

Nanotechnology: Smiles all round

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A smile can say more than a thousand words, the saying goes. Orthodontics can help improve the appearance and position of people's teeth and jawbones, for better functioning teeth and more attractive smiles. In recent years, dental correction orthodontics has used braces made from clear plastic polymer to good effect, but now they are hoping to improve on this with help from nanotechnology. A Spanish university has patented a breakthrough new process, producing smiles all round.

Orthodontic treatment is carried out using [braces](#), which generally fall into two broad categories: removable braces (or retainers), and fixed braces (or train tracks). They may be made of metal, white porcelain or clear plastic. Braces made from a clear [plastic polymer](#) have a better aesthetics when compared to metal braces, but they do come with their own set of problems, such as wear and tear within the mouth. This is where advances in nanotechnology could provide solutions.

'We were estimating the friction between teeth and the brackets [braces], and it occurred to us that nanotechnology might be of use to help us resolve this issue,' remarked Juan Baselga, head of the Universidad Carlos III de Madrid (UC3M) Polymers and Composite Group. The solution that they came up with is to use very hard alumina nanoparticles and spread them evenly in the polysulfone, the [polymer](#) mould that the company CEOSA-Euroortodoncia uses in the industrial production of the braces.

The researchers from UC3M, together with a private company, have patented a new process and have produced a new material that increases the mechanical as well as the friction resistance, thereby maintaining the braces' transparency. 'We have been able to develop a more rigid material with this technology which has a clearly improved friction resistance, thus helping to withstand the wear and tear produced by the teeth or by chewing,' Professor Baselga explained. 'In addition, it is biocompatible, which is essential for something that is going to be used in the mouth, and complies with European requirements for products which are in contact with food.'

This innovation allows nanoparticles to be incorporated and evenly dispersed in a polymer mould in a very low proportion. After this process - based on green chemical techniques - is carried out by UC3M researchers, the particles are dispersed in the polymer through micro-extrusion and microinjection techniques, and are finally mixed to

produce the final piece.

'We measure out the plastic since the minimum that a normal machine can inject is 15 grams, whereas our pieces weigh .06 grams ... it would be akin to injecting insulin with a horse syringe,' explained company Director, Alberto Cervera. 'And with the technology we are using, micro-extrusion and the micro-injection, we are capable of controlling these minuscule quantities of material with the utmost precision,' he added.

It is worth noting that the relationship between UC3M and CEOSA-Euroortodoncia takes advantage of the synergy between the public and private sector. 'We are a small to medium-sized enterprise and we get support from the University to produce a first-rate product, which is then advantageous in the agreements which we have had for a decade in the form of end-of-degree-projects, doctoral theses and joint research programs within the European Union and in the Madrid Autonomous Community, for example,' Alberto Cervera elaborated. 'We learn a lot from this collaboration,' continued Juan Baselga, 'because this company presented us with real problems that they face in their industrial area and they open up their laboratories to our needs.'

According to the researchers, these new materials, nano-reinforced plastics, can have applications in fields other than [orthodontics](#). In particular, polysulfone is of interest in the biohealth field in the development of medical/surgical equipment: its biocompatibility means it can be used to improve rigidity and friction resistance. Furthermore, it has potential applications in the auto industry and in the area of safety, such as the development of a new visor for firefighters, for example.

More information: www.dmceosa.com/

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