“Are You Ready for the Next Generation of Denture Material?”

JUVORA™ are at the forefront of the dental industry, with their advanced solutions they are leading the way for technological advancements in the manufacture of dentures.

**Supply Chain efficiency**

JUVORA is also the **only company** to obtain this high performance polymer from a supplier who has more than a decade of proven performance and success in over 4 million implanted devices globally.
Proven Purity and Quality

- Spine fusion
- Hip cups / knee prostheses
- CMF implants
- Suture anchors
- Heart valve frames
- Dental abutments and healing caps
- Intervertebral disc replacement, spinal cages

.....And many more

Safe and controlled supply chain – ONLY use materials from Invibio Biomaterial Solutions who have proven experience and performance in a diverse range of applications
JUVORA Material Properties

They are made from the purest material, which is not changed by additives, meaning no colouring! This purity is proven in human medicine e.g. as an implantable intervertebral disc replacement material in surgery.

Stiffness is more like bone
The product's properties such as elasticity similar to that of bone and high endurance are crucial in dental technology.

JUVORA is a strictly controlled material, which must undergo all tests that verify its biocompatibility in the body. The most important factor is that it is absolutely pure and that no other substances are mixed with it.

JUVORA is tough - melting temperature is 340°C
The solubility and water absorbency of JUVORA are so low that it can be worn for long periods of time with no problem whatsoever.
JUVORA Technician Advantages

• Allergy-free
• High elasticity with e-module
• High resistance against wear, abrasion and corrosion
• Very good sliding properties
• High rigidity with very low weight
• Able to be sterilised
• X-ray transparent
• Retains its original properties even after irradiation
• High freedom of design
• Conserves metal - just think of today's price of gold!

“Through JUVORA dental labs can exploit the advantages of CAD/CAM for the manufacture of dentures, which will be beneficial in reducing labour, error and time”

Thomas Pohland, Master Dental Technician
Duo Dental
JUVORA Patient Advantages

- Allergy-free
- No irritation, redness or burning
- No unpleasant taste
- No residual solvent
- Resistant against deposits and staining
- Inconspicuous colour of the framework
- Easy to clean
- High comfort of wear due to low weight
- High comfort of wear due to immediate absorption of the body heat
- No foreign body sensation
- Cost-savings - not using metal
- Shock absorbing behaviour improves patient comfort

“JUVORA provides patients with an innovative solution that offers a viable alternative to traditional metal dentures”

Bernd Siewert, Dentist
Clinica Somosaguas
Applications for JUVORA

JUVORA can be used in the following applications:

- Screw-retained suprastructures supported by implants
- Attachment Dentures
- Telescope Dentures
Problem:

Due to the ever growing awareness of patients, allergy and metal-free dental restorations are becoming increasingly common.

*An allergy is described as an excessive defence reaction of the immune system to certain, normally harmless, substances. These allergies can cause swelling, redness, burning and a metallic taste in the mouth and even loosening of teeth and tooth loss.
Metal Free Solution – JUVORA is the answer

Solution

• Whether a patient’s dentures are permanent, removable or screw-retained, JUVORA is always the material of choice when it comes to sensitive contact with gums, residual teeth and the new dentures.

• No material helps the gum adapt to the dentures better than JUVORA.

Question:
Why should patients take the risk of a metal allergy when the alternative solutions available are so good?
Juvora Application Data

Performance

Clinic

Application

Material

Processing

Veneering

Wear

Cleaning & Bacteria Adhesion

Juvora Data to Provide Guidance and Drive Device Uptake

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# Typical Mechanical Properties

<table>
<thead>
<tr>
<th></th>
<th>JUVORA</th>
<th>Flexistrong</th>
<th>Polyamide</th>
<th>PMMA</th>
<th>Acetal</th>
<th>Promysan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexural Strength (MPa)</td>
<td><strong>164</strong></td>
<td>118</td>
<td>106</td>
<td>90</td>
<td>85</td>
<td>83.5</td>
</tr>
<tr>
<td>Flexural Modulus (GPa)</td>
<td><strong>4.1</strong></td>
<td>3.5</td>
<td>2.7</td>
<td>2.9</td>
<td>2.5</td>
<td>2.35</td>
</tr>
<tr>
<td>Notched Izod Impact (KJ/m²)</td>
<td><strong>7.6</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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In-vitro testing:
For a material to be recommended for use, the denture needs to withstand a force of 500N without fracture or chipping of the veneer, after it has been submitted to the chewing simulation equivalent of 5 years intra-oral use.

Regensburg University conducted the chewing simulation testing used to simulate oral stress conditions equivalent to 5 years intraoral use ($1.2 \times 10^6$ cycles with a mechanical load of 50N and thermal cycling of 3000 x 5°C/55°C).
Regensburg University conducted the chewing simulation testing used to simulate oral stress conditions equivalent to 5 years intraoral use (1.2x10^6 cycles with a mechanical load of 50N and thermal cycling of 3000 x 5°C/55°C).

Veneering - Sinfony 3M Espe; Thickness 1mm; Al203 - 50 μm/2bar; Clearfill „Alloy Primer“; Clearfil Opaque)

<table>
<thead>
<tr>
<th>Material</th>
<th>Average Failure force [N]</th>
</tr>
</thead>
<tbody>
<tr>
<td>JUVORA un-veneered</td>
<td>4393</td>
</tr>
<tr>
<td>JUVORA veneered</td>
<td>2553</td>
</tr>
</tbody>
</table>

If veneered, then specific fabrication is required to prevent cracking. The chewing simulation showed that the material was strong enough for use.
Telescope Dentures transversal connector

JUVORA removable partial dentures transversal connector did not show any damaged during in-vitro testing. JUVORA transversal connector when failing at higher loads did not fractured and showed good resilient behaviour by regaining their initial shape again after the load was removed. Conversely CoCrMb connectors will fracture at higher loads likely damaging the surrounding tissue.

When choosing thin profiles, it is advisable to increase the rigidity of the connector with stiffening ridges at the edges or at the centre of the connector.

Regensburg University chewing simulation test used to simulate oral stress conditions equivalent to 5 years intraoral use (thermo-cycling (6000x5C/55C) and mechanical loading (1.2x10^6x20N)).

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Flexure Fatigue testing

Also tested other denture materials:
Promysan = 70 MPa
Flexistrong = 70 MPa

JUVORA
140 MPa

Promysan

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## Veneering

<table>
<thead>
<tr>
<th>Surface Treatment</th>
<th>Primer</th>
<th>Opaque</th>
<th>Veneer</th>
<th>Shear Bound Strength (MPa) After 90 days ageing</th>
</tr>
</thead>
<tbody>
<tr>
<td>3M ESPE, Rocatec Plus</td>
<td>3M ESPE, Rocatec Sil</td>
<td>3M Espe, opaquer</td>
<td>3M Espe, Sinfony</td>
<td>27.1</td>
</tr>
<tr>
<td>Alumina oxide</td>
<td>Shofu, Photo Primer</td>
<td>Shofu, Flow opaquer</td>
<td>Shofu, Solidex</td>
<td>14.3</td>
</tr>
<tr>
<td>Alumina oxide</td>
<td>Clearfill, Alloy Primer</td>
<td>Clearfill, opaquer</td>
<td>3M Espe, Sinfony</td>
<td>13.0</td>
</tr>
<tr>
<td>Alumina oxide</td>
<td>Heraeus Signum, Signum Connector</td>
<td>Heraeus, opaquer</td>
<td>Heraeus Signum</td>
<td>11.7</td>
</tr>
</tbody>
</table>

The shear bond strength between JUVORA and the veneer system was determined following ISO TR 11405.
Gum Material – Bond strength with JUVORA

For building the gum, the GC Reline soft, GC is recommended for use with JUVORA

JUVORA surface was treated with Al$_2$O$_3$ (110μm, 2bar) to enhance bounding

- GC Reline soft, GC after 24hr: 1.6 MPa
- GC Reline soft, GC after 5000 thermal cycles: 1.7 MPa
Wear Simulation

JUVORA showed good performance during wear simulation (5 years intraoral use) against enamel and steatite antagonists. Results similar for that seen for standard PMMA denture tooth.

**JUVORA did not damaged the human enamel antagonist during a 5 year wear simulation**

![Bar chart showing wear depth comparison between JUVORA and Sinfony, 3M ESPE (Composite Veneer).]
Bacterial Adhesion

For the caries relevant \textit{S. Mutans} bacteria, JUVORA demonstrated much improved performance when compared with other dental polymers. JUVORA results match what is observed for dental veneer (Sinfony, 3M ESPE)
Observations indicated that JUVORA dentures can be successfully cleaned using both cleaning tablets or electric toothbrushes. For better results is preferable to use cleaning tablets, such as Blend-a-dent from P&G, which was more effective against *Candida albicans* bacterial adhesion.
Screw Torque use in PEEK Temporary Abutments

Literature Review

For PEEK Provisional abutments dental manufactures recommend **screw torque of 10-30 Ncm**

<table>
<thead>
<tr>
<th>Manufacture</th>
<th>Torque (Ncm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BioHorizons ¹</td>
<td>30</td>
</tr>
<tr>
<td>Biomet 3i ²</td>
<td>20</td>
</tr>
<tr>
<td>Lasak ³</td>
<td>20</td>
</tr>
<tr>
<td>Bego ⁴</td>
<td>15</td>
</tr>
<tr>
<td>Neoss ⁵</td>
<td>10</td>
</tr>
<tr>
<td>NobelBiocare ⁶</td>
<td>Manual</td>
</tr>
<tr>
<td>Camlog ⁷</td>
<td>not specified</td>
</tr>
<tr>
<td>Zimmer ⁸</td>
<td>not specified</td>
</tr>
</tbody>
</table>

References: ¹ BioHorizons Prosthetics Catalog; ² Biomet 3i Restorative Manual; ³ Lasak IMPLADENT prosthetics; ⁴ Bego Implant Systems Product Catalogue; ⁵ Neoss Implant System Guidelines; ⁶ Nobel Esthetics Procedures and Products; ⁷ CAMLOG implant system; ⁸ Zimmer plastics temporary abutments

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Thank you for your attention