SIMPLICITY, COMFORT, AESTHETICS

axiom®
TECHNICAL FILE

The new dimension

anthogyr

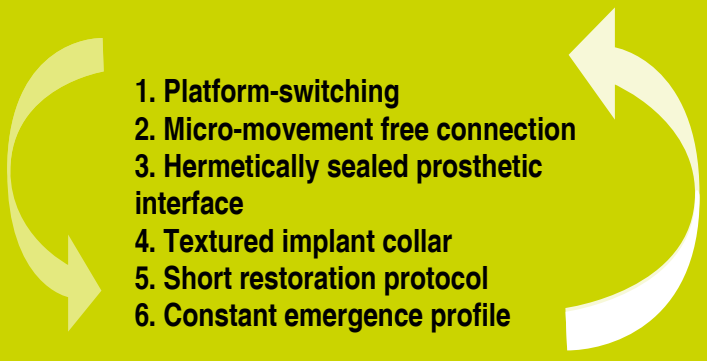
A global solution for **dental implantology**

Axiom®, a new generation of implants

Axiom® belongs to this new generation of implants which is intended to promote rapid predictable bone healing and to recreate a similar periodontal environment to what is seen with natural teeth.

Based on recent scientific and clinical implantology data, the Axiom® implant has all the necessary features to enable predictable, sustainable, peri-implant tissue stabilisation, i.e. a non-resorbed crestal bone acting to support healthy stable gum over time.

↓ *Peri-implant tissue stability*



1. Platform-switching
2. Micro-movement free connection
3. Hermetically sealed prosthetic interface
4. Textured implant collar
5. Short restoration protocol
6. Constant emergence profile

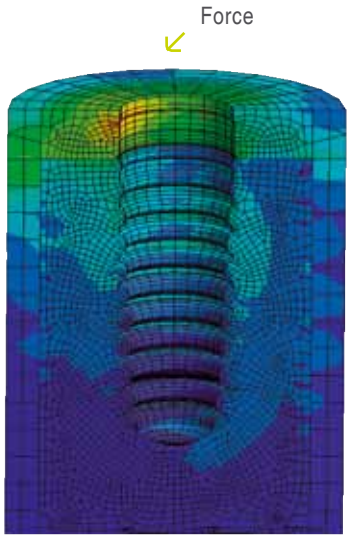
But above all, Anthogyr wanted to go further, giving an additional dimension to the Axiom® implant : *« mini-invasivity »*.

This involved giving the implants optimal bone anchoring capacity and mechanical resistance to be able to restore the majority of clinical cases using the lowest volume implants possible.

« **Mini-invasivity** » has several advantages.
It significantly helps to simplify the three-dimensional positioning of the implant particularly on thin crests.
It helps to simplify surgical protocols and finally to avoid some bone grafts which are burdening and demanding on the patient. Axiom® therefore fits completely into the modern implantology approach, relatively non-invasive and needful to practitioner's requirements and patient's comfort.

Axiom®, enhanced bone anchoring

The Axiom® threading is designed to optimise primary implant anchoring and then transmit occlusal forces on the surrounding bone. Finite element modelling is a tool which can pre-visualise the force distribution in the bone when a load is applied to the implant.



← *The model shows forces generated in the bone when a force directed at 30° is applied by Axiom® Ø 3.4 mm*

Several simulations were conducted and Axiom® emerges as the ideal solution for homogeneous load distribution without a localised force peak. The asymmetrical progressive screw pitch transforms axial forces into compression forces which are beneficial to bone stimulation along the implant.

→ **The design of Axiom® therefore provides optimal use of the implant's surface to ensure high performance bone anchoring, even with small implants.**

Mechanical performance

A/ SELECTION OF MATERIAL

The primary factor influencing the mechanical performance of the implant is the material which must be entirely biocompatible and as resistant as possible.
In this concept of excellence, the Axiom® implant has been designed from a grade V medical titanium alloy in accordance with international requirements and directives for implantable medical devices.

This material has been widely used successfully for decades in the orthopaedics sector.
For a few years now, and according to the ADA*, Grade V medical titanium alloy emerges as *a material of choice* to manufactured dental implants because of its physical and chemical properties.

** American Dental Association Council of scientific Affairs 2003.*

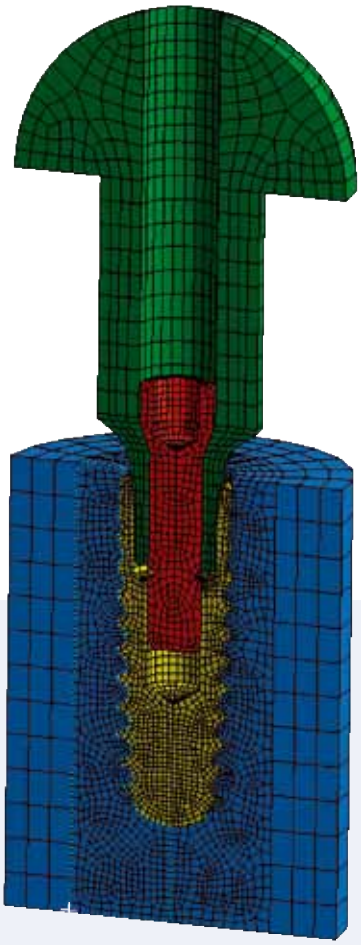
As shown in the table below, the titanium alloy chosen widely surpasses lower grade pure titanium in its mechanical features.
As such, it becomes an important factor reducing the invasivity of standard implants without compromising their biocompatibility.

	Grade I	Grade II	Grade III	Grade IV	Grade V
Breaking limit*	240 MPa	345 MPa	450 MPa	550 MPa	860 MPa

** ISO 5832-2 et ISO 5832-3.*

B/ FINITE ELEMENT MODELLING

In parallel to the material, the connection for the Axiom® implant has also been studied particularly in its dimension design.



Commonly used in the aeronautics and aerospace, digital finite element modelling has also helped to precise simulations of complex mechanical behaviour of the Axiom® implant device.

Force transmission, load distribution and displacement analyses have shown high performance concepts applied to the Axiom® implant.

→ **As a result, the implant device consisting of the implant, an abutment and a prosthetic screw has been perfectly sized to meet the many clinical situations that may be seen by the dental surgeon and his/her prosthetist.**

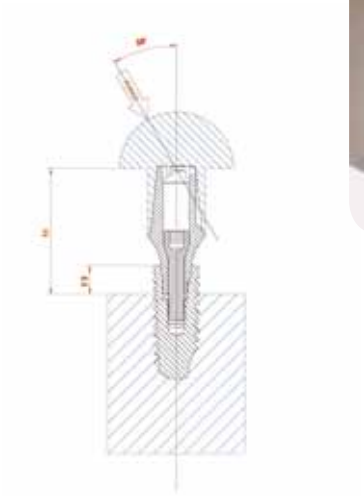
↖ *Finite element model*

C/ STATIC TESTS

In order to validate the digital simulations and to ensure the mechanical validity of the system, the Anthogyr teams conducted various tests in accordance with standard ISO 14801.

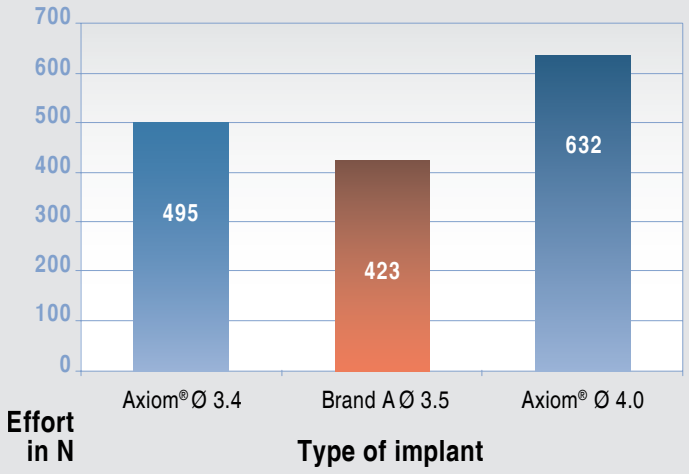
This defines a position for the implant device in a critical unique situation for the components. This extreme *in situ* configuration envisages applying force to an implant assembled onto a crown, of mean height 8 mm. The assembly is then embedded with an implantation angle at 30° and peri-implant bone loss of 3 mm.

In an initial analytical study phase, static tests were used to assess the loads and mechanisms of damage (deformities, maximum loads, ruptures, etc.) of the Implant / Abutment / Crown assembly compared to implants of the same type belonging to internationally renowned competing brand names.



Standard ISO 14801 requirements

Test device



↑ *Maximum load before rupture, static situation*

The comparative results obtained for the Axiom® system demonstrated its greater capacity to counter extensive forces despite an adverse implantation. As a result, the Axiom® diameter 3.4 mm and 4.0 mm implants resist static occlusal forces of up to more than 50 kg (495 N) and 64 Kg (632 N).

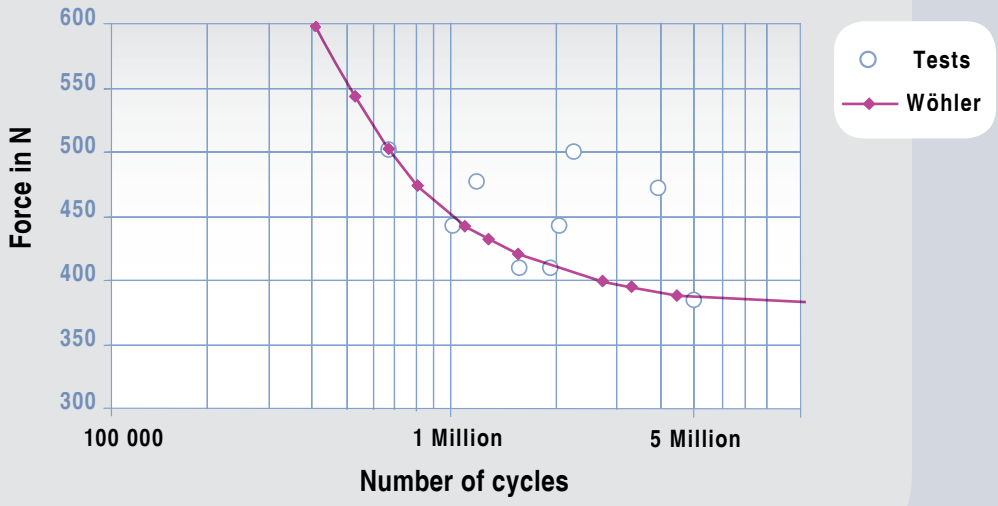
For comparison, the maximum occlusal forces in an adult are estimated to be between 222 N in the anterior sectors and 522 N in the posterior sectors.

** A simple instrument for the measurement of maximum occlusal force in human dentition, Blamphin 1990.*

D/ ENDURANCE TESTS

**With the goal of complete performance, additional endurance tests were also conducted on the Axiom® implant.
The aim of these tests was to validate the lifespan of the implant and guarantee the mechanical longevity of the device in the mouth.
The implant was subjected to more than 5 million applications at a frequency of 10 Hz in the standardised ISO 14801 configuration described above.**

After a series of tests with different loads, the corresponding Wöhler fatigue curve was defined describing the statistical endurance behaviour of the Axiom® device: i.e. the life expectancy of the device depending on of occlusion forces applied. We can say that the product will last a lifetime after exceeding 5 million cycles.

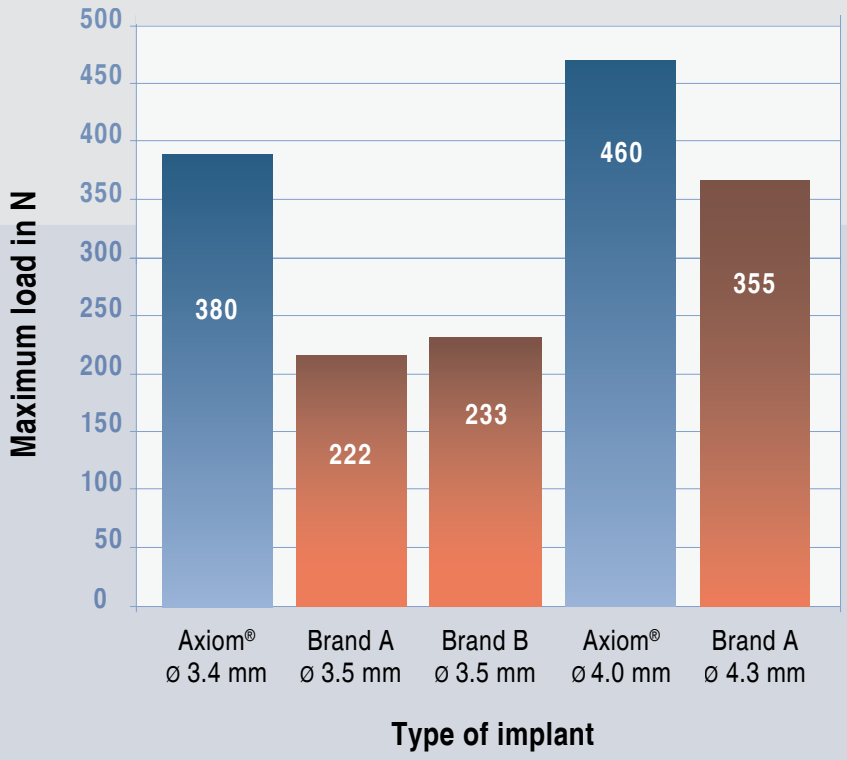


Wöhler fatigue curve for the Axiom® Ø 3.4 mm implant

The load that can sustain the Axiom® implant Ø 3.4mm (380 N, about 40 Kgs) on the basis of 10 pressures per second, is higher than the one sustained by the comparative implant brand «A» (internationally-known reference brand, with morse taper connection Ø 4.3 mm).

This means that, in a similar situation , the Axiom® implant is able to better support occlusal loads compared with the brand «A» implant.

This aspect is particularly interesting when bone volume is low and graft is not wanted. Also, Axiom® is a small-diameter implant, making placement protocol easier. Thanks to its strength resistance, Axiom® introduces the concept of «**mini-invasivity**».

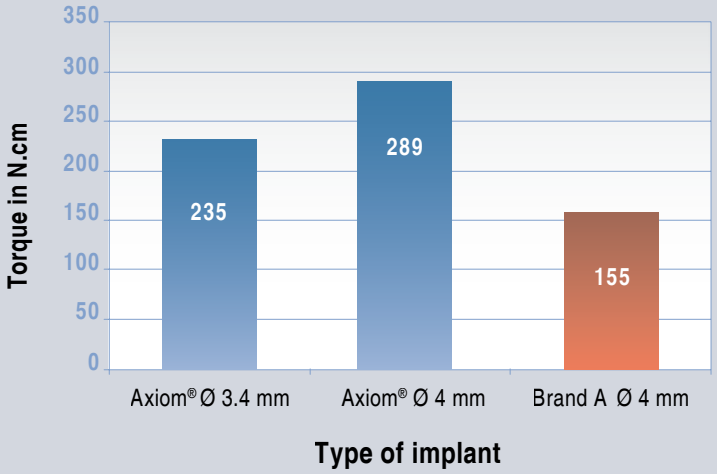


↑ *Fatigue resistance during 5 million cycles*

E/ IMPLANT TIGHTENING TORQUE

**Keeping to the initial objectives, the Anthogyr research and development department designed an implant device resistant not only over time but also to the applications experienced in the implant positioning phases.
Connection between the implant and the prosthetic components also exhibits high torque mechanical resistance.**

Mechanical tests were conducted and the maximum acceptable tightening torques were measured for implant diameters 3.4 mm and 4.0 mm.
The results obtained (235 N.cm and 289 N.cm respectively) guaranteed correct operation of the device in actual use.



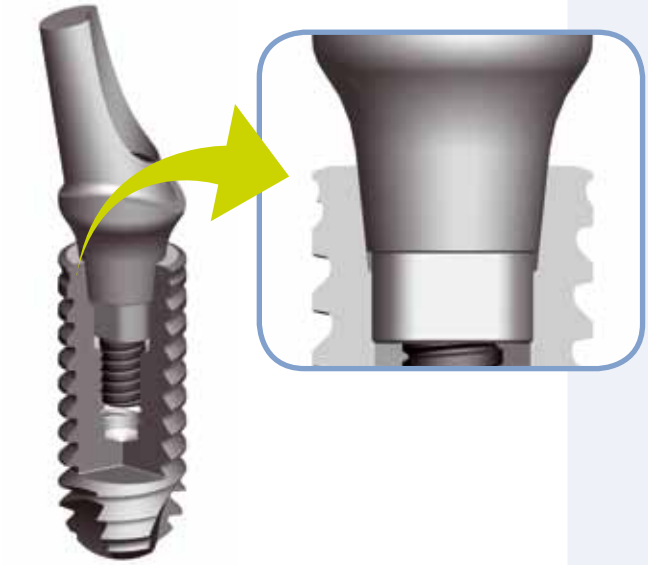
↑ *Resistance of the implant torque connection*

High-performance connection

A/ STABILITY AND HERMETIC SEAL

These exceptional mechanical results for the Axiom® implant device combine closely with the clinical and therapeutic advantages of the system.

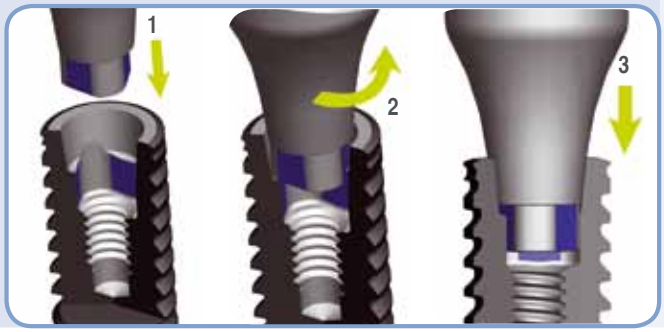
Functional and precise because of its geometry, the connection meets the many expectations of implantology practitioners.
The Axiom® implant connection has two major benefits: mechanical rigidity without micro-movement combined with complete hermetic sealing.
The prosthetic interface, i.e. the conical assembly of the implant and the abutment generates an auto-adjustable hermetic seal, the tolerances of which are defined with a few microns.
From a clinical perspective, this type of connection promotes respect and sustainability of the biological space through its stability and by eliminating bacterial infiltration or accumulation of oral fluids in the interstices which predispose to peri-implant infections.



↑ *Section of 'Axiom® Ø 3.4 mm and enlargement of the hermetic sealed connection*

B/ INTUITIVE

Beyond the mechanical and biological features, one of the attributes of the Axiom® connection is also its ease of use. The connection has been designed so that in three movements the parts are literally "naturally" guided during the interlocking of the prosthetic components.



Conclusion

It now becomes possible to use low-invasive implants offering efficient anchoring in the bone and high mechanical properties.
As it meets these criteria, Axiom® implant belongs to a new generation of implants, making tomorrow's surgical act easier.

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We would also like to thank all the Scientific Committee members who took part in developing the product for their valuable collaboration, without whom this project could not have been completed.

ANTHOGYR, SERVICE INCLUDED

Further information, advice, contacts :
our marketing, sales and R&D departments
will be happy to answer all you enquiries.

Let's meet !

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anthogyr

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