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digital

international magazine of digital dentistry

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including AI supplement

interview

"Patients always respond favourably to visual information, especially when it involves their mouth!"

case report

Clinical success in guided full-arch rehabilitation using Smilecloud

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Using AI to address oral healthcare inequities requires wide-ranging collaboration

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Magda Wojtkiewicz

Managing Editor

Embracing the future of dentistry: A season of innovation

As the vibrant colours of autumn settle around us, we are excited to welcome you to another issue of digital—**international magazine of digital dentistry** packed with insights, innovations and inspiring stories that reflect the rapid evolution of digital dentistry. Whether you are an early adopter of new technology or cautiously observing from the sidelines, this issue offers something of value for you.

At the heart of this issue is our special artificial intelligence (AI) supplement, exploring how AI is transforming clinical practice and education. In an interview, Drs Ahmed S. Sultan and Zaid H. Khoury, present AI's role as a supportive tool—enhancing practitioners' decision-making rather than replacing it. Their message is clear: AI offers immense potential but must be integrated thoughtfully, seeking to preserve the artistry and human touch that define excellent oral care.

On a related note, Prof. Falk Schwendicke and Dr Sergio E. Uribe discuss in another interview how AI-based tools such as ChatGPT can strengthen dental education. This is an exciting possibility, offering new ways to improve teaching, learning and patient communication—areas critical to the modern dental practice.

The current issue also offers deep dives into relevant topics shaping the dental landscape. In our industry news, we explore the state of the intra-oral scanner market in 2023, covering global trends and leading manufacturers. Case reports, including one detailing a hybrid digital–analogue workflow for a maxillary full-arch prosthesis, demonstrate the real-world applications of new technologies, bridging the gap between innovation and patient care.

Dr Jeremy Ueno, in an article about practice management, challenges readers to rethink what success means in dentistry, moving beyond traditional measures to focus on personal and professional growth. His reflections resonate with the modern dental community's evolving priorities—where the balance between technology, business and well-being is more important than ever.

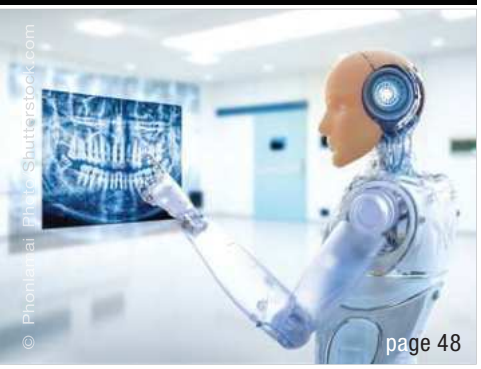
Achieving this balance includes cultivating your knowledge and fostering a supportive community. In that regard, articles in this issue on events such as the Implant Solutions World Summit and the inaugural DDS.Berlin meeting emphasise the importance of continuing education and networking for staying connected with the latest advancements.

We hope this issue encourages you to explore how AI, 3D printing and other digital tools can enhance your practice, improve patient outcomes and provide new avenues for learning and growth. As digital dentistry advances at an ever-faster pace, now is the time to embrace these changes, ensuring that your practice can stay ahead of the curve and deliver the best care to your patients.

Thank you for joining us on this journey through the exciting world of digital dentistry. Enjoy the issue!

Sincerely,

Magda Wojtkiewicz
Managing Editor



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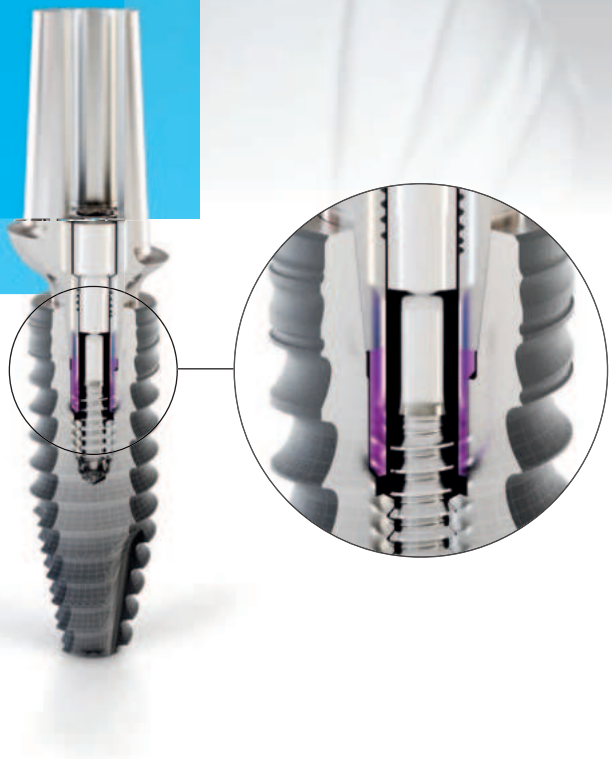

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[1] Semper-Hogg, W, Kraft, S, Stiller, S et al. Analytical and experimental position stability of the abutment in different dental implant systems with a conical implant–abutment connection Clin Oral Invest (2013) 17: 1017.
[2] Semper Hogg W, Zulauf K, Mehrhof J, Nelson K. The influence of torque tightening on the position stability of the abutment in conical implant-abutment connections. Int J Prosthodont 2015;28:538-41.

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Interested parties had two months to comment on a proposed American Dental Association standard that aims to enable comparison of aligners made by different manufacturers.

ADA releases first standard for clear aligner materials

Dental Tribune International

Aligner therapy has revolutionised the treatment of malocclusion; however, regulators have been unable to keep pace with the rapid market expansion. US dental associations played a pivotal role in reigning in direct-to-consumer providers to improve patient safety, and efforts are well under way to regulate the materials used in the aligner manufacturing process. In August 2024, the American Dental Association (ADA) released a draft version of the first national standard on aligner materials. The public had two months to provide feedback on the standard, which aims to provide a framework for characterisation of the mechanical, physical and thermal properties of aligner materials.

The proposed standard mandates specific mechanical testing to enable comparison of the strength and flexibility of aligners made by different manufacturers. It outlines the necessary requirements and test methods for both thermoforming and additive manufacturing materials used in the production of aligners and stipulates requirements for the packaging and labelling of aligners.

Dr Hera Kim-Berman, leader of the project behind the draft standard, commented in an ADA press release: "Clear aligner therapy is widely used in orthodontic treatment. However, there is no dental standard that specifically addresses the characteristics of the materials used to produce orthodontic sequential aligners, neither for thermoformed nor additively manufactured aligner materials." She added: "This makes it difficult for practitioners, patients and regulators to compare them."

The ADA is accredited by the American National Standards Institute to develop standards for dental applications and has been doing so since 1928. According to the ADA, "these standards establish requirements for safe and effective dental products and technologies through a consensus-based process". The ADA Standards Program working groups consist of volunteers who contribute their expertise to the development of standards and represent clinicians, health bodies, academic institutions and the dental industry.

"Developing precise test methods and criteria for key dental materials is essential for researchers, industry professionals and clinicians to better understand and identify their optimal characteristics, ultimately improving patient care," commented Dr Spiro Megremis, chair of the ADA Standards Program Working Group 1.7 on Orthodontic Products, which helped develop the standard.

The proposed standard—American National Standards Institute/ADA Standard No. 188—can be accessed online. Visit ADA.org/dentalstandards to learn about more about the standards programme.

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1 Norton MR, Astrom M. The influence of implant surface on maintenance of marginal bone levels for three premium implant brands: A systematic review and meta-analysis. Int J Oral Maxillofac Implants 2020;35(6):1099-111

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Multilayer materials enhance the efficacy of aligner treatment

An interview with Dr Tarek Elshazly

Anisha Hall Hoppe, Dental Tribune International

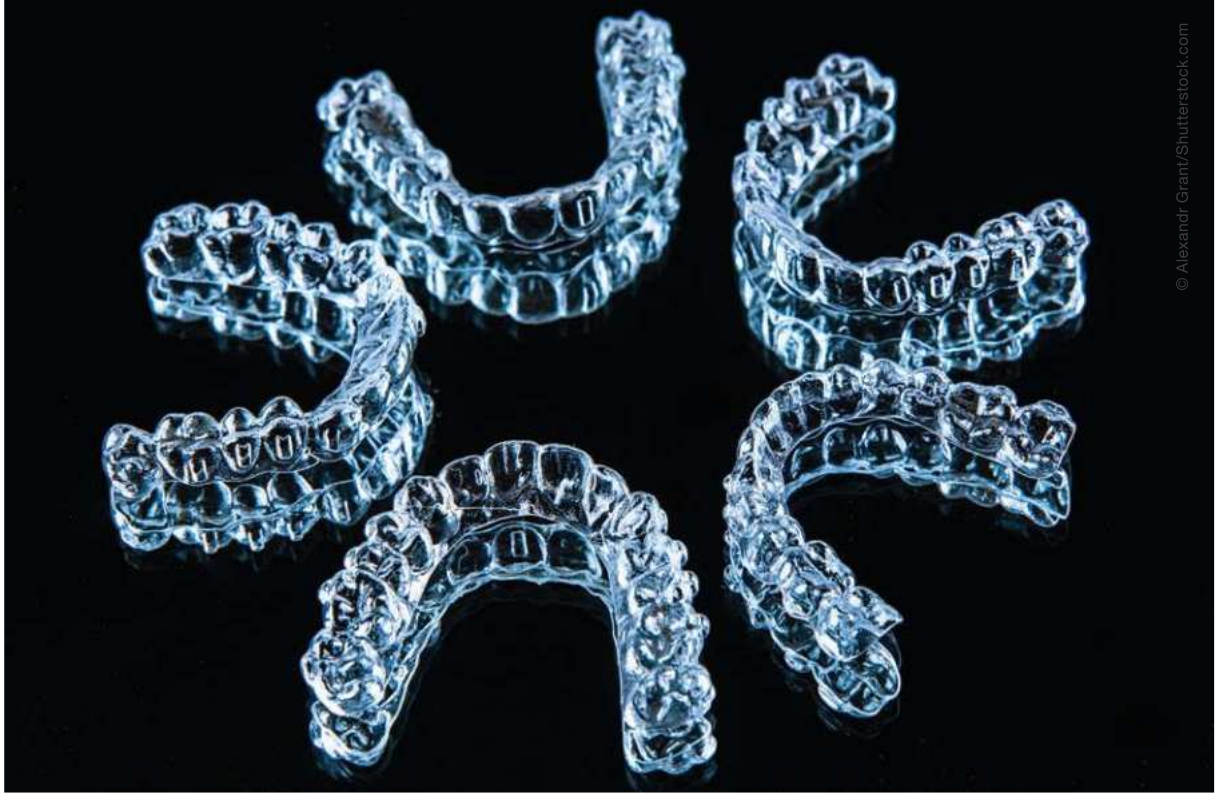
Dr Tarek Elshazly.

According to a recent study, aligner force depends on the type of material and the direction of movement, and multilayer materials are superior to single-layer ones owing to their lower initial force for enhanced patient comfort and their ability to maintain consistent force application even after ageing. Dental Tribune International spoke with lead author Dr Tarek Elshazly, who conducted wide-scale research on different aligner materials at the University Hospital Bonn in Germany, about the implications of the research findings on orthodontic treatment with aligners.

Dr Elshazly, could you tell our readers a bit about your background and how you ended up in the very specific research area of materials development for dentistry?
I am a dentist with a strong interest in materials engineering. I earned my bachelor's degree in dentistry from Ain Shams University in Cairo in Egypt, where I also completed a master's degree in dental biomaterials. After this, I moved to Germany to pursue a doctoral degree (Dr. med. dent.) and a PhD in oral technology at the University of Bonn. To identify a suitable and novel research topic for my PhD, I reviewed the literature extensively and brainstormed ideas. I discovered that the use of aligners was gaining significant global traction as a promising alternative to traditional orthodontic treatments. However, there were still notable drawbacks and limitations associated with the materials used and the biomechanical behaviour of these appliances. This led to my focusing my PhD research on this topic under the supervision of Prof. Christoph Bourauel, a renowned scientist in dental biomechanics. As part of my research, we collaborated with various companies to test new and innovative materials, employing different techniques and specialised methodologies to study the forces generated by these aligners.

In your research you found that there was a significant reduction in force transmission after 48 hours of thermal and mechanical ageing of aligner materials. Do these findings hold significance for the schedule of wearing aligners?
We are constrained not only by the aligner material but also by the periodontal ligament. Orthodontic tooth movement occurs through a biomechanical process within the periodontal ligament and bone when an appropriate force is applied to the tooth. Therefore, the ideal scenario is to use a material that can consistently apply the optimal force over the desired time frame. Based on our research, we suggest changing the aligner every week or seeking a material capable of maintaining the necessary force over a longer period. Otherwise, the force is most effective only during the first few days of use—typically two or three—after which the aligner merely functions as a retainer.

Some researchers argue that this is acceptable because tooth movement primarily occurs within the first few days and that the aligners are only needed to maintain the new position to allow for bone resorption over the remainder of the period, usually ten days to two weeks. In my opinion, it would be more effective



New research on dental materials has shown that aligners made with multiple layers could lead the way to improved treatment times and potential benefits for the environment.

to change the aligner weekly. However, this approach would lead to increased material consumption, raising costs and negatively affecting the environment. The best solution would be to develop a superior material that can sustain the necessary force for a longer duration. Multilayer materials have been introduced relatively recently to address some of the limitations of single-layer materials. While they are not yet ideal, they do offer better force sustainability.

Could you explain a bit more about the specific benefits of using multilayer materials over single layer materials, and should clinicians consider changing their choice of materials?

The type of material used does not significantly alter the overall process. Typically, aligners are quite rigid during the first few days as they move the teeth. However, multilayer materials are more flexible, offering greater comfort, whereas, in our research, we showed that single-layer materials provide better control over tooth movement. Based on these findings, we recommend using a combination of two materials for each single step. Treatment should start with a multilayer material for one week, followed by a single-layer material for another week or just three days. This approach enhances movement control and maintains the necessary force. I believe that Angel Aligners is already implementing this technique.

Are there any new topics of research in materials development on the horizon that you are particularly excited about?

What concerns me most right now is the high consumption of plastic in the aligner industry, which is why we are actively seeking solutions. One potential solution is to use 3D-printed shape memory materials to reduce material waste. This approach would also allow for better control over the design, leading to improved tooth movement, increased treatment accuracy and fewer refinements and thus minimising the need for retreatment to achieve optimal alignment. By ensuring precise control of tooth movement from the outset, we can reduce the number of aligners required and, consequently, the amount of material wasted.

“What concerns me most right now is the high consumption of plastic in the aligner industry.”

Another area of great interest to me is the development of recyclable aligner materials. I recently encountered an American company at a dental show that has innovatively introduced an eco-friendly, recyclable thermoformed aligner material. I haven’t found any research on this material in the literature yet, so we are planning to initiate studies on it soon.

Editorial note: The study, titled “Effect of thermomechanical ageing on force transmission by orthodontic aligners made of different thermoformed materials: An experimental study”, was published on 18 June 2024 in Orthodontics and Craniofacial Research*, ahead of inclusion in an issue.*