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3D printing

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Dr George Freedman

Editor-in-chief

3D printing: Unveiling the future of dentistry

The digital transformation of dentistry is driving the profession faster than any previous technological revolution. It is transforming and reconfiguring the clinical practice of dentistry before our eyes. A change that was expected to take decades is now projected to unfold in a matter of years, or mere months. The innovations are startling. They are game-changing. They affect everyone. These massive dental paradigm shifts can be considered frightening or joyously astounding. The practitioner, educator, manufacturer or distributor who has the latter response will embrace these innovations and adapt them for the advancement of patient treatment and oral health.

Digital dentistry is truly a worldwide phenomenon. The research, discoveries, adaptations and applications seem to spring up anywhere and everywhere that bright minds focus on current problems and future solutions. The key is to bring these visionaries, producers and consumers together so that they can catalyse each other to improve the developmental process, facilitate the path of manufacturing and deliver the finished product to the practitioner. Dental Tribune International's 3D printing **magazine** has been at the forefront of shaping the written medium for communication and networking in this novel technology environment, both online and in hard copy, since 2021. Pertinent articles, highlighting the leaders in 3D development and their innovative clinical applications of the newest products, have made 3D printing a must-read for every forward-looking dentist. The magazine's regular buyers' guides, alternately comparing the latest printers and the newest printing materials, are an indispensable tool for the practitioner seeking to stay at the cutting edge.

As evidenced by the experience of many decades, the best setting to supercharge and empower revolutionary progress is a live meeting. This is the environment wherein creative thinkers and intrepid industry leaders combine their efforts to move the profession forwards, effectively and efficiently. The Digital Dentistry Show, the biennial international platform for all things digital in dentistry (www.dds.berlin), will be held at the Arena Berlin events space in Germany on 28 and 29 June. With over 30 speakers, more than 120 exhibitors and well over 2,000 registrants, the Digital Dentistry Show will assemble the best and the brightest in the field. The Digital Dentistry Show promises to provide a unique setting enabling communication and collaborative interaction by the designers of software platforms, technologies and materials in a research and development space where the terminology is standardised and mutually comprehensible.

The Digital Dentistry Show will serve as an incubator through which researchers, developers and manufacturers can begin to establish a broadly recognised and internationally accepted framework of measurements, standards and guidelines canvassing the existing leadership of 3D printing at various levels. The most important goal is to formulate a basis for industry-wide compatibility, one that provides adequate headroom for flexibility and growth that can reasonably accommodate foreseeable (and perhaps unforeseen) upcoming developments and will build the bridge of continuity between the present and the future.

See you at the Digital Dentistry Show in Berlin, where we will be unveiling the future of dentistry.

Dr George Freedman
Editor-in-chief

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Ongoing growth of the global clear aligner market

Dr Kamran Zamanian & Federica Cogoni, Canada

The global clear aligner market was valued at approximately US$5.2 billion (€4.8 billion) in 2022 and is expected to grow at a double-digit rate in the coming years. This growth is being driven by the advantages and popularity of aligners, the rise of alternative and less expensive options offered by direct-to-consumer (D2C) aligner companies, and the expansion of the market to general dentists.

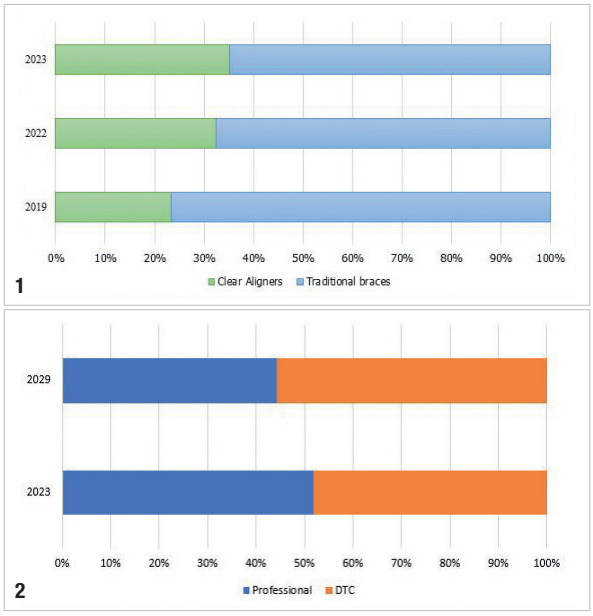

Fig. 1: Share of patients using traditional braces and clear aligners in 2019, 2022, and 2023, according to iData Research. **Fig. 2:** iData clear aligner research shows that the market share of D2C aligners is forecast to increase. *(Images: © iData Research)*

Invisible, practical, comfortable: The main advantages of aligners

Advertising, teleworking, video meetings and social media play important roles in the beauty economy, driving the belief that the appearance of the face and upper body determines beauty and acceptability to others and encouraging the pursuit of straighter teeth and an attractive smile. Aligners are a proposed solution for treating varying degrees of reverse overjet, cross bite, overbite and open bite.

If their malocclusion permits the choice, patients prefer aligners over fixed appliances because the solution comes with multiple advantages. The obvious one is that they are barely visible compared with fixed appliances. Aligners can be removed when eating or drinking, whereas with fixed appliances patients may have limitations on the type of food that they can eat. Sticky or hard food can be a problem. Their removability also promotes hygiene maintenance and gingival health. Significantly better gingival health has been observed in patients using aligners.[1]

Additionally, wearing aligners requires less care by dental professionals. As the tooth movement is pre-planned by the dental professional, dental appointments are simpler

and assistance from an orthodontist may not be required during each appointment. In comparison, an orthodontist may need to make appliance adjustments, for example to the archwires, every three to four weeks.

Aligners offer greater treatment comfort. Fixed appliances can irritate the oral tissue, whereas aligners only cause some discomfort when new trays are worn owing to the extra pressure applied. Patients treated with fixed appliances report greater discomfort and consume more analgesics than patients treated with aligners do.[2] Fear of pain is one of the primary reasons that patients fail to seek orthodontic care, and pain has a negative effect on patient compliance.

The business model adaptation of D2C

Patients may be discouraged by the high cost of aligners. By cutting out in-person dental supervision and monitoring, D2C companies offer treatment for considerably less than the cost of an in-office procedure. Proponents of D2C orthodontics argue that the low cost of D2C aligners makes tooth alignment accessible to a greater number of individuals. However, D2C companies have been criticised for their inability to adequately treat malocclusion. In 2018, the American Dental Association passed a resolution against D2C tooth alignment,[3] and the American Association of Orthodontists has publicly cautioned against the practice via a consumer alert and has filed legal complaints with 36 dental boards against SmileDirectClub, the leading D2C aligner company.[4]

In order to regain trust and improve their reputation, D2C companies have changed their business model. Whereas the D2C business model previously involved no visits to a dentist or an orthodontist, it is now common for D2C aligner patients to consult either an orthodontist or a general dentist who is employed by the company for an intra-oral scan. This adaptation to the business model results in higher costs for the patient. Customers will still receive their aligners through the mail.

SmileDirectClub, for example, is introducing the CarePlus aligner offering this year, which offers customers the possibility of consultations with their treating dentist in-person or via the company's teledentistry platform. This programme targets higher-income customers and offers them a hybrid approach including remote and in-person care. The CarePlus offering was priced at US$3,900 (€3,600) when the pilot programme was launched in the first quarter of this year, and further expansion is planned throughout the year.

Expansion of the aligner market to general dentists

Some orthodontists are sceptical about the efficacy of aligners in treating malocclusion. In some cases, for greater efficacy, patients need to switch from aligners to fixed appliances during the course of treatment. For example, one in six patients switched from aligners to fixed appliances to finish treatment because the aligner treatments could not adequately achieve certain tooth movements or correct common malocclusions.[5]

Aligner companies are therefore expanding their products to general dentists for treatment of mild malocclusions or those requiring less complicated movement. Align Technology continues to increase its presence globally by making its Invisalign products available to more customers in more countries. Among other growth strategies, the company is seeking to enable general dentists, who have access to a larger patient base than orthodontists do, to easily identify potential cases they can treat with the Invisalign system and monitor patient progress while providing high-quality restorative, orthodontic and preventive oral care. Align is accomplishing this strategy by providing training and clinical education to general dentists and by offering digital tools such as iTero scanners.

Conclusion

The aligner market is forecast to grow at a double-digit rate in the coming years, and that growth is expected to be driven by the popularity and practicality of aligners, along with various efforts by companies to expand their market share. Although D2C companies have been criticised for addressing malocclusion inadequately, they are adapting their business model to involve consultations with dental professionals. Considering the sceptical stance taken by some orthodontists towards aligners, treatment providers are planning to expand their businesses to general dentists who have larger patient bases than orthodontists do.

Editorial note: Please scan the QR code for the list of references.

about

Dr Kamran Zamanian is CEO and founding partner of iData Research. He has spent over 20 years working in the market research industry with a dedication to the study of dental implants, dental bone grafting substitutes, prosthetics, as well as other dental devices used in the health of patients all over the globe.

Federica Cogoni is a research analyst at iData Research. She develops and composes syndicated research projects about various fields within the medical device industry.

How far has 3D printing brought clear aligners?

Dental Tribune International

In the dynamic field of orthodontics, the advent of clear aligners has marked a significant leap forward, marrying aesthetics with functionality to offer patients an appealing alternative to fixed appliances. A new comprehensive review delves into the burgeoning realm of 3D-printing technology and its use in the fabrication of aligners. For dental professionals striving to stay abreast of cutting-edge research and developments, the peer-reviewed synopsis provides an insightful overview, encapsulating the evolution, methodologies and future prospects of aligner technology.

In addition to covering the historical technological development leading to today's aligners and the associated CAD/CAM technology, the review offers a brief refresher course on 3D-printing technology. Among the various 3D-printing methods, such as stereolithography, digital light processing (DLP) and fused deposition modelling—which offer unparalleled benefits in terms of customisation, speed and cost-effectiveness—DLP stands out for its suitability in aligner production owing to its ability to achieve high accuracy and optimal material properties for dental applications.

However, the clinical efficacy of aligners is contingent upon a myriad of factors, encompassing mechanical properties, such as elasticity, force delivery and resilience, as well as the precision of fit and accuracy. The review underscores the paramount importance of these factors in achieving desired orthodontic outcomes, highlighting the need for continuous material innovation and process optimisation.

Challenges in aligner therapy, including the management of complex tooth movements and the maintenance of material properties in the oral environment, are addressed with a forward-looking perspective. The review advocates for a multidisciplinary approach, leveraging advancements in materials science, digital dentistry and biomechanical understanding to surmount these hurdles.

Aligner technology is poised to harness the potential of emerging materials and 3D-printing techniques, promising further refinements in treatment efficiency, predictability and patient satisfaction. Innovations such as smart materials capable of dynamic force application and the integration of teledentistry for remote monitoring are envisioned to redefine orthodontic treatment approaches.

For dental professionals, the review offers a concise yet comprehensive understanding of current trends, challenges and future prospects, equipping them with the knowledge to navigate the evolving landscape of orthodontic treatment. As the field continues to advance, embracing these innovations will be instrumental in delivering superior patient care and achieving optimal treatment outcomes.

Editorial note: The study, titled "Advancements in clear aligner fabrication: A comprehensive review of direct-3D printing technologies", was published online on 29 January 2024 in Polymers.

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