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
• Kulzer
• Ivoclar Vivadent

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

• Finishing of the JUVORATM milled framework
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  - Positioning of the teeth
  - Recommended Surface Preparation
  - Application of Silane and Preparation of Pre-Manufactured Teeth
  - Application of the Foundation Opaque
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  - Dentine and Gingiva Flow – Application of Pre-Manufactured Teeth
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• Veneering of JUVORA™ with Milled Zirconia Crowns

• Veneering of JUVORA™ with Acrylic Systems

• Veneering of JUVORA™ with Composite Systems

• List of Composite Veneering Systems

• List of 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

Anterior Base Framework:
Minimum width of 8 mm

Cantilever:
Maximum of 1 pontic.

Posterior Base Framework:
Minimum width of 9 mm
Implant Bars

Posterior Wall Thickness:
Minimum of 6 mm

Abutment Wall Thickness:
Minimum width of 1 mm

Anterior Wall Thickness:
Minimum of 5 mm

Height:
Minimum of 4 mm
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.

Framework Wall Thickness: Minimum wall thickness of 2 mm on occlusal, lingual and buccal regions.

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

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

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

Framework Wall Thickness:
Minimum wall thickness of 2 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 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

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.

Framework Wall Thickness:
Minimum wall thickness of 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 26
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 26
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.

**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

**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

**Framework Wall Thickness:**
Minimum wall thickness of 2 mm
Removable Telescope Dentures

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

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

Wall Thickness Between Adjacent Secondary Telescope Crown:
Preferably greater than 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 JUVORATM (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.

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<th>Use silicon carbide or diamond tipped tooling</th>
<th>Use diamond tipped tooling</th>
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<td><strong>Instructions</strong></td>
<td>Use a 5-axis milling machine to enable a milling angle of 15°</td>
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<tr>
<td>Clearance Angle (°)</td>
<td>5 - 15</td>
<td>15 - 30</td>
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<tr>
<td>Rake Angle (°)</td>
<td>6 - 10</td>
<td>6 - 10</td>
</tr>
<tr>
<td>Cutting Speed (RPM)</td>
<td>Up to 15000</td>
<td>Up to 15000</td>
</tr>
<tr>
<td>Coolants</td>
<td>Compressed air</td>
<td>Compressed air</td>
</tr>
<tr>
<td>Feed may be up to 0.5 mm/tooth</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Finishing of the JUVORA™ milled framework

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.

![Image of sandblasting process](image)

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.

![Image of silane application process](image)

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).
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 – Scothbound 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
Veneering of JUVORA™ with Acrylic Systems

- Surface treatment of the Juvora framework – Sandblasting (Al2O3, 2bar, 50µm)
- Application of the bounding primer – Signum connector, Kulzer
- Application of the opaque – Signum opaque F, Kulzer
- Acrylic veneer – PalaXpress, Kulzer
- Application of the acrylic veneer utilizing a pressure polymerisation unit – Palamat Elite, Kulzer
- Finish and Polishing – Tungsten burs, silicone rubber, sand paper and polish with pumice paste & Universal Polishing paste, Ivoclar Vivadent
Veneering of JUVORA™ with Composite Systems

- Surface treatment of the Juvora framework – Sandblasting (Al2O3, 2bar, 50µm)
- Application of the bounding primer – GC Metal Primer II, GC
- Application of the opaque paste - GC opaquer, GC
- Application of the dentin veneer – GC Gradia, GC
- 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
## List of 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>
</tr>
</thead>
<tbody>
<tr>
<td>GC Gradia</td>
<td>( \text{Al}_2\text{O}_3/2 \text{ bar/50} \mu \text{m} )</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 Pro, Plus</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>( \text{Al}_2\text{O}_3/2 \text{ bar/50} \mu \text{m} )</td>
<td>Bredent, Visiolink</td>
<td>Combo lign</td>
<td>Crea.lign</td>
<td>24.2</td>
</tr>
<tr>
<td>Shofu, Ceramage</td>
<td>( \text{Al}_2\text{O}_3/2 \text{ bar/50} \mu \text{m} )</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 Plus</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>( \text{Al}_2\text{O}_3/2 \text{ bar/50} \mu \text{m} )</td>
<td>GC Metal primer II</td>
<td>GC opaquer</td>
<td>GC Gradia</td>
<td>19.6</td>
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<tr>
<td>3M ESPE, Sinfony</td>
<td>3M ESPE, ocatec Plus</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>( \text{Al}_2\text{O}_3/2 \text{ bar/50} \mu \text{m} )</td>
<td>Ivoclar, SR Link</td>
<td>Ivoclar, SR Opaquer</td>
<td>Ivoclar, SR Adoro</td>
<td>17.9</td>
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<tr>
<td>Heraeus Kulzer/Signum</td>
<td>( \text{Al}_2\text{O}_3/2 \text{ bar/50} \mu \text{m} )</td>
<td>Metallbond I and II</td>
<td>Opaquer F</td>
<td>Heraeus, Signum</td>
<td>14.6</td>
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<tr>
<td>Shofu, Solidex</td>
<td>( \text{Al}_2\text{O}_3/2 \text{ bar/50} \mu \text{m} )</td>
<td>Shofu, Photo Primer</td>
<td>Shofu, Flow Opaquer</td>
<td>Shofu, Solidex</td>
<td>14.3</td>
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<tr>
<td>3M ESPE, Clearfill/Sinfony</td>
<td>( \text{Al}_2\text{O}_3/2 \text{ bar/50} \mu \text{m} )</td>
<td>Clearfill, Alloy Primer</td>
<td>Clearfill, Opaquer</td>
<td>3M ESPE, Sinfony</td>
<td>13.0</td>
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<tr>
<td>Schuetz, A+B Composite</td>
<td>( \text{Al}_2\text{O}_3/2 \text{ bar/50} \mu \text{m} )</td>
<td>Schuetz, Bonding Fluid</td>
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<td>Schuetz, A+B Composite</td>
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<tr>
<td>Heraeus, Signum</td>
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<td>Heraeus, Opaquer</td>
<td>Heraeus, Signum</td>
<td>11.7</td>
</tr>
</tbody>
</table>
### Surface treatment - Plasma

Plasma treatment is a technology that potentially could be used to enhance the bonding 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**
For additional information contact:

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