Invisalign Q&A with Simon Beard, Senior Vice President and Managing Director, Align Technology EMEA

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**In-office welding by Nd:YAG laser**

By Prof. Carlo Fornaini & Prof. Caroline Bertrand, France

**Introduction**
Just after the introduction of the first laser by Maiman in 1960, there was a very fast evolution of this new technology, characterised by constant progression in techniques and applications, increasing the possibility to have smaller and cheaper devices and introducing ever-new wavelengths. Laser welding was first introduced in the jewellery industry during the 1970s and soon after successfully used by dental technicians as well. The first lasers used were the carbon dioxide and Nd:YAG lasers, but the market was rapidly conquered by the second, owing to the results that could be obtained with it.1, 2

Laser welding offers a great number of advantages compared with traditional welding. Firstly, the laser device saves time in the commercial laboratory because all welding is done directly on the master cast. Inaccuracies in assembly caused by transfers from the master cast along with investment are reduced.3 The possibility of welding very close to acrylic resin or ceramic parts with no physical (cracking) or colour damage.4 This means it is possible to save time and money during the restoration of broken prostheses or orthodontic appliances. Because it is not necessary to remake the non-metallic parts, this welding technique may be used on every kind of metal, but its property of being very active on titanium makes it particularly advisable for prostheses supported by endosseous implants.5

Many laboratory tests have demonstrated that laser welded points have a high reproducible strength for all metals, consistent with that of the substrate alloy. All these advantages led to this method being extensively used in dental technicians’ laboratories and stimulated companies to put on the market increasingly upgraded appliances. Some aspects, such as large dimensions, high costs and delivery systems, today still characterise those machines that use fixed lenses, strictly limiting their use to dental technicians’ laboratories.

The aim of this study is to show, through the description of a series of clinical cases, the utilisation of a laser device normally used for surgery in the dental office to weld orthodontic appliances and to demonstrate the advantages of this technique. The appliance used, the Fidelis Plus III (Fotona), is a combination of two different laser wavelengths, the Er:YAG (λ = 2.940 μm) and Nd:YAG (λ = 1.064 μm). The first allows the dentist to treat hard tissue (enamel, dentine and bone) with a mechanism that utilises the affinity of this laser for the explosion of intracellular water molecules and so causes the ablation of the tissue.6 Its utilisation may be extended also to dermatology, where it can be employed in the treatment of keloid scars and wrinkles with resurfacing, in addition to the elimination, by vaporisation, of lesions such as condyloma, naevi, warts and molluscus contagiosus.7 The Nd:YAG laser allows the dentist to perform surgery with complete haemostasis, utilising the affinity of this wavelength for haemoglobin and thus avoiding the use of sutures.8 The delivery system for this laser is provided by optic fibres of different sizes, chosen according to the kind of application needed, ranging from 200 μm (endodontic) to 900 μm (whitening).

In addition to a pulse duration of microseconds, which is necessary during dental interventions, the peculiarity of the Fidelis Plus III appliance is the possibility of pulse durations of milliseconds (50-75), which can be utilised in phlebology, in the treatment of lesions of vascular origin, owing to the affinity of this wavelength for haemoglobin.9 In our previous work,10 we demonstrated by in vitro tests on different metal samples, the good quality and high resistance of a joint welded by this device, while in this paper we demonstrate the clinical application of this technique.

**Material and methods**
The laser device used was, as already stated, the Fidelis Plus III, with a 900 μm fibre and a 2 mm spot handpiece (R32, Fotona), normally utilised in dermatology, or in some cases a prototype provided by Fotona itself. The parameters that we normally use for welding are:
- Wavelength: 1.064 μm
- Energy: 9.9 J
- Frequency: 1 Hz
- Spot diameter: 1 mm
- Pulse duration: 15 ms/s
- Fluence: 1,260 J/cm2
- Working distance: 8 mm

**Clinical cases**

**Case 1**
A 9-year-old female patient in orthodontic treatment in our office came in urgently owing to damage to the rapid palatal expander applied to her maxillary molars. The clinical examination revealed that the brace had been damaged close to the connection with the arm (Fig. 1). The patient had just finished one stage of the expansion, and since it was very risky to leave her without an appliance, we decided to weld it directly in the office with the Fidelis laser.

The expander was prepared with the conventional procedure required before laser welding (sandblasted with alumina powders of 50 μm in diameter using the Miniblaster, Deldent, cleaned with acetone and both parts dried). The appliance was directly welded in the office using CoCr-Schweifladewelding wire (DENTAL-ALU). After a few minutes only, the appliance was ready to be reinserted into the patient’s mouth (Fig. 2).

**Case 2**
An 8-year-old male patient in treatment in our office with a Schwartz removable orthodontic appliance came to us for periodic checking of the appliance, and we saw that one of the Adam’s hooks had broken (Fig. 3). We welded it without filler metal (Fig. 4), and the appliance, although very close to the welding zone, was not damaged or modified (Fig. 5). We were able to reseat the repaired appliance in the patient’s mouth after only some minutes (Fig. 6).

**Case 3**
An 8-year-old male patient in treatment in our office with a Franklin removable orthodontic appliance came to us for periodic checking of the appliance, and we saw that one of the wires had broken (Fig. 7). We welded it without metal filler (Fig. 8), and the appliance, although very close to the welding zone, was not damaged or modified. We were able to reseat the repaired appliance in the patient’s mouth after only some minutes.

**Case 4**
A 14-year-old male patient came to our office with the lingual wire of his appliance broken. The appliance was an orthodontic appliance called De laire consisting of two wires, one ven-

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*Fig. 1: The damaged appliance removed from the mouth. Fig. 2: The repaired appliance. Fig. 3: The Schwartz appliance with a broken Adam’s hook. Fig. 4: Laser welding process without filler metal. Fig. 5: The hook repaired without damaging the nearby acrylic part. Fig. 6: The appliance replaced into the mouth. Fig. 7: The Franklin orthodontic appliance with a fractured wire. Fig. 8: The orthodontic appliance repaired.*
Orthodontic treatment not associated with overall happiness, study finds

By DF

ADELAIDE, Australia: Research undertaken at the University of Adelaide has examined whether an orthodontic treatment has an impact on psychosocial outcomes. The study concluded that, contrary to popular belief, such therapy does not result in better psychosocial functioning later in life.

The study, the first of its type in Australia and the second in the world, investigated whether having undergone treatment with fixed orthodontic appliances led to a greater level of happiness or psychosocial outcomes later in life. The longitudinal study followed 484 13-year-olds from Adelaide who had previously participated in an oral epidemiology study between 1988 and 1989. By the time the participants turned 30 in 2015 and 2016, more than a third had received an orthodontic treatment.

There was a pattern of higher psychosocial scores in people who did not have orthodontic treatment, meaning people who hadn't had braces fitted were significantly more optimistic than those that did have braces,” said study co-author Dr Esma Dolgmaci, lecturer in orthodontics at the university’s School of Dentistry. “Those who didn’t have braces had varying levels of crooked teeth, just like those who had braces, treatment, ranging from mild through to very severe.”

The study looked at four psychosocial aspects. First, it examined how well the participants felt they coped with new or difficult situations and associated setbacks. Then, the researchers checked how confident they felt in taking care of their own health. The researchers also assessed the support the participants believed they received from their personal network and, finally, their level of optimism.

“These indicators were chosen because they are important for psychosocial functioning and are relevant to health behaviours and health outcomes, since the core research question was the impact of braces treatment on patients’ self-confidence and happiness in later life,” Dolgmaci noted. “A lot of people are convinced that if they have braces, they will feel more positive about themselves and do well, psychosocially, in later life. This study confirmed that other factors play a role in predicting psychosocial functioning as adults—braces as a youngster was not one of them.”

The study, titled “The long-term influence of orthodontic treatment on adults’ psychosocial outcomes: An Australian cohort study,” was published online on 27 May 2019 in Orthodontics and Craniofacial Research, ahead of inclusion in an issue.
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