“We need to stay open-minded to new crazy ideas”

An interview with Dr Rickard Brånemark, Sweden

The concept of osseointegration has been applied to dental implants for several decades. As an orthopaedic surgeon and engineer, Dr Rickard Brånemark has continued the work of his famous father by adapting the concept to the treatment of amputees. In an recent interview with Dental Tribune at the EAO congress in Sweden, Brånemark explained the benefits and future possibilities of osseointegrated amputation prostheses.

Dental Tribune: Dr Brånemark, could you please give an outline of the development of osseointegrated prostheses?

Dr Rickard Brånemark: The work started by my father was the foundation of what we do in orthopaedics today. Using his concept, I developed new treatments for amputees based on osseointegrated implants, which I have been performing for about 25–30 years now.

Since 1998, I have mostly worked with my own companies, namely Brånemark Integration, the dental company I started with my father, and Integrum, which does all the development for orthopaedic osseointegration. However, we now also have multinational collaborations with universities in Gothenburg, Vienna, San Francisco and Chicago, and hopefully also Göttingen in the near future. As the Swedish implant system has recently been approved by the US Food and Drug Administration (FDA) for the treatment of amputees. I am currently establishing an orthopaedic osseointegration centre in San Francisco and am working closely with the US Department of Defense, which has many soldiers with amputations and is thus very interested in supporting our work.

What do you consider the main challenges of this treatment?

Anchoring something to the bone is the core of osseointegration technology and that is a fairly robust technology we have proven in millions of dental implants. However, in orthopaedics, we face additional challenges. There are, for example, no materials available today that are strong enough to withstand 20–50 years of high physical activity. Therefore, we have developed and continue to develop new materials and surfaces that better withstand the higher loads.

Another important concern is the mucosal area and skin penetration, which is maybe even more challenging. We are working with a concept very similar to the old Brånemark protocol and the bone-anchored hearing aid that we have a smooth surface that is not an attachment. There are many groups working with attachments and, as far as I know, all have failed, especially in the orthopaedic field.

However, just like with every surgical procedure, the outcome largely depends on the skills of the surgeon too.

For the last six years, you have also been using osseointegration in conjunction with implanted electrodes. Could you tell us more about this programme?

Yes, we are also developing the next generation of amputation prostheses. In addition to the osseointegrated implant, we are able to attach electrodes to muscles and nerves to have a brain-controlled prosthesis, which helps us to direct the prosthetic device in a much better way and provides feedback. This is extremely important for truly restoring function.

The main advantage of our approach compared with our competitors is that they have to use wireless technology because they do not have the means to bring wires out of the body owing to the risk of infection. However, we have this fantastic osseointegrated implant to use as a conduit so that the wires can pass through the implant system. Similar to a fibre-optic Internet connection, the wired connection in a robotic arm is much better, stable and robust.

We have already successfully treated one patient. However, our research is still in the early phase, but I think we could do amazing things in the future.

Do you think that osseointegrated prostheses could potentially replace traditional prostheses in the future? This treatment would not apply to amputations of the lower leg as a result of poor circulation caused by diabetes or vascular diseases related to smoking. Such patients constitute about 90 per cent of the amputee population. However, the younger population who have been in road or war accidents or who have musculoskeletal tumours, which are more likely to occur in younger patients, will be candidates for this treatment.

If the technology continues to be as promising as it appears now, the majority of patients will opt for it—just like they now have the choice between dentures or fixed dental implants, which are much better for the patient. There will be a shift, but this will take some time. The introduction of dental implants took about 17 years, similarly, this shift could take another ten to 20 years. However, receiving FDA approval and having the system in use by the military could definitely speed up the establishment.

Overall, this treatment offers many alternatives to conventional treatments. However, there is often too much conservatism in the dental and medical fields when it comes to innovations, but I think we need to stay open-minded to new crazy ideas. This research shows what might be possible in the future. It might be able to restore sensory function of a non-existing limb, creating good artificial sensation. It also shows that the dental and the medical professions should work more closely together. As one can see, there are many synergies that could be drawn from the fields of dental and orthopaedic research in our case. The idea of translation of knowledge was also the original idea of the EAO, which has now become a purely dental meeting. This is a pity because we have to collaborate more, but maybe there will be more cross-disciplinary presentations and meetings in the future.
## LONDON'S TOP 10 ATTRACTIONS

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<th><strong>1. BRITISH MUSEUM</strong></th>
<th><strong>2. NATIONAL GALLERY</strong></th>
<th><strong>3. NATURAL HISTORY MUSEUM</strong></th>
<th><strong>4. TATE MODERN</strong></th>
<th><strong>5. THE LONDON EYE</strong></th>
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<td>The world-famous British Museum exhibits the works of man from prehistoric to modern times, from around the world. Highlights include the Rosetta Stone, the Parthenon sculptures and the mummies in the Ancient Egypt collection. Entry is free but special exhibitions require tickets.</td>
<td>The crowning glory of Trafalgar Square, London's National Gallery is a vast space filled with Western European paintings from the 13th to the 19th centuries. In this iconic art gallery you can find works by masters such as Van Gogh, da Vinci, Botticelli, Constable, Renoir, Titian and Stubbs. Entry is free but special exhibitions require tickets.</td>
<td>As well as the permanent (and permanently fascinating!) dinosaur exhibition, the Natural History Museum boasts a collection of the biggest, tallest and rarest animals in the world. See a life-sized blue whale, a 40-million-year-old spider, and the beautiful Central Hall. Entry is free but special exhibitions require tickets.</td>
<td>Sitting grandly on the banks of the Thames is Tate Modern, Britain’s national museum of modern and contemporary art. Its unique shape is due to it previously being a power station. The gallery's restaurants offer fabulous views across the city. Entry is free but special exhibitions require tickets.</td>
<td>The London Eye is a major feature of London's skyline. It boasts some of London’s best views from its 32 capsules, each weighing 10 tonnes and holding up to 25 people. Climb aboard for a breathtaking experience, with an unforgettable perspective of more than 55 of London’s most famous landmarks – all in just 30 minutes!</td>
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<th><strong>6. SCIENCE MUSEUM</strong></th>
<th><strong>7. VICTORIA &amp; ALBERT MUSEUM</strong></th>
<th><strong>8. TOWER OF LONDON</strong></th>
<th><strong>9. ROYAL MUSEUMS GREENWICH</strong></th>
<th><strong>10. MADAME TUSSAUDS</strong></th>
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<td>From the future of space travel to asking that difficult question: “who am I?” the Science Museum makes your brain perform Olympic-standard mental gymnastics. See, touch and experience the major scientific advances of the last 300 years; and don’t forget the awesome Imax cinema. Entry is free but some exhibitions require tickets.</td>
<td>The V&amp;A celebrates art and design with 3,000 years’ worth of amazing artefacts from around the world. A real treasure trove of goodies, you never know what you’ll discover next: furniture, paintings, sculpture, metal work and textiles; the list goes on and on... Entry is free but special exhibitions require you to purchase tickets.</td>
<td>Take a tour with one of the Yeoman Warders around the Tower of London, one of the world’s most famous buildings. Discover its 900-year history as a royal palace, prison and place of execution, arsenal, jewel house and zoo! Gaze up at the White Tower, tiptoe through a medieval king’s bedchamber and marvel at the Crown Jewels.</td>
<td>Visit the National Maritime Museum - the world’s largest maritime museum, see the historic Queen’s House, stand astride the Prime Meridian at Royal Observatory Greenwich and explore the famous Cutty Sark: all part of the Royal Museums Greenwich. Some are free to enter; some charges apply.</td>
<td>At Madame Tussauds, you’ll come face-to-face with some of the world’s most famous faces. From Shakespeare to Lady Gaga you’ll meet influential figures from showbiz, sport, politics and even royalty. Strike a pose with Usain Bolt, get close to One Direction or receive a once-in-a-lifetime audience with Her Majesty the Queen.</td>
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Clear aligners more beneficial than braces

By DTI

MAINZ, Germany: In recent years, clear aligners have become a favourable treatment alternative in orthodontics to fixed orthodontic appliances (FOA). However, there are few studies about the effects of aligner treatment on oral hygiene and gingival condition. A recent German research has now compared the oral health status, oral hygiene and treatment satisfaction of patients treated with FOA and the Invisalign aligner system. They found that Invisalign patients have better periodontal health and greater satisfaction during orthodontic treatment.

To date, the majority of patients, particularly during childhood and adolescence, are treated with FOA. However, these appliances tend to complicate oral hygiene and thus interfere with patients’ peri- odontal health. Moreover, treatment with FOA is not very popular in adult orthodontics for aesthetic reasons. Therefore, other ortho-dontic techniques have been developed to improve aesthetics and simplify oral hygiene procedures. An alternative to FOA is clear aligners, which are discreet and have the advantage of being removable during oral hygiene and eating or drinking. Clear aligners have increased greatly in the last decade; one prominent example being Invisalign, produced by Align Technology since 1999. However, only a limited number of studies have compared the effects of Invisalign and FOA on oral hy-giene, the researchers from the Johannes Gutenberg University of Mainz pointed out.

Their study included 100 pa- tients who underwent orthodontic treatment, divided equally between FOA and Invisalign, for more than six months. The researchers per- formed clinical examinations before and after treatment to evaluate the patients’ periodon- tal condition and any changes. Furthermore, a detailed ques- tionnaire assessed the patients’ personal oral hygiene and dietary habits, as well as satisfaction with the treatment. All of the patients received the same oral hygiene instructions before and during orthodontic treatment. This in- cluded the use of toothbrush, den- tal floss and interdental brushes three times daily.

The data analysis showed no dif- ferences between the two groups regarding periodontal health and oral hygiene prior to the ortho- dontic treatment. However, the researchers observed notable changes in periodontal condition in both groups during orthodontic treatment. They found that gin- gival health was significantly better in patients treated with Invisalign, and the amount of dental plaque was also less but not significantly different compared with FOA patients.

The questionnaire results showed greater satisfaction in patients treated with Invisalign.

Only 6 per cent of the Invisalign patients reported impairment of their general well-being during orthodontic treatment, compared with 46 per cent of the FOA pa- tients.

Other negative effects that also were significantly higher in FOA patients included gingi- val irritation (FOA: 58 per cent; Invisalign: 14 per cent), being kept from laughing for aesthetic rea- sons (FOA: 26 per cent; Invisalign: 6 per cent), having to change eating habits during orthodontic treatment (FOA: 70 per cent; Invisalign: 50 per cent), and hav- ing to brush one’s teeth for longer and more often (FOA: 84 per cent; Invisalign: 53 per cent).

The researchers concluded that orthodontic treatment with Invisalign has significantly lower negative impacts on a patient’s condition than treatment with FOA, both with regard to gingival health and overall well-being.