ITI Funded Research – Meet the Researchers!

Each year the ITI provides over 2 million Swiss francs to fund pertinent research that will eventually impact the way clinicians practice implant dentistry. These competitive ITI research grants have resulted in the publication of preclinical and clinical research by research teams from all over the world in quality scientific journals.

For more information about ITI research support go to www.iti.org

Dr. Wei-Shao Lin, DDS, is an Associate Professor at the University of Louisville, Department of Oral Health and Rehabilitation, where he currently serves as Director of Clinical Fixed Prosthodontics. In addition to his role in the department's research mission, Dr. Lin teaches fixed, removable and implant prosthodontics at the pre and postgraduate levels. He received his DDS from Chung-Shan Medical University, Taiwan in 2003 and his Certificate in Prosthodontics and Certificate in Surgical Implant Fellowship from the University of Rochester in 2010. Dr. Lin's research interests include clinical dental implant research, ceramic restorations and digital dentistry. He has published numerous research and clinical articles in peer-reviewed journals. Dr. Lin is a Fellow of the International Team for Implantology (ITI) and maintains an intramural prosthodontics practice at the University of Louisville, Dental Associates.

ITI Research Committee Chair Lisa Heitz-Mayfield talks to Dr. Wei-Shao Lin, who in 2015 published his ITI-funded preclinical research project entitled "Effect of implant divergence on the accuracy of definitive casts created from traditional and digital implant-level impressions: an in vitro comparative study."

Lisa Heitz-Mayfield (LHM): How long have you been involved in research and where is your research team based?
Wei-Shao Lin (WSL): I have always been interested in the specialty of prosthodontics as well as research into the disciplines of dental materials, dental implants and associated technology. My initial focus was on the mechanical properties of all-ceramic materials, particular those associated with CAD/CAM technologies. I continued to develop this research interest while completing my residency training and as a faculty member in the Department of Oral Health and Rehabilitation, School of Dentistry, University of Louisville, KY.

Fig. 1: Research team in the Department of Oral Health and Rehabilitation, School of Dentistry, University of Louisville, KY, USA. First Row from left: Drs. Jack Goldberg and Adrien Pollini. Second Row from left: Drs. Bryan Harris, Dean Morton, Wei-Shao Lin and Jang-Ching Chou. Third Row: Dr. Hunter Dawson

Our faculty works together as a team and we have devoted our collaborative research efforts to digital dentistry and especially its application in implant dentistry.

LHM: How did your team choose this topic as your research focus?
WSL: Our research team is primarily a group of practicing specialists and as such we encounter patient care issues on a daily basis. We focus on research opportunities that can change patient care for the better and allow us to identify meaningful recommendations that others may utilize. Implant level impressions, for example, present unique concerns, and digital methods can provide more predictable and accurate solutions. We adapted our clinical treatment protocol to these contemporary technologies at an early stage and our research shares our experiences because the application and accuracy of digital implant-level impressions and/or the resulting cast was not previously widely studied. Dr. Dean Morton, who is the chairperson in our department and chairman of the ITI Section USA, encouraged me to refine the research idea and apply for an ITI Research Grant to support this project. Being awarded a research grant was essential to undertaking the research project and all the investiga-

tors thank the ITI Foundation. Our team would also like to acknowledge Cagenix Inc., Memphis, Tennessee, and Roy Dental Laboratory, New Albany, IN. for assistance in this study. Members of our research team are shown in Figure 1.

LHM: For those readers who are not directly involved in research can you describe how your research project was planned and conducted?
WSL: We initially identified a shortage of research related to the utilization of digital impressions in implant dentistry. There were, however, many digital options for clinicians and our goal was to develop a research strategy that could provide meaningful results and lead to recommendations that could be applied to daily patient care. Prior to applying for the ITI research grant, we reviewed the available literature that would allow the development of a meaningful research proposal. The generous support of the ITI allowed our research to begin in 2011 and it was completed within the proposed time frame in 2013. Brief examples of our study method are shown in Figure 2.

The results indicated that divergence between two implants did not affect the

accuracy of definitive stone casts poured from conventional impressions (p=0.970). We found, however, that divergent implants significantly affected the accuracy of milled master casts fabricated from digital impressions (p<.001). The decreasing linear trend (p< 0.001) in deviations for both distance and angle measurements suggested the digital pathway produced more accurate definitive casts as the two implants became more divergent. When compared with conventional impressions and casts (0° and 15° divergence groups), the digital pathway produced significantly less accurate definitive milled casts. At 30° and 45° divergence groups, the milled casts obtained from the digital pathway showed either no difference or marginal difference when compared with those obtained conventionally.

LHM: How do you think your research findings will help clinicians?
WSL: Implant level digital impressions will continue to improve and develop as part of an evolving complete digital workflow for implant restorations. The digital impression could potentially offer advantages over conventional impression techniques, such as reduced risks of distortion during impression and the cast fabrication process, improved patient comfort and acceptance
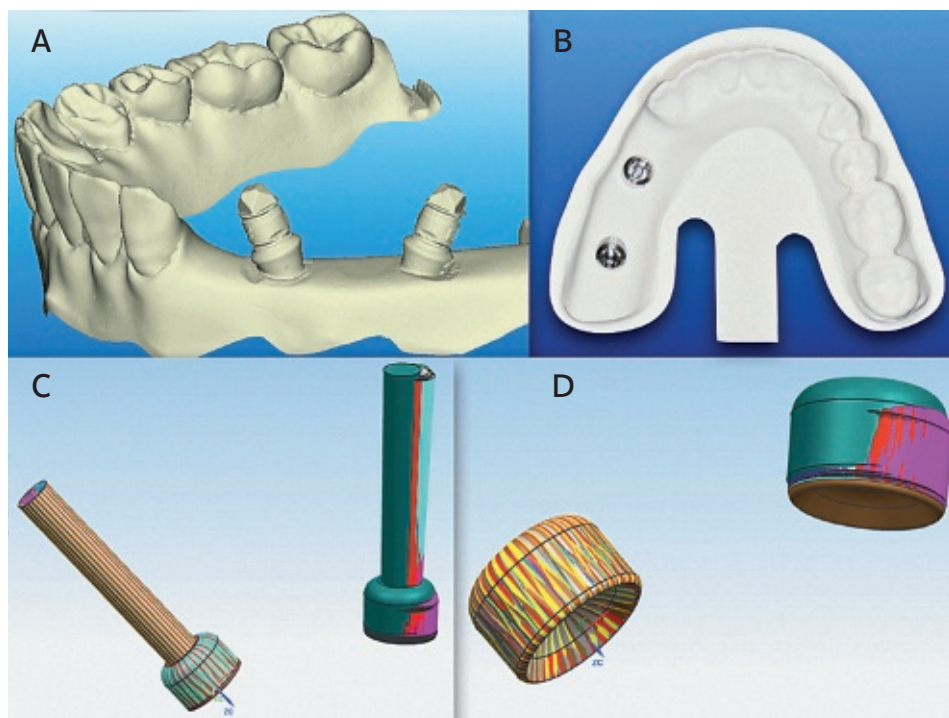
Fig. 2:

A. The test groups with the 2-piece scannable impression copings

B. Definitive milled polyurethane cast

C. A proprietary scanner and proprietary scanning gauge were used to scan the implant position at an accuracy to 1 micron and the distance measurements were taken from the center point of the bottom surface of the virtual mating cylinders

D. Angle measurements were taken from the vertical axes of two mating cylinders

(especially from those with a strong gag reflex), and cost effectiveness from the direct data output as a complete digital workflow. It is important though that the accuracy and reproducibility not be compromised. The accuracy of digital impressions at implant level and the resultant CAD/CAM-fabricated cast have not been widely studied, so our research project can provide insights for clinicians. The conclusion drawn from this research is that the currently available digital pathway produces less accurate definitive milled casts than the stone casts poured from conventional impressions. In order to ensure the passive fit of definitive prosthesis when using a digital workflow clinicians should consider use of verification matrices and modified casts when indicated.

For those readers interested in the details of our research, please see our publication in The International Journal of Oral and Maxillofacial Implants. The article was published in the 2015, volume 30, issue 1, page 102 to 109, and its title is "Effect of implant divergence on the accuracy of definitive casts created from traditional and digital implant-level impressions: an in vitro comparative study."

LHM: Are you planning to be involved in further research in this field?
WSL: Of course! Research is the most important reason why I chose a career in academia and pursue scholarly activities. Furthermore, I am currently involved in many research projects with graduate students and with our ITI Scholars at the University of Louisville. Young collaborative researchers provide us with fresh perspectives for different research ideas. In addition to this particular research grant, our department has been awarded several other research grants by the ITI, and it's our hope that our research team can maintain a productive and positive relationship with the International Team for Implantology (ITI) to promote further advances in digital technology in dentistry.