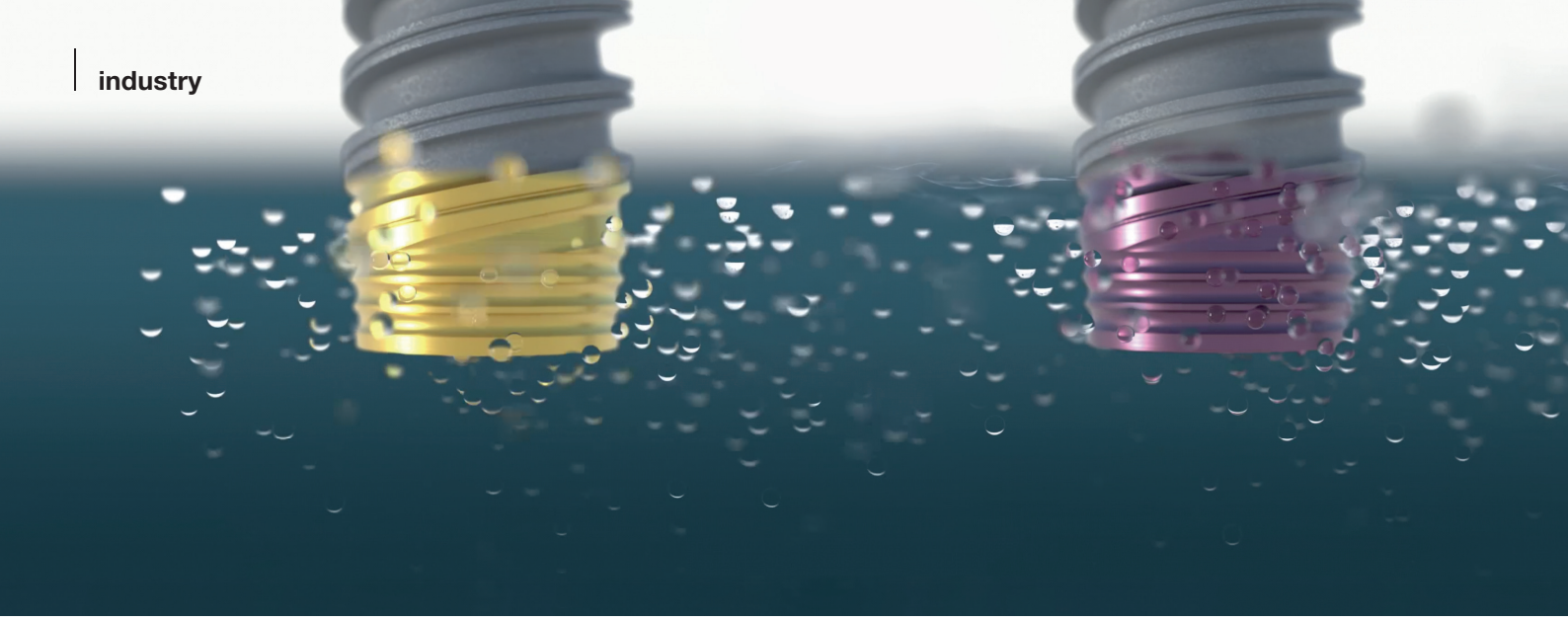


What's your favourite colour?

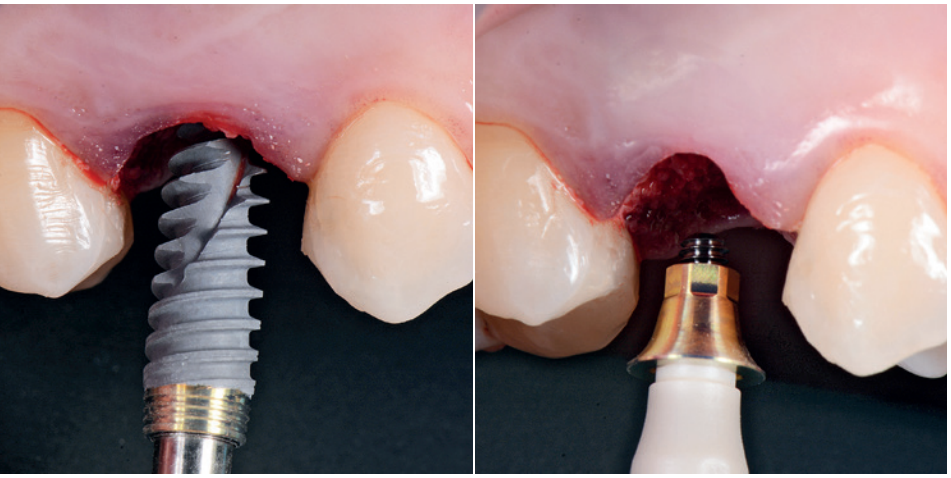
A quick guide to surface anodisation

Nobel Biocare, Switzerland

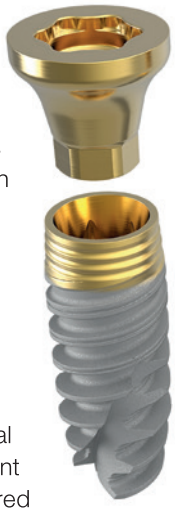
Surface characteristics are key to the body's response to the implant and abutment that you place in your patient.[1,2] Ultimately, it could decide whether your mission for tissue integration succeeds or fails, both for early healing and long-term stability.[3] This is why the surface treatment chosen by your implant and abutment manufacturer is so important: their engineering determines those crucial surface characteristics. Despite the importance of changes to the surface, to the naked eye, it might be difficult to see such a difference—other than a different shade of grey, depending on the treatment process. However, with the recently developed anodised surfaces, Xeal and TiUltra, you will see a distinctive golden hue. This colouration has not been created simply for appearance. The gold is a by-product of our advancements in applying this technology, in order to create different characteristics for different tissue integration—from soft tissue, to cortical bone, to cancellous bone. Anodisation can take titanium through an entire spectrum of colour, depending on the surface characteristics it creates.

What is anodisation?

Anodisation is an electrochemical process used to engineer a titanium surface. While titanium provides high-strength and cell adhesion, it's the oxide layer—instantly created when titanium is exposed to the air—that makes tissue attachment possible.[4] While subtractive surface technology (such as sandblasting and/or acid etching) removes material to create the roughness, anodisation does the opposite—it increases the thickness of the oxide layer. And it's this change of thickness that causes the change of colour. The basic process is this: We place the implant in an electrolyte fluid, making it the anode when we apply an electric voltage. As the voltage intensifies, and the length of time increases, the oxide layer expands to a thickness of up to 10,000 nm.[5] The oxide's changing thickness tailors interference of light at the surface, and the thicker it becomes,



the more its colour moves along the spectrum. If a critical voltage is reached, sparks appear (spark anodisation) and the oxide begins to break down, creating even more roughness with volcano-shaped nodules.[6] The colour then returns to grey, but with a matt finish.



Why the golden hue?

Our surface treatment of Xeal abutments and TiUltra implant collars has not been tailored simply for appearance. Nonetheless, the colour at abutment and implant collar level could potentially bring its own benefits: Studies have shown that improved soft-tissue appearance can be achieved by changing the abutment colour from grey to yellow or pink.[7–10] But in essence, the golden hue is a consequence of the time and voltage needed to create a surface topography and surface chemistry specifically designed to optimise tissue attachment at a collar and abutment level.

At abutment level, studies have shown that:
- An oxidised, nanostructured surface stimulates more gingival-fibroblast adhesion than machined.[11, 12]
- An oxidised surface enables more epithelial-cell attachment than a machined surface.[13, 14]
- Reduced surface roughness at the abutment can decrease plaque accumulation.[15–17]

At implant collar level, it is important to minimise marginal bone loss.[18] Turned surfaces with just a slight roughness have demonstrated this after over ten years of function[19]; and minimal to moderate roughness can reduce marginal bone loss compared to smooth surfaces.[20, 21] Built on evidence demonstrating the benefits of a smooth, anodised, nanostructured abutment and a minimally rough, anodised, nanostructured implant collar, our applied anodisation has been fine-tuned even further. The result? As well as a desired surface topography and surface chemistry, it's a surface with a golden hue.

Fine-tuning anodisation— it's more than roughness

Nobel Biocare has two decades' expertise in applying anodisation technology. After the original transition from machined to anodised implants, the impact on early failure rates was truly remarkable; from 11.4 % to just 2.1 % in the maxilla*.[22] When it comes to long-term survival, the anodised surface showed a significantly higher survival rate than surfaces used by other brands for ten years or longer.[19] Our further steps forward today go beyond just roughness, but chemistry, ultra-hydrophilicity and protection of the surface too.

References are available upon request.

* Average failure rate of machined implants 1986–2002, compared to anodised TiUnite implants 2003–2011.

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