem referencial para visualização de estruturas endodônticas delicadas.

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Ivkovic, U. (2022)

Application of COAM as a Novel Strategy for Hydrogel Functionalization with Chemokines: Towards Chemokine-Mediated Dental Tissue Regeneration

Oral Health Sciences Department Day KU Leuven, 22 November 2022, GC Europe, Heverlee, Belgium



Application of COAM as a Novel Strategy for Hydrogel Functionalization with Chemokines: Towards Chemokine-Mediated Dental Tissue Regeneration

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Introduction — Tissue repair and regeneration and the cells that guide the immune system can be modulated. In this study, we aimed to evaluate the effect of the chemokine-binding and antimicrobial polymer, chlorite-oxidized oxanylose (COAM), in the delivery of chemokines for dental pulp repair and regeneration.

Materials and Methods — Chemokine (SDF-1/CXCL12 and MCP-1/CCL2) binding to COAM was investigated using gel filtration chromatography. The release of COAM of chemokines from fibrin hydrogels was evaluated by enzyme-linked immunosorbent assay (ELISA). The effect of 3D encapsulation in fibrin hydrogels on the immunophenotype of dental pulp stromal cells (hDPSCs) was performed with flow cytometry analysis (FACS). The influence of encapsulation and the presence of COAM and SDF-1/CXCL12 on hDPSCs proliferation was evaluated by FACS. An ex-vivo tooth model was used to investigate the dental pulp reaction to functionalized hydrogels.

Results — In gel chromatography analysis COAM formed a strong binding complex with SDF-1/CXCL12, while this was not observed for MCP-1/CCL2. The formation of this binding complex influenced the patterns of SDF-1/CXCL12 release from fibrin hydrogels. hDPSCs maintained their phenotype after seven days of encapsulation. However, a CD34+ population emerged in all experimental groups. The presence of COAM and SDF-1/CXCL12 did not affect the proliferation pattern of encapsulated hDPSCs.

Conclusion — COAM formed a binding complex with SDF-1/CXCL12 leading to it delayed chemokine release from fibrin hydrogels. Binding to COAM can be promising strategy for chemokine & cytokine delivery for dental tissue engineering.

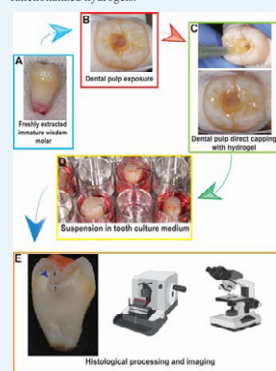


Figure 1: Ex-vivo human tooth-culture-pulp-capping assay

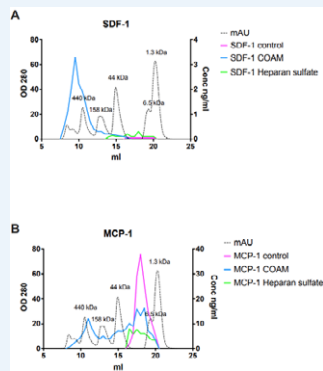


Figure 2: Chemokine binding assay. (A) Formation of a binding complex between COAM and SDF-1/CXCL12 (B) absence of a binding complex between COAM and MCP-1/CCL2 as well as heparan sulphate

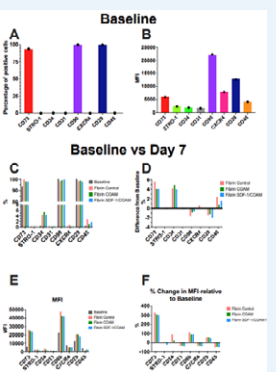


Figure 4: FACS characterization and analysis. (A) Percentage of positive cells for the corresponding antibodies. (B) Median fluorescent intensity (MFI) as expressed at baseline. (C-F) Phenotype characterization after harvesting the cells at D7 from the hydrogels compared to baseline

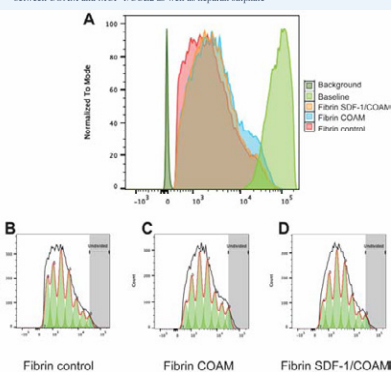


Figure 5: Effect of encapsulation and different hydrogel formulations on hDPSC proliferation (A) Distribution of signal intensity for labeled cells at baseline, the three experimental groups and un-labeled cells (B-D) Proliferation models for cells harvested from the three experimental groups

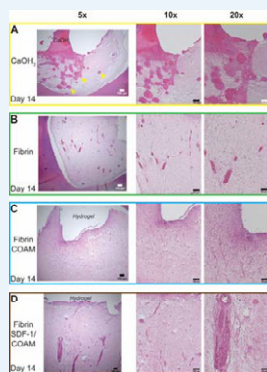


Figure 6: Dental pulp cells response to functionalized hydrogels after 14 days (H&E staining)

Li, J. (2022)

A patient-specific approach for orthognathic surgery to prevent complications in asthmatic subject
International Oral Health Symposium on Innovation, Strategy, and Future Perspectives, 7-8 June 2022, Karolinska Institutet, Sweden, National Dental Centre, Singapore, Tohoku University, Japan, Nanyang Technological University, Singapore, University of Hong Kong, Hong Kong, University of Melbourne, Australia.

Karolinska Institutet

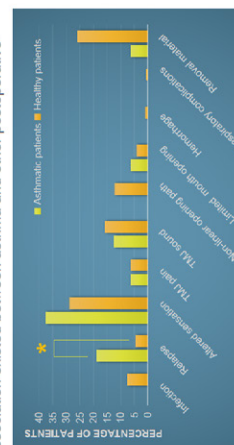
A patient-specific approach for orthognathic surgery to prevent complications in asthmatic subject



Jing Li¹, Soheil Shujaat¹, Jonas Ver Berne¹, Eman Shaheen¹, Constantinos Politis¹, Reinilde Jacobs¹
¹OMFS-IMPATh Research Group, Department of Imaging & Pathology, Faculty of Medicine, KU Leuven and Department of Oral and Maxillofacial Surgery, University Hospitals Leuven, Leuven, Belgium; ²Department of Dental Medicine, Karolinska Institutet, Stockholm, Sweden

Results

- ❖ Sixteen patients were identified as having asthma (male: 6; female: 10; mean age: 25.4 ± 13.3 years), and 278 patients were systematically healthy (male: 105; female: 173; mean age: 25.6 ± 11.8 years)
- ❖ A higher rate of relapse (18.8% and 4.7%) and altered sensation (28.8% and 37.5%) were found in asthmatic patients compared to healthy patients.
- ❖ Following adjustment of other baseline variables, asthma only showed a significant association with relapse (OR=4.704, P=0.027). No significant association existed between asthma and other postoperative



Conclusion

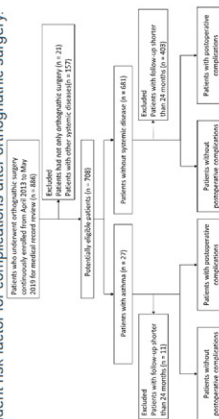
- ❖ Orthognathic surgery needs to be addressed at a patient-specific level.
- ❖ Asthmatic patients have a significantly higher risk of open bite relapse.
- ❖ They should be well informed of the risk of complications and need to be closely monitored following orthognathic surgery to ensure long-term stable outcome.

Introduction

- ❖ Asthma is a chronic respiratory disorder characterized by variable and recurring symptoms, airway obstruction, inflammation, and hyperresponsiveness.
- ❖ Asthmatic patients undergoing surgical interventions are at an increased risk of postoperative pulmonary complications and inflammation compared to the general population.^{1,2}
- ❖ Asthma is one of the most common coexisting medical diagnoses in patients with dentoalveolar deformities undergoing orthognathic surgical treatment.³

Methods

- ❖ A retrospective cohort study was conducted during a 6-year period from April 2013 to May 2019. The sample consisted of asthmatic and healthy patients who underwent orthognathic surgery.
- ❖ Recorded baseline variables were age, gender, type of malocclusion, orthognathic surgical procedure, and bone grafting. The outcome variables included infection, relapse, respiratory complications, hemorrhage, neurosensory disturbances (hypoesthesia, paresthesia, dysesthesia), temporomandibular joint (TMJ) complications, and removal of osteosynthesis material.
- ❖ Bivariate analysis and logistic regression were applied to identify asthma as an independent risk factor for complications after orthognathic surgery.



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3. Cunningham SJ, Miles DN (2009) A national review of mandibular orthognathic surgery activity in the National Health Service in England over a nine year period: Part 2 - patient factors. Br J Oral Maxillofac Surg 47:274-276.

Merken, K. (2022)

A simulation framework with anthropomorphic head model for virtual clinical trials in dental CBCT imaging

ECR (European Congress of Radiology) congress, 13-17 July 2022, Vienna, Austria

A simulation framework with anthropomorphic head model for virtual clinical trials in dental CBCT imaging

Merken K^{1,2}, Marshall NM^{1,3}, Nuyts J^{1,2}, Michelaen K^{1,2}, Jacobs A^{1,2}, and Bosmans H^{1,2}¹KU Leuven, Department of Radiology, Leuven²KU Leuven, Department of Nuclear Medicine, Leuven³KU Leuven, Department of Imaging and Pathology, Medical Physics & Quality Assessment, Leuven

Hildebrandt, Department of Medical Imaging, Tongeren

Merkel K. Nothing to disclose

Marshall N. Nothing to disclose

Nuyts J. Nothing to disclose

Michelaen K. Nothing to disclose

Jacobs A. Nothing to disclose

Bosmans H. Nothing to disclose

Topic: Physics in Radiology - CBCT imaging

PURPOSE OR LEARNING OBJECTIVE:

Over the past two decades, the use of cone beam computed tomography (CBCT) imaging has become increasingly common for various dental applications, including endodontics, implant placement, orthodontic planning and maxillofacial surgery, covering problems such as superimposition and distortion that are associated with 2D imaging [1]. Currently, more than 200 CBCT models are available on the market with different image parameters leading to a wide variety of results in terms of both radiation exposure and clinical diagnostic performance [2–5]. This suggests that optimization of dental CBCT imaging is still in a preliminary stage and needs to be addressed.

Clinical trials have been considered the gold standard for system evaluation and optimization. However, in practice, several difficulties have to be faced, for instance, ethical limitations, fundamental lack of ground truth (i.e. the knowledge of the exact anatomy and pathology, etc.). Virtual clinical trials (VCTs) are becoming a powerful alternative for clinical trials provided that relevant, sufficiently realistic images can be simulated (Fig. 1). One of the challenges in VCTs is to let the ground truth be exactly known. VCTs also have the potential to evaluate new technologies prior to use in clinical practice [6]. The aim of this work was to develop a CBCT simulation platform with anthropomorphic voxel models containing relevant clinical tasks for dental applications to perform virtual clinical trials in dental CBCT imaging.

METHODS OR BACKGROUND:

Clinical task

Diagnosis and treatment of root fractures (RFs) have been known to be a challenging task for dental professionals in daily practice, representing the third most frequent cause of tooth extraction. CBCT imaging has clear potential for RF diagnosis, but currently there is still no consensus on the accuracy of CBCT scans for the diagnosis of RFs. Particularly challenging is diagnosis in the presence of artefacts formed by beam filling materials [5]. Therefore, RF detection has been proposed as the clinical task to focus on for dental CBCT evaluation and optimization.

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Moreno Rabie, C. (2022)

Convolutional neural network for automated classification of osteonecrosis and related mandibular trabecular patterns

Oral Health Sciences Department Day KU Leuven, 22 November 2022, GC Europe, Heverlee, Belgium

Convolutional neural network for automated classification of osteonecrosis and related mandibular trabecular patterns

Catalina Moreno-Rabie^{a,b}, Soroush Baseri Saadi^{a,b}, Tim van den Wyngaert^{c,d}, Reinhilde Jacobs^{a,b,e}^aOMFS-IMPATh Research Group, Department of Imaging and Pathology, Faculty of Medicine, University of Leuven, Leuven, Belgium.^bDepartment of Oral and Maxillofacial Surgery, University Hospitals Leuven, Leuven, Belgium.^cDepartment of Nuclear Medicine, Antwerp University Hospital, Edegem, Belgium.^dFaculty of Medicine and Health Sciences, University of Antwerp, Antwerp, Belgium.^eDepartment of Dental Medicine, Karolinska Institutet, Stockholm, Sweden.

*Shared first authorship

Objective: The present study aimed to develop and validate a tool for the automated classification of normal, affected, and osteonecrosis mandibular trabecular bone patterns in panoramic radiographs using convolutional neural networks (CNNs).

Methods: A dataset of 402 panoramic images from 376 patients was selected, comprising 112 control radiographs, 70 showing thickening of the lamina dura, 128 with abnormal bone pattern, and 92 images of clinically diagnosed osteonecrosis of the jaw (Figure 1).

Four pre-trained CNNs were fine-tuned and customized to detect and classify the different bone patterns. The best performing network was selected to develop the classification tool. The output was arranged as a colour-coded risk index showing the category and their odds. Classification performance of the networks was assessed through evaluation metrics, receiver operating characteristic curves (ROC), and a confusion matrix (Figure 2). Furthermore, Gradient-weighted Class Activation Mapping (Grad-CAM) was employed to visualise class-discriminative regions (Figure 3).

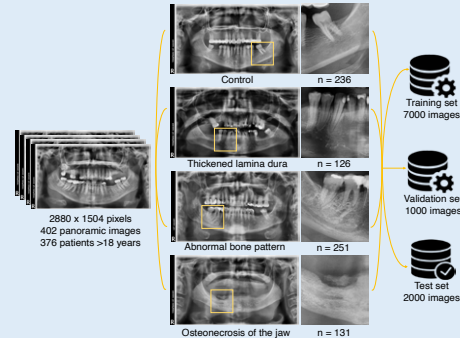


Figure 1. Workflow from image collection to the final number of images used for training, validation and testing of the algorithm. Once collected, panoramic images were classified into different groups, then areas of interest of 512x512 pixels were selected and labelled. Finally, augmentation techniques were performed until the final number of 10000 images was reached.

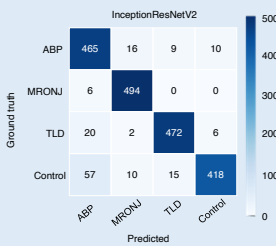


Figure 2. Multiclass confusion matrix of InceptionResNetV2 using the test dataset (2000 images in total, 500 images for each class). The diagonal values refer to the correctly classified images (true positives), and the off-diagonal values depict misclassifications (false positives). Elements were color-mapped according to the maximum and minimum values at the right color-map bar.

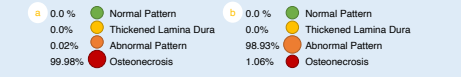


Figure 4. Display of the interface using a panoramic radiograph of a 70-year-old patient presenting with clinical bone exposure in the right posterior mandible. No other lesions were observed on the clinical examination. Once the image is imported, manual selection of different regions of interest (a, b) can be performed. The output will show the category to which the selected trabeculated region belongs together with the corresponding probability in the form of a color-coded index.

Contact information: catalina.moreno@kuleuven.be

Automated prediction of graft volume for maxillary sinus augmentation

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1OMFS-IMPATh, KU Leuven, 2 MKA, UZ Leuven, Leuven, Belgium, 3 Dental Medicine, Karolinska Institutet, Stockholm, Sweden

PO-31

CLINICAL INNOVATIONS

Abstract

Objectives: The aim of this study was to compare a graft volume estimate based on automated sinus segmentation with the actual intraoperative graft volume for lateral sinus floor elevation serving implant placement.

Methods: A retrospective analysis of 30 maxillary sinus CT scans, acquired for pre-surgical planning of lateral window sinus lift were used for sinus graft volume estimation. First, a recently validated CNN model was used to obtain automatic maxillary sinus segmentation. The resulting segmentation was then imported into Mimics Innovation Suite (Materialise N.V., Leuven, Belgium). A height of 13 mm was measured from the alveolar bone crest in the center of the augmented region and the corresponding volume was extracted. The actual intraoperative volume was measured using a sterilized syringe.

Results: The study enrolled 30 patients who needed unilateral sinus lift surgery prior to maxillary implant placement. There was no significant difference between average volume used (144 cm³) and the estimated volume for observer 1 ($p = 0.754$) and observer 2 ($p = 0.791$). A strong positive correlation was found between actual and estimated volume of 0.8 and 0.77 for observer 1 and observer 2, respectively. Inter-observer reliability showed a value of 0.9 implying excellent agreement between observers.

Conclusion: Automatic segmentation of maxillary sinus provided fast, accurate, and consistent 3D virtual models that could be useful in pre-surgical planning of sinus augmentation, facilitating graft volume extraction. The proposed methodology allowed to accurately mimic the placed graft volume giving prior knowledge to material needed before surgery.

Background and Aim

Background: Maxillary sinus augmentation is the surgical technique used to expand the posterior maxillary bone volume by filling the Schneiderian membrane and inserting a bone graft. Adequate preoperative planning of the graft volume may help to avoid sinus over-filling and occluding the ostium, decide on the ratio of bone and bone substitutes to be mixed, and estimate the cost of xenografts prior to the actual operation[2]. It is worth noting that in cases where autogenous graft will be harvested, preoperative knowledge of the amount of graft required is useful in selecting the optimal donor site, reducing time and complexity of the surgical procedures, as well as minimizing the potential postoperative complications[3].

Aim: To compare a graft volume estimate based on automated sinus segmentation with the actual intraoperative volume for cases as signed for lateral sinus floor elevation.

Methods and Materials

Estimation of bone graft volume

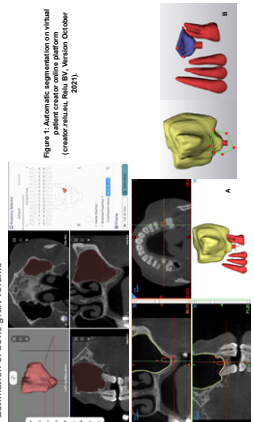


Figure 1: Automatic segmentation on virtual maxillary sinus CT scans (November 2021).

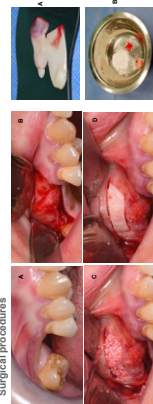


Figure 2: (A) Virtual graft planning in Mimics Innovation Suite (version 23.0, Materialise N.V., Leuven, Belgium). (B) Extraction of planned graft volume in 3D.

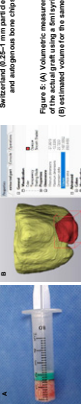


Figure 3: (A) Intraoral appearance of the maxillary sinus. (B) Intraoperative appearance of the maxillary sinus. (C) Intraoperative appearance of the maxillary sinus.

Presented at



Morgan, N. (2022)

Automated prediction of graft volume for maxillary sinus augmentation
EAO congress, 29 September – 1 October 2022, Geneva, Switzerland

Results

Number of the two observers identified any necessary refinements to the automated segmentation, thus the calculation was performed directly.

Table 1 illustrates the descriptive analysis for the actual and estimated volume by both observers.

Descriptive Analysis	Actual volume (Observer 1, cm ³)	Estimated volume (Observer 1, cm ³)	Estimated volume (Observer 2, cm ³)
Mean (SD)	144.0 (53.31)	143.5 (53.35)	144.4 (53.31)

No significant difference was found between the actual and estimated volumes for observer 1 ($p = 0.754$) and observer 2 ($p = 0.791$). A strong positive correlation of 0.83 and 0.82 for observer 1 and observer 2, respectively. Inter-observer reliability showed a value of 0.91 implying excellent agreement between observers.

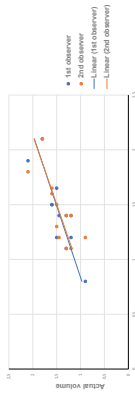


Figure 4: Correlation between actual and estimated volumes.

Conclusion

Automatic segmentation of maxillary sinus provided fast (~24 sec), accurate, and consistent 3D virtual models that could be useful in pre-surgical planning of sinus augmentation, facilitating graft volume extraction. The proposed methodology allowed for an accurate, fast, and reliable simulation of the actual graft volume, providing prior knowledge of material needed before surgery.

References

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Nogueira-Reis, F., Morgan, N., Nomidis, S., Van Gerven, A., Jacobs, R., Tabchoury, C. P. M.
Three-dimensional maxillary virtual patient creation based on integrated segmentation
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Three-dimensional maxillary virtual patient creation based on integrated segmentation of convolutional neural networks

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Salar Amoli, M. (2022)

Development and characterization of pNIPAM-based microgels for drug delivery within dentoalveolar tissue engineering strategies

Oral Health Sciences Department Day KU Leuven, 22 November 2022, GC Europe, Heverlee, Belgium

Development and characterization of pNIPAM-based microgels for drug delivery within dentoalveolar tissue engineering strategies

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KU LEUVEN

Introduction

Maintaining the optimum concentration of growth factors and signaling molecules has an important impact on the outcome of tissue engineering strategies. Consequently, various release systems, either sustained, or trigger-based, have been designed to be incorporated in tissue engineering scaffolds (Eksear et al. 2013). Microgels based on poly-N-isopropylacrylamide (pNIPAM) are widely used for delivery applications considering their highly controllable properties. However, synthesis of such microgels involves a wide variety of parameters that can affect the outcome of the drug delivery strategies. This study therefore aims to synthesize pNIPAM based microgels for drug delivery in dentoalveolar tissue engineering, and systematically analyze the effect of different factors on the final properties of the microgels.

Materials and Methods

Methylcellulose was selected as a co-monomer to induce degradability, considering its limited functional groups preventing reactions with the drugs, and novel pNIPAM-methylcellulose microgels were synthesized through a precipitation polymerization process at 45 °C. A 2³ factorial set of experiments was designed to evaluate the effects of (i) material ratio, (ii) crosslinker concentration and (iii) presence of surfactants during synthesis, on final properties of the microgels. The microgels were characterized in terms of their chemical structure through Fourier-transform infrared spectroscopy (FTIR), their size through Dynamic light scattering (DLS), and their volume phase transition temperature (VPTT) through spectrophotometry. Genipin, a natural compound known to promote odontoblastic differentiation of dental pulp stem cells, was used as a model drug and the loading capacity of the microgels was evaluated through a "breathing-in" method followed by centrifugation and spectrophotometry. Factorial statistics were applied to determine the most important parameters affecting the microgel properties.

Results

Material Development

Chemical reaction

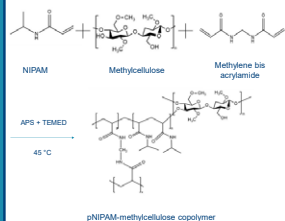


Figure 1. Chemical reaction producing Poly(N-isopropylacrylamide)/methyl cellulose microgel

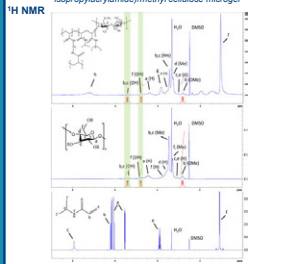


Figure 2. 1H NMR Spectra of the microgel, pNIPAM and methyl cellulose

Reduction in the area under the peaks corresponding to hydroxyl groups of methylcellulose, confirms formation of copolymers of pNIPAM and methylcellulose.

Table 1. The factorial design of synthesized microgel classes

Label	pNIPAM : Methyl cellulose	Methylene-bisacrylamide	SDS
L-2.5	2:1	2.5mol%	0
H-2.5	5:1	2.5mol%	0
L-10	2:1	10mol%	0
H-10	5:1	10mol%	0
L-2.5-S	2:1	2.5mol%	2mM
H-2.5-S	5:1	2.5mol%	2mM
L-10-S	2:1	10mol%	2mM
H-10-S	5:1	10mol%	2mM

CONCLUSION

The results confirmed successful synthesis of pNIPAM methylcellulose microgels. The properties of synthesized microgels were evaluated through a factorial design of experiments. The characterizations demonstrated a volume phase transition in the range of 35 to 42 °C in PBS, in addition to a hydrodynamic diameter ranging from 187 nm to 479 nm. Furthermore, Genipin, as a model drug, was loaded with different efficiencies in the microgels. Statistical analysis determined the crosslinking degree to have the most significant impact on loading capacity of the microgels. Furthermore, a sustained release of genipin from the microgels was observed within one week. In addition, absence of any toxicity resulting from exposure of dental pulp stem cells to microgels was confirmed. Taken together, the results of this study, obtained through a systematic analysis of parameter effects, can serve as a solid basis for the development of drug delivering pNIPAM-methylcellulose microgels for dentoalveolar tissue engineering applications.

This work is part of KU Leuven
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32nd Annual Conference of the European Society of Biomaterials, 4 September 2022, Bordeaux, France

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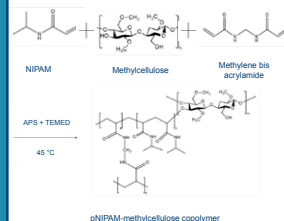


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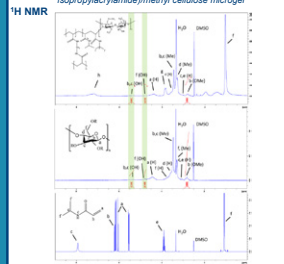


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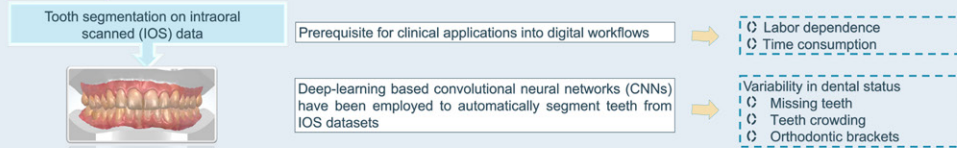
This work is part of KU Leuven
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Wang, X. (2022)
Deep Learning-Based Automatic Tooth Segmentation on Intraoral Scans
 Oral Health Sciences Department Day KU Leuven, 22 November 2022, GC Europe, Heverlee, Belgium



Xiaotong Wang¹, Khalid Ayidh Alqahtani¹, Tom Van den Bogaert¹, Reinhilde Jacobs^{1,2}, Eman Shaheen¹
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Objectives

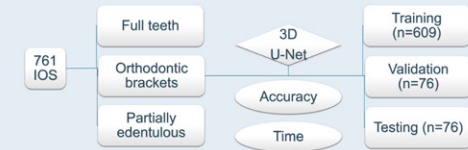


Aim

To design and validate the performance of a deep learning-based CNN model for automated tooth segmentation on IOS images

Methods

1. Design

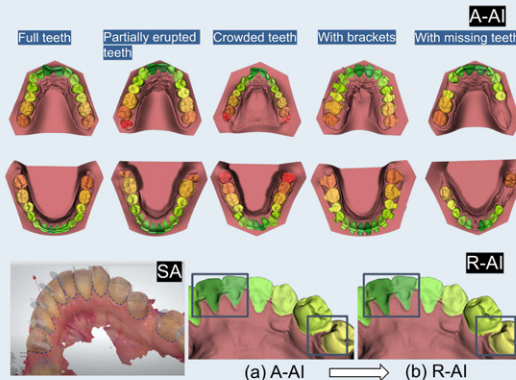


Results

Table 1. AI model segmentation performance (Mean±SD) compared to ground-truth

Dentition group	IoU (%)	DSC (%)	TimingPer jaw (s)
Full teeth	92.2±3.8	95.5±3.2	33.0±7.4
Partially edentulous	89.3±8.0	93.0±7.5	31.2±10.6
Brackets	90.0±3.4	94.6±2.0	28.8±2.5
Average	91.0±5.5	94.6±4.8	31.7±8.1

Fig. 1. A-AI: Example of automated AI segmentation results of upper and lower jaws for the different dentition groups; SA: Semi-automatic segmentation; R-AI: Refined AI segmentation.



2. Evaluate clinical applicability



Fig. 2. Mean time of SA, A-AI and R-AI (min) for upper and lower jaw.

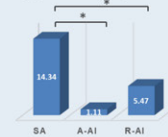


Table 2. Accuracy assessment of A-AI and R-AI vs SA methods (Mean±SD).

Metric	A-AI vs SA	R-AI vs SA
IoU (%)	90.5±4.0	92.5±5.4
DSC (%)	94.9±2.2	96.0±3.1

Table 3. Inter and intra-observer assessment based on ICC values in terms of IoU (%) for SA and R-AI methods.

	Intra-operator consistency	
	SA	R-AI
Full teeth	93.7	98.2
Partially edentulous	95.4	95.5
Brackets	90.9	98.9
	Inter-operator consistency	
	SA	R-AI
Full teeth	92.9	98.3
Partially edentulous	94.2	97.1
Brackets	91.9	98.2

Conclusions

- 3D U-Net for automatic tooth segmentation on IOS images
 - accurate
 - efficient
 - consistent
- AI-cloud platform may act as efficient, accurate and reliable alternative to SA tools in clinical practice.

Xu, L. (2022)
Qualitative Comparison of 3D Face Scanners
 Oral Health Sciences Department Day KU Leuven, 22 November 2022, GC Europe, Heverlee, Belgium



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01 Introduction

Facial morphology and analysis are very critical in various disciplines of dentistry such as craniofacial surgery, maxillofacial surgery, orthodontics, craniofacial orthodontics, prosthodontics, and forensics.

2D photography is not suitable for the detection of facial volumes, deformities, and asymmetries. Modern technologies overcome the limitations of direct anthropometry and 2D photography.

Stereophotogrammetry is currently the most promising method of soft-tissue evaluation. Infrared-Structured Light is the most popular used technique for professional scanners for human bodyface scanning. In general, most scanners had accuracy values that were acceptable for clinical use.

To evaluate the clinical acceptance of 3D facial scanners for clinical application in terms of working time of processing images, convenience and comfortability.

02 Materials & Methods

2.1 Study Population

Inclusion/Exclusion
 Inclusion: Participants with an adult age range of 18-50 years;
 Exclusion: Participants who have facial deformities; Participants who have less compliance to be able to sit still.

2.2 Scanners & Imaging taking
 Face scan obtained from 3D scanners including Vectra H1 (Canfield, New Jersey, USA), RAYFace (raymedical, Gyeonggi-do, South Korea) and Real 2E color 3D scanner (3D-scantech, Hangzhou, China).



2.3 Scanning time & Qualitative assessment

Assessing Method
 6 practitioners, 13 subjects, 4 observers
 Timing, Questionnaire, Subjective (Qualitative) Analysis

Figure 2. Flowchart of the observer's analyses.

2.3.1 For practitioners
 Seven practitioners received hand-on training of three scanners by one expert, and completed 3 times scanning of a same volunteer as well as a questionnaire related to convenience with a 3-point Likert scale (1: Bad, 2: Moderate, 3: Good).

2.6 Statistical analysis
 One-way ANOVA and Turkey test was adopted to evaluate 3D facial scanners in terms of working, convenience and comfortability.

2.3.1 For Subjects
 Volunteers completed a questionnaire related to similarity and comfortability after the scanning. (0: no data, 1: Poor, 2: Moderate, 3: Good, 4: Very Good, 5: Excellent). For the comfort level (1: Bad, 2: Moderate, 3: Good).

Table 2. Questionnaire for subjective assessments.

Table 3. Questionnaire for observers.

Table 4. Practitioners' scores of convenience and similarity assessment of observers.

03 Results

3.1 Scanning/Processing Time with Vectra H1, RAYFace, and iREAL.

The scanning time for RAYFace is the shortest because human face images were taken at one-time with nine in-built cameras in the device. Vectra H1 might have stitching problem which further prolonged the whole processing time.

	Scanning Time (s)	Processing Time (s)	Sum (s)
Vectra H1	20.34 ± 1.45	100.19 ± 6.39	120.53 ± 6.77
RAYFace	9.17 ± 0.23	34.77 ± 4.43	43.94 ± 4.66
iREAL	17.71 ± 0.13	18.19 ± 3.27	35.90 ± 2.1

Table 4. Consuming time of face scanning, processing, and all both.

3.2 Face Scanning with Vectra H1, RAYFace, and iREAL.

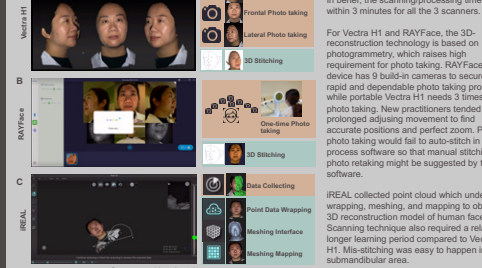


Figure 3. Scanners and imaging taking.

3.3 Three-dimension Reconstruction of Human Face

Image data from Vectra, RAYface, and iREAL were illustrated in Blender program.

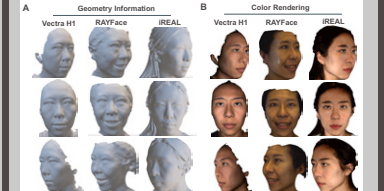


Figure 4. Three-dimensional human face.

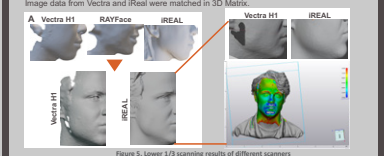


Figure 5. Lower 1/3 scanning results of different scanners.

3.4 Convenience, Comfortability Comparison among Vectra H1, RAYFace, and iREAL.

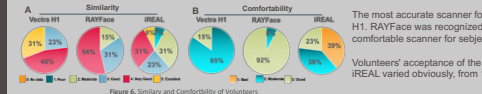


Figure 6. Similarity and Comfortability of volunteers.

3.5 Convenience and Similarity

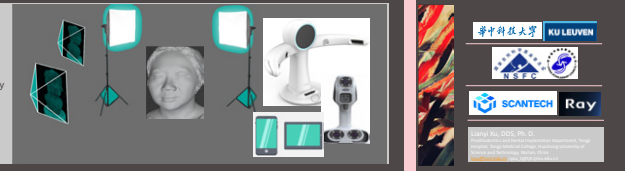
The most accurate scanner for observer was Vectra H1. RAYFace was recognized as the most convenient scanner for subjects.

	Vectra H1	RAYFace	iREAL
Convenience	2	3	1.5
Similarity	3.84±0.55	3.62±0.25	3.64±0.24

Table 4. Practitioners' scores of convenience and similarity assessment of observers.

04 Conclusion

- There are many face scanners on market, which have different advantages and disadvantages.
- Scanners applying photogrammetry technology may obtain better-rendered 3D images, however, the accuracy and scanning details need further improvement.
- For the creation of virtual patients, an ideal scanner should be easy to handle, comfortable for patients, and offer high-quality results.



B. INVITED LECTURES

R. Jacobs K. Bacher	10-1/01/2022	2-day online course on radioprotection in dentistry	PAV Mondgezondheidswetenschappen Leuven, Online
R. Jacobs	10/01/2022	Webinar: Patient and staff dosimetry in dental X-ray imaging	PAV Mondgezondheidswetenschappen Leuven, Online
R. Jacobs	11/01/2022	Webinar: Radioprotection in the dental practice: staff protection.	PAV Mondgezondheidswetenschappen Leuven, Online
F. Van der Cruyssen	28/01/2022	Klinische wijsheden over wijsheidstanden	Benedenti Herentals Herentals, Belgium
C. Politis	01/02/2022	Wondhelingsproblemen in de mond	NIVVT Stiernerheide Genk
C. Politis	05/02/2022	Webinar: Ziekenhuisfinanciering: een artsenperspectief	VBS-GBS Online
R. Jacobs	19/02/2022	Artificial Intelligence (AI)-Driven Molar Angulation Measurements to Predict Third Molar Eruption on Panoramic Radiographs	Journal Club EADMFR Online
C. Politis	22/02/2022	Extracties durven en doen	NIVVT Affligem
C. Politis	08/03/2022	Iatrogene problemen	NIVVT NH Hotel, Brugge
C. Politis	12/03/2022	OSAS bekeken vanuit MKA in 2022 Selected Topics in otorhinolaryngology	AZK voor orthodontisten Leuven
C. Politis	19/03/2022	Disaster of the Master in Orthognathic Surgery	KBVSMFH Lentevergadering Complications, errors and pitfalls in OMFS Sheraton, Brussels, Belgium
C. Politis	24/03/2022	3D printed medical devices – the ultimate customization part 1	26th EAHP Congress EAHP European Association of Hospital Pharmacists Vienna, Austria
C. Politis	25/03/2022	3D printed medical devices – the ultimate customization part 2	26th EAHP Congress EAHP European Association of Hospital Pharmacists Vienna, Austria
C. Politis	29/03/2022	Mijn patiënten hebben implantaten: wat nu?	NIVVT Stiernerheide Genk
M. EzEldeen	29-30/03/2022	3D-printing for CBCT-guided tooth autotransplantation	3D Dental Printing Conference Veldhoven, The Netherlands

M. Salar Amoli	29-30/03/2022	Development, characterization and encapsulation of drug-loaded microgels in bioinks aimed at dentoalveolar bioprinting	3D Dental Printing Conference Veldhoven, The Netherlands
K. Nagy, et al.	31/03/2022	Modern multidisciplinary care for patients with cleft lip and palate	Voice, speech and swallowing therapy course, Faculty of Health Sciences, Semmelweis University Budapest, Hungary
C. Politis	01/04/2022	Ziekenhuisfinanciering : een artsen perspectief	VVMKA St. Niklaas
R. Jacobs	18/05/2022	The Artificial Wonders of CBCT	Virtual Symposium FDCU International Symposium Faculty of Dentistry, Chulalongkorn University (FDCU) Bangkok, Thailand Online
F. Van der Cruyssen	19/05/2022	De heilige drievuldigheid in nervus trigeminusschade	Voorjaarsvergadering NVMKA Putten, The Netherlands
R. Jacobs, K. Bacher, T. Clarijs, R. Pauwels	02-03/06/2022	2-day course on the use of Cone Beam CT for dentomaxillofacial diagnostics	PAV Mondgezondheidswetenschappen De Jacht Heverlee, Leuven
R. Jacobs	08/06/2022	The art of artificial scanning and planning	The International Oral Health Symposium 2022 Karolinska – Singapore – Hong Kong - Melbourne Karolinska Institutet Stockholm, Sweden Online
R. Jacobs	09/06/2022	Imaging beyond imagination	11 th International Congress, 21 th Sardinian Meeting AIO (Associazione Italiana Odontoiatri) Sardegna, Chia Laguna, Cagliari
R. Jacobs	8-10/06/2022	AI in Oral Healthcare + Host Round Table Panel	18 th ECDMFR 2022 Lublin, Poland Online
R. Jacobs	17/06/2022	Radiologie en radioprotectie: toepassingen voor forensische odontologen en DVI	Terugkomdag: Opleiding forensische odontologen Federale Politie DVI, Koningsstraat, Brussel
M. Ezeldeen, R. Jacobs	18/06/2022	Imaging and use of 3D in Paediatric Dentistry: CBCT-guided tooth autotransplantation and inspirations for 3D bioprinting	16 th Congress of the European Academy of Paediatric Dentistry 41 th Iberian Congress Lisbon, Portugal
R. Jacobs	01/07/2022	Workshop Cone Beam CT in de praktijk: basis	PAV Mondgezondheidswetenschappen De Jacht Heverlee, Leuven
R. Jacobs	04/07/2022	Workshop Cone Beam CT in de praktijk: diagnostiek	PAV Mondgezondheidswetenschappen De Jacht Heverlee, Leuven

R. Jacobs	30/07/2022	Artificial intelligence driving CBCT-based surgical planning	ALARID Virtual 2022 ALARID (Latin American OMFR Association) Mexico City, Mexico Online
R. Jacobs	01/09/2022	Workshop Cone Beam CT in de praktijk: presentatie van eigen casus	PAV Mondgezondheidswetenschappen De Jacht Heverlee, Leuven
R. Jacobs	04-05/09/2022	2-day course on radioprotection in dentistry	PAV Mondgezondheidswetenschappen De Jacht Heverlee, Leuven
C. Politis	06/09/2022	Lokale anesthesie voor tandartsen anno 2022	NIVVT Stiemerheide Genk
R. Jacobs	17/09/2022	Een stralend beeld van het gelaat	Symposium radioprotectie AZ Delta Roeselare Roeselare, Belgium
C. Politis	17/09/2022	Zwellingen in het gelaat	NIVVT Stiemerheide Genk
C. Politis	22/09/2022	Locale anesthesie anno 2022	VBT Hotel Serwir, St. Niklaas
C. Politis	22/09/2022	Extracties in de tandheelkunde	VBT Hotel Serwir, St. Niklaas
C. Politis	22/09/2022	Wijsheidstand verwijdering	VBT Hotel Serwir, St. Niklaas
C. Politis	22/09/2022	Wondhelingsproblemen in de mond	VBT Hotel Serwir, St. Niklaas
C. Noffke, E. Raubenheimer	23/09/2022	Webinar: Odontogenic cysts	IADMFR Education Track IADMFR Online
C. Politis	23/09/2022	Facial Asymmetry	IBRA course, Faculty Member BASEL, Switzerland
C. Politis	23/09/2022	SARPE	IBRA course, Faculty Member BASEL, Switzerland
C. Politis	28/09/2022	De medische raad geadviseerd - expert editions: intra en extra murale samenwerking tussen ziekenhuisartsen	VAS Antwerpen-Limburg-Vlaams Brabant Online
C. Politis	07/10/2022	In Patients with reduced bone height <5 mm in the posterior maxilla, Short implants versus Sinus Lift Grafting and regular implants: Bruxism	IAOFR meeting Haarlem, The Netherlands

C. Politis	08/10/2022	Intraoral graft exposure and wound infections - salvage surgery versus open secondary healing	IAOFR meeting Haarlem, The Netherlands
R. Jacobs	08/10/2022	Scanning and planning with the art of artificial intelligence	40 th Panhellenic Dental Congress Renaissance in Dentistry Athens International Convention Center Athens, Greece
R. Jacobs	14/10/2022	The art of artificial scanning and planning	4 th DDS State of the Art Conference Digital Dentistry Rodas Palace Hotel, Rhodes, Greece
C. Politis	14/10/2022	Transverse dimension of the upper jaw: a surgeon's point of view	Club International de Morphologie Grand Marriot, Brussels
C. Noffke, E. Raubenheimer	14/10/2022	Webinar: Fibro-osseous disease	IADMFR Education Track IADMFR Online
F. Van der Cruyssen	20/10/2022	Wijsheden over wijsheidstanden	Post-academische vorming KUL Brugge, Belgium
M. Tarce	20/10/2022	Clinical photography course	Department Oral Health Sciences, KU Leuven Leuven, Belgium
C. Politis	26/10/2022	Cadavercourse TMJ Arthroscopy – open TMJ Surgery	MKA ZOL, KULeuven Vesalius Instituut, Leuven
C. Politis	01/11/2022	Blijvende pijn na tandheelkundige behandelingen: neuropathische pijn	ITI Study Club Oost Nederland Lunteren, The Netherlands
R. Jacobs	04/11/2022	CBCT imaging beyond imagination	4 th International Congress ASSO (Associazione Società Scientifiche Odontoiatriche) Palazzo dell Cultura e dei Congressi, Bologna, Italy
M. Tarce	11/11/2022	Clinical photography course	Postgraduate course, Queen Mary University of London London, UK
K. Nagy	18/11/2022	Cleft Surgery	Department of Pediatrics Training Course Semmelweis University, Hungary
R. Jacobs	21/11/2022	AI in DMFR en MKA-chirurgie	Artificial intelligence: the future is now LVSO Leuven, Belgium
R. Jacobs	25/11/2022	Radiation Protection in Dental Radiology	IAEA Radiation Protection of Patients Unit (RPOP) Online

R. Jacobs	30/11/2022	The art of artificial scanning & planning in Dento-maxillofacial Imaging	METAL IONS 2022 17 th International Symposium on Metal Ions in Biology and Medicine Nehru Science Centre, Mumbai, India Online
R. Jacobs	1/12/2022	Meer kennen van CBCT scannen	Digital Dentistry Belgium Online
R. Jacobs	Sep 2022 – June 2023	How high is radiation dose of CBCT	Dental MOOC DMFR MOOC University of Hong Kong Hong Kong, China Online
R. Jacobs	Sep 2022 – June 2023	Ideal CBCT imaging: case by case optimization	Dental MOOC DMFR MOOC University of Hong Kong Hong Kong, China Online
C. Noffke, E. Raubenheimer	09/12/2022	Webinar: Odontogenic tumours	IADMFR Education Track IADMFR Online
M. Bila	10/12/2022	Update over neo-adjuvante immuuntherapie voor hoofd- en halskanker	VWHHT Knokke, Belgium
R. Jacobs	15/12/2022	CBCT's waar beginnen we? Een update	PAV Mondgezondheidswetenschappen Onderwijs en Navorsing, campus Gasthuisberg, Leuven
P.-J. Verhelst, Cleft Lip and Palate Team UZ Leuven	19/12/2022	Cleft Care, a future perspective	IOMFCOT Leuven, Online
M. Bornstein	22/12/2022	Diagnostic challenges in oral medicine and radiology - webinar	PAV Mondgezondheidswetenschappen Online
M. Bila	22/12/2022	Update on oral cancer for dentists	IOMFCOT Leuven, Belgium

5

3D lab

A. TEAM**B. PROJECTS****C. PUBLICATIONS**

- International peer-reviewed publications
- Book chapter publications

The 3D lab facility was officially introduced in autumn 2014, as an integrated part of the Department of Oral and Maxillofacial surgery at UZ Leuven. Together with the maxillofacial imaging centre, the 3D-lab facility is fully integrated in the workflow of the daily clinic. The work started from simple segmentation and 3D printing of anatomical structures to 3D planning of complex surgeries.

Currently, the 3D lab works in a multidisciplinary team that brings together the expertise of doctors, scientists, engineers to improve care for each individual patient. This closed cooperation enabled the surgeon and patient to maximize the benefits from 3D technology. The focus of our 3D lab is how to integrate 3D technologies in the clinical workflow to develop new medical treatment methods and to carry out clinical research in the field of oral and maxillofacial surgery. This involves computer assisted surgical planning, 3D printing of anatomic models and surgical templates, 3D metal printing of patient specific implant and image-guided surgery.

Technology is evolving very fast. Although 3D printing is still prominent, the applications of artificial intelligence can no longer be ignored. Design within virtual and augmented reality environments is also finding its way into daily practice. At the speed of the current transition, as of next year the 3D-lab should be renamed into VR-lab.

In 2021 the Medical Device Regulatory came into effect as a European directive and has been implemented in European Hospitals. In contrast to the industrial environment no official agency exists to help Hospitals implement these new regulations. These regulatory requirements are deeply affecting patient care and inflict collateral damage, while companies retract existing patient solutions from the market. MDR slows down the efforts to establish point-of-care metal printing facilities in the hospitals. MDR acts mainly as a cost-multiplicator far more than its positive effect on patient quality. Only patients who can afford the increased cost of 3D-constructs will benefit from MDR. In contrast to TÜV in Germany, FAGG is not really helping hospitals to find in-house solutions. Society, at large, can impossibly carry the cost burden of regulatory overload. Hospitals are also gradually starting to realize that they cannot continue to finance the ever-expanding legal departments.

A. TEAM

Constantinus POLITIS

Constantinus Politis is Oral and Maxillofacial Surgeon. He is currently Full Professor and Chairperson of the Department of Oral and Maxillofacial Surgery at Leuven University Hospitals, KULeuven, Belgium. He is an invited Lecturer at the EHSAL in Brussels. He graduated at the Catholic University of Leuven in medicine (MD, summa cum laude), in dentistry (DDS, magna cum laude). He specialized in oral and maxillofacial surgery at the Catholic University of Leuven. Postgraduate training was additionally followed in Arnhem (Stoelinga), Aachen (Koberg), Copenhagen (Pindborg), Göteborg (Bränemark) and San Francisco (Marx). He holds an honorary professorship at the Fourth Medical Military University of Xi'an, China. He also holds a master degree

in management (MM) from the Applied Economic Sciences at the University of Hasselt and a master degree in Hospital Management (MHM) from the Catholic University of Leuven. He became a recognition as medical specialist in management of health care data and is now member of the National Council of Hospital Facilities. He is Vice-President of the Professional Union of Belgian Oral and Maxillofacial Surgeons. He is President of the Belgian Royal Scientific Society of Oral and Maxillofacial Surgery. He is acknowledged trainer of OMFS trainees. He defended his doctor's thesis on the subject of complications of orthognathic surgery (PhD). His professional field of interest is in orthognathic and orthodontic surgery and trigeminal nerve dysfunction. Clinical research projects include prevention and repair of iatrogenic trigeminal nerve injury, transplantation of teeth and orthognathic surgery. He has been granted membership of the Belgian Royal Academy of Medicine.

Researchgate: https://www.researchgate.net/profile/Constantinus_Politis2

Reinhilde JACOBS

Reinhilde Jacobs is dentist, Doctor in Dental Sciences (PhD University of Leuven), periodontologist (KU Leuven) and Master in Dental Radiology (University of London). She is full professor at the University of Leuven and visiting professor at Karolinska Institutet, Stockholm, Sweden and the Dalian Medical University in China. R. Jacobs is heading the omfs impath research group of the KU Leuven (omfsimpath.be) and the clinical center of dentomaxillofacial radiology (UZleuven). She is Secretary General of the International Association of DentoMaxilloFacial Radiology. She is section editor of 5 journals (Journal of Dentistry, Clinical Oral Investigations, International Journal of Oral Implantology, European Journal of Radiology and Oral Radiology). She has received the D

Collen Research Travel Award (1994), a postdoctoral fellowship of the European Commission (1994-95), the IADR Young Investigators Award (1998) and the Belgian Joachim Award in Odontostomatology (1999). In 2013, she received a Dr Honoris Causa at the "Iuliu Hatieganu" University of Medicine and Pharmacy in Cluj-Napoca. She is involved in many multidisciplinary and interuniversity research collaborations, with a specific focus on imaging research, artificial intelligence and bioprinting. She has been actively participating in 5 European projects and is (co-)author of 5 books and more than 560 publications in peer-reviewed journals besides multiple invited lectures and publications in other journals or books. Scopus (2023): h:74

Eman SHAHEEN

Eman (Emmy) Shaheen was born on July 12th, 1982 in Giza, Egypt. She graduated with honor from the faculty of Computer Sciences and Information Technology (2003), Cairo University, Egypt where she also worked as a teaching assistant from 2003 till 2007 with major in Image Processing. Meanwhile, she obtained her Master's Degree in Video Processing (2007) from Cairo University. In 2008, she joined the team of Medical Physics where she finished with distinction her pre-doctoral studies about mammography and breast cancer (2009) in Biomedical Sciences at the KU Leuven, Belgium. She was granted a PhD scholarship from the OPTIMAM project (UK) in 2010 to develop, simulate and validate 3D models of breast lesions and tools to optimize the performance of breast

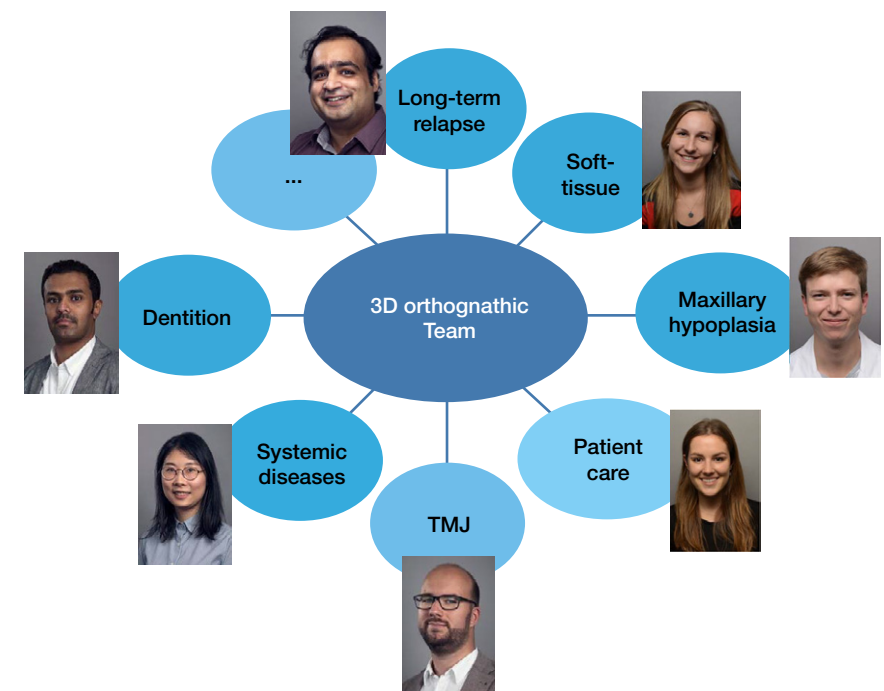
tomosynthesis. She obtained her doctoral degree in 2014, KU Leuven, Belgium. In the same year, she started working in the department of Maxillofacial surgery, University hospitals Leuven (Belgium) with Prof. dr. Constantinus Politis as clinical engineer with focus on 3D planning of orthognathic surgeries. Next to the patient related work, she is part of the research group of the OMFS-IMPATh research group (KU Leuven, Belgium) where she supervises students, supports different research projects related to 3D printing and 3D simulations. She is also collaborating with Materialise (Leuven, Belgium) as consultant to improve the CMF software for orthognathic surgeries next to other research related projects.

Yi SUN

Yi Sun obtained his PhD in Biomedical Sciences, Master of Medical imaging and Bachelor in Electronic Engineering. Since 2007, he worked in the field of computer assistant surgery planning, with focus on oral and maxillofacial surgery. His main professional interest is template-based and image-guided solution for dental implant placement, design of digital splint for orthognathic surgery, orofacial reconstruction using fibular or DCIA flap. Currently he is responsible for the 3D surgical simulation team in the department of oral and maxillofacial surgery (UZ Leuven). His current research interest are: design of patient specific implant, tissue engineering by using 3D printed titanium scaffold and development of image-guided surgical simulation system (navigation system).

B. PROJECTS

- Long-term bone relapse: maxillary relapse and mandibular remodeling
- Soft tissue changes after orthognathic surgery
- Transverse maxillary hypoplasia for orthognathic patients
- Continuous Quality Improvement in orthognathic surgery
- Condylar changes after orthognathic surgery
- Systemic diseases related to orthognathic surgery
- Dental changes evaluation in 3D after orthognathic surgery
- 3D evaluation of airway changes after orthognathic surgery
- Maxillofacial trauma management
- Cost-benefit of in-house designed 3Dprinted reconstruction plates
- VR design and planning in traumatology



C. PUBLICATIONS

INTERNATIONAL PEER-REVIEWED PUBLICATIONS

- Alqahtani, K. A., Jacobs, R., Shujaat, S., Politis, C., & Shaheen, E. (2022). Automated three-dimensional quantification of external root resorption following combined orthodontic-orthognathic surgical treatment. A validation study. *J STOMATOL ORAL MAXILLOFAC SURG.* doi:10.1016/j.jormas.2022.09.010
- Alqahtani, K. A., Jacobs, R., Smolders, A., Van Gerven, A., Willems, H., Shujaat, S., & Shaheen, E. (2022). Deep convolutional neural network-based automated segmentation and classification of teeth with orthodontic brackets on cone-beam computed-tomographic images: a validation study. *EUROPEAN JOURNAL OF ORTHODONTICS*, 6 pages. doi:10.1093/ejo/cjac047
- Alqahtani, K. A., Shaheen, E., Morgan, N., Shujaat, S., Politis, C., & Jacobs, R. (2022). Impact of orthognathic surgery on root resorption: A systematic review. *JOURNAL OF STOMATOLOGY ORAL AND MAXILLOFACIAL SURGERY*, 123(5), e260-e267. doi:10.1016/j.jormas.2022.04.010
- da Costa Senior, O., Peeters, M., Aelterman, N., Mulier, D., Verstraete, L., Verhelst, P. J., . . . Politis, C. (2022). Iatrogenic retroposition of the lips sequel after bicuspid extraction-a retrospective study. *JOURNAL OF STOMATOLOGY ORAL AND MAXILLOFACIAL SURGERY*, 123(4), E178-E185. doi:10.1016/j.jormas.2022.05.025
- De Ketele, A., Meeus, J., Shaheen, E., Verstraete, L., & Politis, C. (2022). THE usefulness of cutting guides for resection or biopsy of mandibular lesions: A technical note and case report.. *J STOMATOL ORAL MAXILLOFAC SURG.* doi:10.1016/j.jormas.2022.08.015
- Dons, F., Mulier, D., Maleux, O., Shaheen, E., Politis, C. Body dysmorphic disorder (BDD) in the orthodontic and orthognathic setting: A systematic review. *J STOMATOL ORAL MAXILLOFAC SURG.* 2022 Sep;123(4):e145-e152. doi: 10.1016/j.jormas.2021.10.015. Epub 2021 Oct 30. PMID: 34728407.
- Dubron, K., Shaheen, E., Vaes, L., da Costa Senior, O., Miclotte, I., Politis, C. Higher need for removal of osteosynthesis material after multi-piece versus one-piece Le Fort I osteotomy: A retrospective study of 339 patients. *J CRANIOMAXILLOFAC SURG.* 2022 Mar;50(3):204-210. doi: 10.1016/j.jcms.2021.12.002. Epub 2021 Dec 6. PMID: 34924278.
- Dubron, K., Van Camp, P., Jacobs, R., Politis, C., & Shaheen, E. (2022). Accuracy of virtual planning and intraoperative navigation in zygomaticomaxillary complex fractures: A systematic review. *JOURNAL OF STOMATOLOGY ORAL AND MAXILLOFACIAL SURGERY*, 123(6), E841-E848. doi:10.1016/j.jormas.2022.07.003
- Dubron, K., Verbist, M., Shaheen, E., Dormaar, T. J., Jacobs, R., Politis, C. Incidence, Aetiology, and Associated Fracture Patterns of Infraorbital Nerve Injuries Following Zygomaticomaxillary Complex Fractures: A Retrospective Analysis of 272 Patients. *CRANIOMAXILLOFAC TRAUMA RECONSTR.* 2022 Jun;15(2):139-146. doi:10.1177/19433875211022569. Epub 2021 Jun 17. PMID: 35633769; PMCID: PMC9133524.
- Gu, Y., Sun, Y., Shujaat, S., Braem, A., Politis, C., & Jacobs, R. (2022). 3D-printed porous Ti6Al4V scaffolds for long bone repair in animal models: a systematic review. *JOURNAL OF ORTHOPAEDIC SURGERY AND RESEARCH*, 17(1), 17 pages. doi:10.1186/s13018-022-02960-6
- Hassing, G.J., The, V., Shaheen, E., Politis, C., de Llano-Pérula, M. C. Long-term three-dimensional effects of orthognathic surgery on the pharyngeal airways: a prospective study in 128 healthy patients. *CLIN ORAL INVESTIG.* 2022 Mar;26(3):3131-3139. doi: 10.1007/s00784-021-04295-8. Epub 2021 Nov 26. PMID: 34826028.

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