Nippon Piston Ring Presents
A Fully Made-in-Japan Implant Brand

IAT EXA

We at Nippon Piston Ring Co., Ltd. are pleased to offer you the IAT EXA, a fully made-in-Japan dental implant system.
As a manufacturer of automotive components such as piston rings, we are a global company with a high level of technology that is world-wide recognized, and our philosophy is to produce the IAT EXA with same challenging spirit and to meet the world-wide standards of quality at all times. IAT is an abbreviation of “Intelligent Artificial Teeth,” which is the general name for an implant system made of pure titanium with our unique surface processed by wire electric discharge machining called, “ED Surface.”

The study of surface processing with wire electric discharge machining started in 1984 by the Division of Biomaterials and Engineering under the School of Dentistry at Showa University. The study continued for twenty years to carry out the processes of basic research, clinical testing and development. These efforts resulted in the creation of the IAT EXA implant system.

We are confident that this implant system is positioned to become one of the effective implant treatment options in the world in the future, providing not only excellent osteogenesis, strong initial stability and great operability during procedures, but also high cost performance based on its use of sophisticated purely made-in-Japan manufacturing method.
Nippon Piston Ring Presents
A Fully Made-in-Japan Implant Brand

IAT EXA

We at Nippon Piston Ring Co., Ltd. are pleased to offer you the IAT EXA, a fully made-in-Japan dental implant system. As a manufacturer of automotive components such as piston rings, we are a global company with a high level of technology that is world-wide recognized, and our philosophy is to produce the IAT EXA with same challenging spirit and to meet the world-wide standards of quality at all times. IAT is an abbreviation of “Intelligent Artificial Teeth,” which is the general name for an implant system made of pure titanium with our unique surface processed by wire electric discharge machining called, “ED Surface.” The study of surface processing with wire electric discharge machining started in 1984 by the Division of Biomaterials and Engineering under the School of Dentistry at Showa University. The study continued for twenty years to carry out the processes of basic research, clinical testing and development. These efforts resulted in the creation of the IAT EXA implant system. We are confident that this implant system is positioned to become one of the effective implant treatment options in the world in the future, providing not only excellent osteogenesis, strong initial stability and great operability during procedures, but also high cost performance based on its use of sophisticated purely made-in-Japan manufacturing method.
Wire electric discharge machining creates a surface property unique to ED Surfaces that benefit osteogenesis

ED Surface means a surface property created and shaped through electric discharge machining with pure titanium wire electrodes. ED Surfaces consist of satin-like micropits made by regularly arranged traces of electrical discharge so that, after embedding bodies into a jaw bone, they provide an easy environment for proteins and cells to congregate on, which is beneficial to osteogenesis. Also, although titanium surfaces are generally covered by titanium oxide, ED Surfaces have a titanium oxide layer of approximately 1µm, which is thick compared to mechanically machined surfaces which have a thickness of only 5-10 nm. Furthermore, the main characteristic of this titanium oxide layer is its functionally graded structure in which the property of titanium shifts from titanium dioxide to titanium oxide, and then to main body titanium respectively from the outer surface to the interior part. This thick and strong titanium oxide layer provides significant corrosion resistance. Its surface has good wettability and provides high compatibility with body fluids and blood, promoting biologic reactions that benefit osteogenesis.

The body design enables initial stability after embedding and excellent functional consistency

The shape of implants affects initial stability after embedding and in-use stability. The IAT EXA implant system enables sufficient osteogenesis up to the neck of the body through ED Surface application up to the top of the body. It also acquires strong initial stability by its screw form in which the groove becomes shallower towards the upper part. Moreover, platform switching ensures an ideal width at the boundary between an implant and an abutment to successfully minimize absorption of alveolar bones.

This unique structure with high operability and adhesion enables better stability

IAT EXA adopts a unique twin hex tapered structure for a close fit with higher operability which enables careful angle adjustment of abutments. This achieved a significant improvement in adhesion and stability of bodies and abutments.
Wire electric discharge machining creates a surface property unique to ED Surfaces that benefit osteogenesis

ED Surface means a surface property created and shaped through electric discharge machining with pure titanium wire electrodes. ED Surfaces consist of satin-like micropits made by regularly arranged traces of electrical discharge so that, after embedding bodies into a jaw bone, they provide an easy environment for proteins and cells to congregate on, which is beneficial to osteogenesis. Also, although titanium surfaces are generally covered by titanium oxide, ED Surfaces have a titanium oxide layer of approximately 1µm, which is thick compared to mechanically machined surfaces which have a thickness of only 5-10 nm. Furthermore, the main characteristic of this titanium oxide layer is its functionally graded structure in which the property of titanium shifts from titanium dioxide to titanium oxide, and then to main body titanium respectively from the outer surface to the interior part. This thick and strong titanium oxide layer provides significant corrosion resistance. Its surface has good wettability and provides high compatibility with body fluids and blood, promoting biologic reactions that benefit osteogenesis.

The body design enables initial stability after embedding and excellent functional consistency

The shape of implants affects initial stability after embedding and in-use stability. The IAT EXA implant system enables sufficient osteogenesis up to the neck of the body through ED Surface application up to the top of the body. It also acquires strong initial stability by its screw form in which the groove becomes shallower towards the upper part. Moreover, platform switching ensures an ideal width at the boundary between an implant and an abutment to successfully minimize absorption of alveolar bones.

This unique structure with high operability and adhesion enables better stability

IAT EXA adopts a unique twin hex tapered structure for a close fit with higher operability which enables careful angle adjustment of abutments. This achieved a significant improvement in adhesion and stability of bodies and abutments.
Simple systematization enables excellent cost performance.

Simple systematization of the product line is one of the main characteristics of the IAT EXA implant system. This improves on-site usability and reliability for implant surgical operations. It also successfully achieved high cost performance by narrowing down products required for each symptom.

**Body**
Evolutionary body in pursuance of further innovation of performance characteristics

**Screw Type**
Embedding procedure variation depending on the diameter of screw type bodies

**Abutment**
Simple systematization enables excellent cost performance.

Simple systematization of the product line is one of the main characteristics of the IAT EXA implant system. This improves on-site usability and reliability for implant surgical operations. It also successfully achieved high cost performance by narrowing down products required for each symptom.

**Body**

Evolutionary body in pursuance of further innovation of performance characteristics

**Screw Type**

Embedding procedure variation depending on the diameter of screw type bodies

Procedure: Two stage technique
Diameter: ø3.3mm*, ø4.0mm, ø5.0mm
Height: 8mm*, 10mm, 12mm, 14mm

(*) ø3.3mm diameter is not available in 8mm height.

Procedure: One stage technique
Diameter: ø3.3mm*, ø4.0mm, ø5.0mm
Margin diameter: R: ø4.5mm, W: ø5.5mm
Height: 8mm, 10mm, 12mm, 14mm

Procedure: Two stage technique
Diameter: ø3.3mm*, ø4.0mm, ø5.0mm
Height: 8mm, 10mm, 12mm, 14mm

(*) ø3.3mm diameter is not available in 8mm height.

Mucosa-penetrating depth: L: h1.5mm, H: h3mm

**Two-stage screws**

**One-stage screws**

**Two-stage cylinders**

Simple procedures for each patient with Systematized Product Line

Simple systematization enables excellent cost performance.

Simple systematization of the product line is one of the main characteristics of the IAT EXA implant system. This improves on-site usability and reliability for implant surgical operations. It also successfully achieved high cost performance by narrowing down products required for each symptom.
Cylinder Type
Embedding procedure variation depends on the diameter of cylinder type bodies.

IAT EXA surgical system
The highly rated drill system especially for long-term clinical settings has great cutting ability and durability. It helps to shorten the length of surgery and eases the burden of patients. Also, operation tools are color-coded according to the diameter of bodies to improve operability and safety.

Abutment flow chart
Prosthetic-related flow of the IAT EXA implant system

The IAT EXA prosthetic system largely consists of the following three systems.
Cylinder Type
Embedding procedure variation depends on the diameter of cylinder type bodies

IAT EXA surgical system
The highly rated drill system especially for long-term clinical settings has great cutting ability and durability. It helps to shorten the length of surgery and eases the burden of patients. Also, operation tools are color-coded according to the diameter of bodies to improve operability and safety.

Abutment flow chart
Prosthetic-related flow of the IAT EXA implant system

The IAT EXA prosthetic system largely consists of the following three systems.
Implant treatments based on a concept of osseointegration has spread, requiring early start of functions and improvement in bone quality. The IAT implant system is the only one in the world which is processed by wire electric discharge machining. Wire electric discharge machining uses titanium wires as electrodes to generate spark discharging between titanium blocks in ultrapure water in order to use the energy not only for shaping the main body of titanium but also for provision of a distinct surface, i.e. ED Surface. ED Surfaces are uniquely rough with accumulated traces of electrical discharge, and it has a thick titanium oxide layer with a large amount of surface energy on the order of µm, which is integrated with titanium metal in a graded manner. Since discharge locally generates high-energy plasma, the titanium oxide layer richly contains the hydroxyl group, providing ultrahydrophilicity and also forming radicals. It is recognized that ED Surfaces benefit protein absorption and cell adhesion, and also promotes early differentiation of osteoblasts in an early stage. Osteogenesis has been evaluated based on cell behaviors and animal tissue specimens so far without directly evaluating the quality of regenerated bones. We have been making efforts to clarify the structure and strength of regenerated bones using a Raman microspectroscopic system and a nanoindentation technique. Regenerated bones on ED Surfaces have better bone quality with a high mockas of elasticity and hardiness of bones through crosslinking of collagen matrix due to the action of radicals. The IAT implant system uniquely created by wire electric discharge machining technology in Japan is expected to contribute to implant treatments in Japan as well as around the world in the future.

### Implant Treatments

**Add Evident Reliability of Made-in-Japan Technologies**

**Shigeru Fujino, DDS, PhD**

Medical Advisor, Japanese Society of Oral Implantology (JSOI) Facility Director, Institute of Implant Restorative Dentistry (IIRD; JISO’s Training Facility for Certification)

Currently, dental implants are an established dental treatment option through the development of various implant systems for clinical application. The IAT implant system is entirely "made-in-Japan" from basic research and development to production, featuring surfaces machined by wire electric discharging (ED Surfaces). In 1994, it started to be clinically applied as the IAT FIT implant system for twenty years and even today it is consistently showing good clinical results. The IAT FIT implant system was developed as a multi-generation implant system with ED Surfaces in 2008. The IAT EXA implant system is clinically featuring ED Surfaces with high biocompatibility and the distinctive shape of implants developed from the point of view of biome. The high osteocompatibility of ED Surfaces has already been proven by twenty-year clinical results of the IAT FIT implant system. There are two types of implant bodies, cylinder shape and screw shape, and two types of procedures, one stage technique and two-stage technique, for type selection of implants in accordance with various clinical conditions depending on locations for embedding implants. Recent clinical research reports on the IAT EXA implant system exhibit good clinical results even from a number of applications for immediate post-extraction embedding cases and immediate post-embedding loading cases, in addition to general cases subject to existing bones. I expect that the IAT EXA implant system will evolve into higher levels in the future through acceleration of new development of not only implant bodies but also peripheral components based on clinical results for a longer term.

### Our Recommendation

**Reasons why I choose IAT EXA**

Takashi Miyazaki, DDS, PhD

Dean, School of Dentistry, Showa University

- **Promotion of Osseointegration by ED Surfaces and Quality of Regenerated Bones around Implant**

- **Surface properties of ED Surfaces**
  - ED Surfaces are distinctively rough with accumulated spark discharge. They are also ultrahydrophilic due to its surface modification by electric discharge.

- **Bone quality evaluation of regenerated bones using a nanoindentation technique**
  - Evaluation of quality of regenerated bones on ED Surfaces and machined surfaces using a nanoindentation technique indicated good bone quality on ED Surfaces with significantly high bone hardness and elasticity coefficient.

- **Stained photos of bones regenerated on an ED Surface**
  - In ultrapure water for shape work of IAT implants.

- **Mechanism of wire electric discharge machining**
  - Titanium wires are used as electrodes to use the energy of spark discharge in ultrapure water for shape work of IAT implants.

- **Observation**
  - A bone anchored bridge was applied after embedding six IAT EXA implant bodies into the lower edentulous jaw in 2008.

- **Implant Treatments**
  - At the time of application of upper structures after three IAT FIT cylinder implant bodies were embedded into mandibular molar area in 1995.

- **IAT FIT implant case (intraoral photo)**
  - A dental X-ray photo of an upper structure after twenty years, which shows the high osteocompatibility of ED Surfaces.

- **IAT EXA implant case**
  - A dental X-ray photo of an upper structure after twenty years, which shows the high osteocompatibility of ED Surfaces.

- **IAT EXA implant case (digital X-ray photo)**
  - A dental X-ray photo of an upper structure after twenty years, which shows the high osteocompatibility of ED Surfaces.

- **Cumulative success rate of the IAT FIT implant system in a range of ten to fifteen years**
  - A clinical study of cylinder-shape implants indicated that ED Surfaces are clinically highly biocompatible and stable for a long period of time. (Extracted and reorganized from Fijino et al., Journal of Japanese Society of Oral Implantology, 21:1326, 3,444-453)
Implant treatments based on a concept of osseointegration has spread, requiring early start of functions and improvement in bone quality. The IAT implant system is the only one in the world which is processed by wire electric discharge machining. Wire electric discharge machining uses titanium wires as electrodes to generate spark discharging between titanium blocks in ultrapure water in order to use the energy not only for shaping the main body of titanium but also for provision of a distinct surface, i.e. ED Surface. ED Surfaces are uniquely rough with a large amount of surface energy on the order of µm, which is integrated with titanium metal in a graded manner. Since discharge locally generates high-energy plasma, the titanium oxide layer richly contains the hydroxyl group, providing ultrahydrophilicity and also forming radicals. It is recognized that ED Surfaces benefit protein absorption and cell adhesion, and also promotes early differentiation of osteoblasts in an early stage. Osteogenesis has been evaluated based on cell behaviors and animal tissue specimens so far without directly evaluating the quality of regenerated bones. We have been making efforts to clarify the structure and strength of regenerated bones using a Raman microspectroscope system and a nanoindentation technique. Regenerated bones on ED Surfaces have better bone quality with a high modula of elasticity and hardness of bones through crosslinking of collagen matrix due to the action of radicals. The IAT implant system uniquely created by wire electric discharge machining technology in Japan is expected to contribute to implant treatments in Japan as well as around the world in the future.

### Our Recommendation

**Reasons why I chose IAT EXA**

Promotion of Osseointegration by ED Surfaces and Quality of Regenerated Bones around Implant

Takashi Miyazaki, DDS, PhD
Dean, School of Dentistry, Showa University

Current dental implants are an established dental treatment option through the development of various implant systems for clinical application. The IAT implant system is entirely “made-in-Japan” from basic research and development to production, featuring surfaces machined by wire electric discharge machining (ED Surfaces). In 1994, it started to be clinically applied as the IAT FIT implant system for twenty years and even today it is consistently showing good clinical results. The IAT EXA implant system was developed as a next-generation implant system with ED Surfaces in 2008. The IAT EXA implant system is clinically featuring ED Surfaces with high biocompatibility and the distinctive shape of implants developed from the point of view of biomechanics. The high osteocompatibility of ED Surfaces has already been proven by twenty-year clinical results of the IAT FIT implant system. There are two types of implant bodies, cylinder shape and screw shape, and two types of procedures, one stage technique and two stage technique, for type selection of implants in accordance with various clinical conditions depending on locations for embedding implants. Recent clinical research reports on the IAT EXA implant system exhibit good clinical results even from a number of applications for immediate post-extraction embedding cases and immediate post-embedding loading cases, in addition to general cases subject to existing bones.

I expect that the IAT EXA implant system will evolve into higher levels in the future through acceleration of new development of not only implant bodies but also peripheral components based on clinical results for a longer term.

<table>
<thead>
<tr>
<th>Observation period (year)</th>
<th>Number of implants</th>
<th>Number of goal</th>
<th>Number of success</th>
<th>Cumulative success rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Embedding-1</td>
<td>220</td>
<td>0</td>
<td>1</td>
<td>99.55</td>
</tr>
<tr>
<td>1-5</td>
<td>189</td>
<td>31</td>
<td>2</td>
<td>99.04</td>
</tr>
<tr>
<td>5-10</td>
<td>171</td>
<td>22</td>
<td>4</td>
<td>96.83</td>
</tr>
<tr>
<td>10-15</td>
<td>133</td>
<td>38</td>
<td>4</td>
<td>94.15</td>
</tr>
</tbody>
</table>

Cumulative success rate of the IAT FIT implant system in a range of ten to fifteen years

A clinical study of cylinder-shape implants indicated that ED Surfaces are clinically highly biocompatible and stable for a longer term. The IAT EXA implant system was developed as a next-generation implant system with ED Surfaces in 2008 to improve upon the IAT FIT implant system. The IAT EXA implant system was clinically featuring ED Surfaces since 2008. Since discharge of ultrapure water for shape work of IAT implants, and it has a thick titanium oxide layer with a large amount of surface energy on the order of µm, which is integrated with titanium metal in a graded manner. Since discharge locally generates high-energy plasma, the titanium oxide layer richly contains the hydroxyl group, providing ultrahydrophilicity and also forming radicals. It is recognized that ED Surfaces benefit protein absorption and cell adhesion, and also promotes early differentiation of osteoblasts in an early stage. Osteogenesis has been evaluated based on cell behaviors and animal tissue specimens so far without directly evaluating the quality of regenerated bones. We have been making efforts to clarify the structure and strength of regenerated bones using a Raman microspectroscope system and a nanoindentation technique. Regenerated bones on ED Surfaces have better bone quality with a high modula of elasticity and hardness of bones through crosslinking of collagen matrix due to the action of radicals. The IAT implant system uniquely created by wire electric discharge machining technology in Japan is expected to contribute to implant treatments in Japan as well as around the world in the future.

### Implant Treatments

**Add Evident Reliability of Made-in-Japan Technologies**

Shigeru Fujino, DDS, PhD
Medical Advisor, Japanese Society of Oral Implantology (JSOI) Facility Director, Institute of Implant Reconstructive Dentistry (IIIRD; JISO’s Training Facility for Certification)

Currently, dental implants are an established dental treatment option through the development of various implant systems for clinical application. The IAT implant system is entirely “made-in-Japan” from basic research and development to production, featuring surfaces machined by wire electric discharge machining (ED Surfaces). In 1994, it started to be clinically applied as the IAT FIT implant system for twenty years and even today it is consistently showing good clinical results. The IAT EXA implant system was developed as a next-generation implant system with ED Surfaces in 2008. The IAT EXA implant system is clinically featuring ED Surfaces with high biocompatibility and the distinctive shape of implants developed from the point of view of biomechanics. The high osteocompatibility of ED Surfaces has already been proven by twenty-year clinical results of the IAT FIT implant system. There are two types of implant bodies, cylinder shape and screw shape, and two types of procedures, one stage technique and two stage technique, for type selection of implants in accordance with various clinical conditions depending on locations for embedding implants. Recent clinical research reports on the IAT EXA implant system exhibit good clinical results even from a number of applications for immediate post-extraction embedding cases and immediate post-embedding loading cases, in addition to general cases subject to existing bones. I expect that the IAT EXA implant system will evolve into higher levels in the future through acceleration of new development of not only implant bodies but also peripheral components based on clinical results for a longer term.

<table>
<thead>
<tr>
<th>Observation period (year)</th>
<th>Number of implants</th>
<th>Number of goal</th>
<th>Number of success</th>
<th>Cumulative success rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Embedding-1</td>
<td>220</td>
<td>0</td>
<td>1</td>
<td>99.55</td>
</tr>
<tr>
<td>1-5</td>
<td>189</td>
<td>31</td>
<td>2</td>
<td>99.04</td>
</tr>
<tr>
<td>5-10</td>
<td>171</td>
<td>22</td>
<td>4</td>
<td>96.83</td>
</tr>
<tr>
<td>10-15</td>
<td>133</td>
<td>38</td>
<td>4</td>
<td>94.15</td>
</tr>
</tbody>
</table>

Cumulative success rate of the IAT FIT implant system in a range of ten to fifteen years

A clinical study of cylinder-shape implants indicated that ED Surfaces are clinically highly biocompatible and stable for a longer period of time. (Extracted and reorganized from Fujino et al., Journal of Japanese Society of Oral Implantology, 2012, 444-453)
Manufacturer
Nippon Piston Ring Co., Ltd.

New Product Business Promotion Department
Implant Group
1111 Nogi, Nogimachi, Shimotsuga-gun, Tochigi, 329-0114, Japan

Order/Contact us
Head office/Sales: 5-12-10 Honmachi-Higashi, Chuo-ku, Saitama City, Saitama, 338-8503, Japan
Tel: +81-48-856-5033 Fax: +81-48-856-5037
http://www.npr.co.jp/english/index.html

<table>
<thead>
<tr>
<th>Brand name</th>
<th>General name</th>
<th>Classification</th>
<th>Medical device approval/certification/registration number</th>
</tr>
</thead>
<tbody>
<tr>
<td>IAT FIT II</td>
<td>Dental implant system</td>
<td>Specially controlled medical devices</td>
<td>20700B2200172000</td>
</tr>
<tr>
<td>Gold Cylinder</td>
<td>Upper structure materials</td>
<td>Controlled medical devices</td>
<td>20900B22001094000</td>
</tr>
<tr>
<td>Dental Implant Operation-</td>
<td>Operation drill bits</td>
<td>General medical devices</td>
<td>09B1X1000300001</td>
</tr>
<tr>
<td>Drill Set</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dental Implant Operation-</td>
<td>Dental implant operation tools</td>
<td>General medical devices</td>
<td>09B1X1000300002</td>
</tr>
<tr>
<td>Tool Set</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drill Extension</td>
<td>Operation drill attachments</td>
<td>General medical devices</td>
<td>09B1X1000300003</td>
</tr>
<tr>
<td>Dental Impression Taking</td>
<td>Dental impression taking instruments</td>
<td>General medical devices</td>
<td>09B1X1000300004</td>
</tr>
<tr>
<td>Tool</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Screwdriver</td>
<td>Operation screwdrivers</td>
<td>General medical devices</td>
<td>09B1X1000300005</td>
</tr>
<tr>
<td>Technical Component</td>
<td>Technical instruments for dental implant</td>
<td>General medical devices</td>
<td>09B1X1000300006</td>
</tr>
</tbody>
</table>