JUVORA™ Dental Disc
The Processing Guide
The Processing Guide

Instructions for Use and Safety Precautions:
The JUVORA™ Dental Disc shall only be processed in accordance with this manual and the instructions for use.

Qualifications and Safety at Work:
The user has to be trained and skilled in dental technology and know the safety regulations for the application.

JUVORA recommend the use of eye protection, extraction units and a dust mask as is applicable for all standard dental milling procedures.

IMPORTANT: This manual covers the use of products from the following companies:
• 3M ESPE
• GC
• Anaxdent
Other possible combinations can be found in the chart at the end of this manual.

Any systems not referenced in this manual MUST be fully tested according to ISO 11405 Dental Materials – Testing of Adhesion to Tooth Structure, and with a resultant adhesive strength of >10 MPa.

Indications

For the manufacture of frameworks used in the production of:

Removable dental prostheses in the form of telescope attachments, precision attachments, and mechanically attached superstructures.
Contents

This manual describes:

• Preparation of the Model

• Construction and Design Guidance – per Application
  1. Implant Dentures
  2. Implant Bars
  3. Overdentures
  4. Clasp Dentures
  5. Attachment Dentures
  6. Telescope Dentures

• Milling of the JUVORA™ Dental Disc

• Cutting out the prosthesis

• Positioning of the teeth

• Recommended Surface Preparation

• Application of Silane and Preparation of Pre-Manufactured Teeth

• Application of the Foundation Opaque

• Application of Coloured Opaque

• Dentine and Gingiva Flow – Application of Pre-Manufactured Teeth

• Veneering a Tooth

• Corrections

• Veneering of JUVORA with Milled Zirconia Crowns

• Acrylic Veneering Systems

• Composite Veneering Systems

• Cement Systems

Not all sections of this manual are applicable to all indications.
Preparation of the Model

Suggestions for Model Preparation:

Scanning Model:
The model for scanning can be made from gypsum and should have no reflective surface.

Veneering Model:
The model for veneering can be made from transparent acrylic.

Wax Model Construction:
Block out with wax – AVOID sharp edges. This makes it easier to fit the denture to the model after construction.

Scanning Considerations:
To achieve detailed scanning results:
Use high resolution.
A good polygon mesh (at least 1 million) is required as less than this will lead to inaccuracies.
Construction and Design Guidance Per Application

Implant Dentures

Buccal Side of Implant:
- Minimum framework thickness of 1.5 mm
- Preferred framework thickness of 2 mm

Lingual Side of Implant:
- Minimum framework thickness of 2 mm
- Preferred framework thickness of 3 mm

Height of Framework:
- Minimum framework height of 5 mm
- Preferred framework height of 7 mm to 10 mm to improve bonding

Palatinal Plate Protection: Required to avoid damage/de-bonding between the framework and the veneering. Where possible avoid contact between the veneer and the antagonist and ensure contact in the anterior region of the Juvora framework.
Implant Dentures

Abutment Wall Thickness:
Minimum width of 1 mm

Posterior Base Framework:
Minimum width of 9 mm

Anterior Base Framework:
Minimum width of 8 mm

Cantilever:
Maximum of 1 pontic.
Attachment Piece (if using):
To secure the attachment piece onto the framework attachment housing please use the primer bonding system recommended in the veneering table at the end of the document: Page 24
Overdentures

Implant Bar:
Overdentures must ALWAYS be supported by implant bars

Protection Plate:
A Palatinal or Lingual protection plate is required for overdentures when a transpalatal bar (horizontal retainer) is not present

Attachment Piece:
To secure the attachment piece onto the framework attachment housing please use the primer bonding system recommended in the veneering table at the end of the document: Page 29

Palatinal Plate Protection: Required to avoid damage/de-bonding between the framework and the veneering. Where possible avoid contact between the veneer and the antagonist and ensure contact in the anterior region of the Juvora framework.
Removable Clasp Dentures

**Clasps:**
Minimum thickness for clasps in the shape of the drop of 2 mm (thickness) x 3 mm (height).

**Transpalatal bar:**
- Minimum framework thickness of 2 mm
- Minimum framework width of 8 mm

**Retention Plate Holes:**
- Maximum hole diameter of 2 mm
- Minimum distance between hole and external plate wall of 1 mm
- Minimum distance between adjacent holes of 2 mm

**T-Shape Reinforcement:**
Required to provide strength and stability. Minimum diameter: 1.5 mm²

**Machining Tip:**
For higher stability whilst milling, the clasps have to be connected with each other or with the framework. Double closed clasps can be used.
Removable Attachment Dentures

Transpalatal bar:
Minimum framework thickness of 2 mm
Minimum framework width of 8 mm

Retention Grooves:
Must have a smooth finish, round curvature and no indentations and sharp edges.
Minimum width of 2 mm, minimum height 1.5 mm.

Retention Plate Holes:
Maximum hole diameter of 2 mm
Minimum distance between hole and external plate wall of 1 mm
Minimum distance between adjacent holes of 2 mm

T-Shape Reinforcement:
Required to provide strength and stability.
Minimum diameter: 1.5 mm

Attachment Piece:
To secure the attachment piece onto the framework attachment housing please use the primer bonding system recommended in the veneering table at the end of the document: Page 24
Removable Attachment Dentures

**Lingual Bar (lower):**
Minimum thickness of 2 mm
Minimum width of 5 mm

**Transpalatal Bar (upper):**
Minimum thickness of 2 mm
Minimum width of 10 mm

**Connector Housing:**
Wall thickness minimum for each area:
- Occlusal: 1 mm EXCEPT in fully anatomic where thickness should be greater than 1.5 mm
- Buccal: 2 mm
- Lingual: 2 mm
- Palatinal: 2 mm

**Attachment Piece:**
To secure the attachment piece onto the framework attachment housing please use the primer bonding system recommended in the veneering table at the end of the document: Page 24
Removable Telescope Dentures

Retention Plate Framework:
Minimum thickness of 2 mm. Minimum width of 8 mm.

Retention Grooves:
Must have smooth finish, round curvature with no indentations or sharp edges
Minimum groove width of 2 mm and height of 1.5 mm.

T-Shape Reinforcement:
Necessary to assure stability and strength of framework
Minimum diameter: 1.5 mm²

Occlusal Region:
Minimum wall thickness of 1.5 mm.

Transpalatal Bar:
Minimum thickness of 2 mm. Minimum width of 10 mm.

Retention Plate Holes:
Additional holes provide maximum veneering stability
Maximum hole diameter of 2 mm
Minimum distance from hole to plate wall of 1 mm
Minimum distance between holes of 2 mm.
Removable Telescope Dentures

Lateral Region of Secondary Telescope Crown:
Minimum wall thickness of 2 mm

Wall Thickness Between Adjacent Secondary Telescope Crown:
Preferably greater than 1 mm thickness
Minimum thickness of 0.7 mm.

Buccal Area of Secondary Telescope Crown:
Preferably 1 mm thickness
Minimum thickness of 0.7 mm

Lingual Region:
Minimum thickness of 2 mm
Removable Telescope Dentures

Removable telescope dentures without transpalatal bar (horizontal retainer) – requires the designing of a palatinal protection plate (for upper jaw denture) or lingual protection plate for (for lower jaw denture).
Palatinal protection plate is required to avoid damage or de-bonding between the framework and the veneering. The antagonist should only make contact in the anterior region with the JUVORA™ material, and not at the juncture between JUVORA and the veneering material.
Important Design Considerations for JUVORA Frameworks

Notches in Framework:
Where possible AVOID introducing notches into the JUVORA framework. Creating a notch creates a point of weakness within the framework.

If unavoidable notches must not be present on areas with a thickness less than 2 mm and must have an angle greater than 45 degrees.

Scooped Features:
Scooped features can weaken the JUVORA framework.

ENSURE that such a feature is not adjacent to a thin wall thickness.

Grooves:
Groove features can act as stress concentrators and can weaken the JUVORA framework.

ENSURE that such a feature is not adjacent to a thin wall thickness.

Key Design Focus:
If the guidance on framework design with regard to avoiding introduction of notches and/or minimum wall thickness is not followed, then failure can occur.
Recommendations Regarding the Construction of Collateral Parts

Construction:
Primary Parts: Primary telescopes and attachments
Parallelism: 0° parallel
No cone
Height of the friction: minimum 3 mm

Zirconium is recommended as the material for primary telescope crowns.

For the secondary telescope crowns produced from a material which is not JUVORA™ (for example gold) a minimum wall thickness of 0.6 mm is recommended.
Milling of the JUVORA™ Dental Disc

Machine Selection:
JUVORA Dental Discs can only be processed on suitable milling machines with suitable milling programs. JUVORA recommends adaptation of the CAM software by your software manufacturer. For an exact fit, JUVORA recommends a 5-axis milling machine of stable construction.

Cooling:
JUVORA recommends cooling the milling head either with compressed air or cooling fluids.

Time Taken:
Milling time should be approximately 2 hours depending upon size and design.

Tool Speed:
It is advisable to keep tool speed above 15,000 rpm to avoid heat generation on the surface of the disc. Operating at lower tool speeds may lead to stresses which in turn can cause dimensional inaccuracies, problems with patient fit and potential framework failure under loading.

Tool Selection:
JUVORA recommend the use of silicon carbide or diamond tipped tooling.

<table>
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<tr>
<th>Milling Machine Set-Up</th>
<th>Use a 5-axis milling machine to enable a milling angle of 15°</th>
<th>Use silicon carbide or diamond tipped tooling</th>
<th>Use diamond tipped tooling</th>
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<tr>
<td>Clearance Angle (°)</td>
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<td>15 – 30</td>
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<td>Rake Angle (°)</td>
<td>6 – 10</td>
<td>6 – 10</td>
<td></td>
</tr>
<tr>
<td>Cutting Speed (m/min)</td>
<td>Up to 15,000</td>
<td>Up to 15,000</td>
<td></td>
</tr>
<tr>
<td>Coolants</td>
<td>Compressed air</td>
<td>Compressed air</td>
<td></td>
</tr>
<tr>
<td>Feed may be up to 0.5 mm/tooth</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Cutting Out the Prosthesis

1) Upon removal from the milling machine - carefully remove the connection bars with a fine bur

2) We recommend the use of grinding instruments which are suitable for soft materials

3) Closed retention holes can be opened with a fine bur

Positioning of the Teeth

1) Use modelling wax to hold the teeth in situ. Teeth will be veneered later (Veneering of the teeth is explained in the veneering section).

2) Application of the transparent silicon aids fixation of the teeth during light curing.
Recommended Surface Preparation

1) Sandblasting of the framework (Rocatec plus, pressure: 3 bar, distance: 1 cm), please see manufacturer’s guidance.

2) Sandblasting of the teeth with Aluminium Oxide – pressure: 3 bar, distance: 1 cm.

Application of Silane and Preparation of Pre-Manufactured Teeth

1) In this manual the silane 3M ESPE Sil is used.

2) A thin application of silane is recommended. Drying time should be between 5 to 30 minutes maximum.

3) The teeth are then glued to the silicone ready for veneering.
Application of Foundation Opaque

1) Apply the Foundation Opaque thinly and evenly to avoid “puddles”.

2) Polymerisation of the opaque
   Time of polymerization of the opaque: 3 Minutes
   Wavelength for polymerization: 380 to 450 Nm

3) After polymerisation a smooth, shiny surface should be achieved. In case of insufficient coverage add another layer.

Application of Colored Opaque

1) Apply the pink colored opaque thinly and evenly in 2 layers to avoid “puddles”.

2) Apply the tooth colored opaque thinly and evenly in 2 layers to avoid “puddles”.

3) Polymerization of the opaque
   Time of polymerization of the opaque: 3 Minutes
   Wavelength for polymerization: 380 to 450 Nm

4) After polymerisation a smooth, shiny surface should be achieved.
Dentine and Gingiva Flow – Application of Pre-Manufactured Teeth

1) The dentine flow should be applied to the model (framework and teeth in silicone) initially from the occlusal side followed by a short polymerization.

2) The gingiva flow is then applied from the buccal side (following removal of silicone) followed by a short polymerization.

3) Apply the Air Barrier and complete a final polymerization according to the thickness of the layer (5 to 10 minutes).
Veneering a Tooth

1) Sandblasting of the framework (Rocatec plus, Pressure: 3 bar, Distance: 1 cm). Please see Manufacturer’s advice

2) Apply a thin layer of 3M ESPE Sil silane.
   Drying time: 5 to 30 Minutes max.

3) Apply the Foundation Opaque thinly and evenly.
   Time of polymerization: 3 Minutes

4) Apply the tooth colored opaque thinly and evenly in 2 layers to avoid “puddles”.
   Time of polymerization: 3 Minutes.

5) Apply opaque dentine using the spatula technique. Do not use any fluid.

6) Apply the opaque O-dentin with a brush, wetting the brush lightly with composite primer. Follow with a short polymerization.

7) Apply the dentine using a brush to modify the shape, wetting the brush lightly with composite primer. Follow wit a short polymerization.

8) Apply the enamel and modify the final shape. Follow with a short polymerization.

9) Apply the Air Barrier and complete a final polymerization according to the thickness of the layer (5 to 10 Minutes).
Corrections

1) Sandblast using Aluminium oxide. Pressure: 3 bar, Distance: 1 cm.

2) Steam clean

3) Apply the composite primer.

4) Light cure for 5 Minutes

5) Apply the required material depending upon the correction.

6) Short Polymerization.

7) Repeat steps 5 and 6 as required.

8) Final polymerization: 5 to 10 Minutes.
Veneering of JUVORA with milled Zirconia crowns

- Surface treatment of the single zirconia crowns – Sandblasting (Al2O3, 2bar, 120µm)
- Surface treatment of the Juvora framework – Sandblasting (Al2O3, 2bar, 50µm)
- Application of the bounding primer – Scotchbond Universal Adhesive, 3M ESPE
- Application of the dental cement – RelyXUltimate, 3M ESPE
- Insertion of the Zirconia crowns onto the Juvora framework
- Application of the gum coloured opaque – GC Gum Opaque, GC
- Application of the gum veneer – GC Reline Soft, GC
- Final polymerization and Polishing – Ceramic rubber polishing instruments & diamond polishing paste
Acrylic Veneering Systems

Finishing the Juvora Prosthesis with Acrylic Injection

Dental acrylic and injection systems which could be used with JUVORA prostheses are:

• **Fast Protec**, acrylic system and pouring technique.

• **PalaXpress**, Heraeus Kulzer, acrylic system applied through injection and pouring techniques.
## Composite Veneering Systems

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<tr>
<th>System</th>
<th>Surface Treatment</th>
<th>Bonding Primer</th>
<th>Opaque Paste</th>
<th>Dentin Veneer</th>
<th>Shear Bond Strength (MPa) – After 90 days aging</th>
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<tr>
<td>GC Gradia</td>
<td>Al₂O₃/2 bar/50μm</td>
<td>Bredent, Visiolink</td>
<td>GC opaquer</td>
<td>GC Gradia</td>
<td>27.3</td>
</tr>
<tr>
<td>3M ESPE, Sinfony</td>
<td>3M ESPE, Rocatec</td>
<td>3M ESPE, ESPE Sil</td>
<td>3M ESPE, Sinfony</td>
<td>3M ESPE, Sinfony</td>
<td>27.1</td>
</tr>
<tr>
<td>Bredent/Visioline</td>
<td>Al₂O₃/2 bar/50μm</td>
<td>Bredent, Visiolink</td>
<td>Combo lign</td>
<td>Crea.lign</td>
<td>24.2</td>
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<tr>
<td>Shofu, Ceramage</td>
<td>Al₂O₃/2 bar/50μm</td>
<td>ML Primer</td>
<td>Pre/Opake</td>
<td>Shofu, Ceramage</td>
<td>21.1</td>
</tr>
<tr>
<td>GC Gradia</td>
<td>3M ESPE, Rocatec</td>
<td>3M ESPE, ESPE Sil</td>
<td>GC opaquer</td>
<td>GC Gradia</td>
<td>21.0</td>
</tr>
<tr>
<td>GC Gradia</td>
<td>Al₂O₃/2 bar/50μm</td>
<td>GC Metal primer II</td>
<td>GC opaquer</td>
<td>GC Gradia</td>
<td>19.6</td>
</tr>
<tr>
<td>3M ESPE, Sinfony</td>
<td>3M ESPE, ocatec</td>
<td>3M ESPE, ESPE Sil</td>
<td>3M ESPE, Sinfony</td>
<td>3M ESPE, Sinfony</td>
<td>19.6</td>
</tr>
<tr>
<td>Ivoclar, SR Adoro</td>
<td>Al₂O₃/2 bar/50μm</td>
<td>Ivoclar, SR Link</td>
<td>Ivoclar, SR Opaque</td>
<td>Ivoclar, SR Adoro</td>
<td>17.9</td>
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<tr>
<td>Heraeus Kulzer/Signum</td>
<td>Al₂O₃/2 bar/50μm</td>
<td>Metallbond I and II</td>
<td>Opaque F</td>
<td>Heraeus, Signum</td>
<td>14.6</td>
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<tr>
<td>Shofu, Solidex</td>
<td>Al₂O₃/2 bar/50μm</td>
<td>Shofu, Photo Primer</td>
<td>Shofu, Flow</td>
<td>Shofu, Solidex</td>
<td>14.3</td>
</tr>
<tr>
<td>Schuetz, A+B Composite</td>
<td>Al₂O₃/2 bar/50μm</td>
<td>Clearfill, Alloy Primer</td>
<td>Clearfill, Opaque</td>
<td>3M ESPE, Sinfony</td>
<td>13.0</td>
</tr>
<tr>
<td>Heraeus, Signum</td>
<td>Al₂O₃/2 bar/50μm</td>
<td>Schuetz, Bonding Fluid</td>
<td>Schuetz, Paste</td>
<td>Schuetz, A+B Composite</td>
<td>12.7</td>
</tr>
</tbody>
</table>

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Cement Systems

<table>
<thead>
<tr>
<th>System</th>
<th>Surface Treatment</th>
<th>Bonding Primer</th>
<th>Cement</th>
<th>Shear Bound Strength (MPa)</th>
<th>After 90 days ageing</th>
</tr>
</thead>
<tbody>
<tr>
<td>RelyXUltimate, 3M ESPE</td>
<td>Al2O3/2bar/50μm</td>
<td>Scotchbond Universal Adhesive, 3M ESPE</td>
<td>RelyXUltimate, 3M ESPE</td>
<td>21.2</td>
<td></td>
</tr>
<tr>
<td>RelyXUnicem, 3M ESPE</td>
<td>Al2O3/2bar/50μm</td>
<td>Scotchbond Universal Adhesive, 3M ESPE</td>
<td>RelyXUnicem, 3M ESPE</td>
<td>20.6</td>
<td></td>
</tr>
</tbody>
</table>

The shear bond strength between JUVORA and the cement system was determined in accordance to ISO TR 11405.

<table>
<thead>
<tr>
<th>System</th>
<th>Surface Treatment</th>
<th>Bonding Primer</th>
<th>Cement</th>
<th>Performance under chewing simulation testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variolink II, Ivoclar-Vivadent</td>
<td>Rocatec Pre, 3M ESPE</td>
<td>Heliobond, Ivoclar-Vivadent</td>
<td>Variolink II, Ivoclar-Vivadent</td>
<td>No decementations were observed with a diverse range of frameworks</td>
</tr>
</tbody>
</table>

Surface treatment - Plasma

Plasma treatment is a technology that potentially could be used to enhance the bounding of dental systems to the PEEK polymer surface, as showed by M. Weppler in Plasmatechnologie - das Multitalent für neue zahntechnische Anwendungen, Quintessenz Zahntechnik 2015; 41(6): 700-716.

Plasma technology could be used in combination with other surface treatment techniques such as grit blasting.
Safety Information
While machining the JUVORA™ Dental Disc, the following safety precautions are recommended:
• Dust mask or dust extraction
• Personal protective equipment (eye protection, gloves)

Storage Information
The JUVORA Dental Disc should be stored in dry conditions and exposure to direct sunlight should be avoided. The PEEK-OPTIMA® polymer from which the JUVORA Dental Disc is made is stable and can be stored for an extended period (10 year shelf life). It has a working temperature range from cryogenic up to 250 °C and hence the storage temperature range for the JUVORA Dental Disc is any ambient temperature and humidity.

Additional Information
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