Test Project

Dental Prosthetics

Submitted by:
Emmitt Miller - Shining 3D, Independent Test Project Designer

Mark Chan - SNF, Independent Test Project Validator

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Introduction

The WSC2026 Dental Prosthetics Test Project is designed to reflect the rapid digitalization of the dental industry. It transitions from clinical simulation and data acquisition to CAD/CAM manufacturing and high-end aesthetic finishing. This project assesses a Competitor's ability to operate as an associate professional capable of delivering precise, patient-ready prosthetic solutions that restore both function and aesthetics. The design concept focuses on the "Digital Workflow" cycle, requiring mastery of intraoral and desktop scanning, restorative CAD design, additive manufacturing (3D printing), and subtractive manufacturing (5-axis milling).

Description of project and tasks

The competition is divided into four modules spanning 22 hours of competition time over 4 days.

Module A: Scan to Print Appliance (Competition day 1 – 6 hours)

Objective: Demonstrate clinical data acquisition and manufacturing of a protective appliance.

Milestones: Clinical patient setup, intraoral scanning, exocad design, 3D printing, and resin tank maintenance.

Assessment Summary: Scored on clinical professionalism (Judgement), design thickness (Measurement), and final fit (Measurement).

Module B: Digital Wax-Up (Assigned at the start of Competition day 1; to be delivered at the end of Competition day 3)

Objective: Restore aesthetic and anatomical form to a prepped arch.

Milestones: Designing teeth 13, 12, 11, 21, 22, and 23 to match a physical unprepared study model.

Assessment Summary: Evaluated via digital STL overlay to measure volumetric deviation from the target morphology.

Module C: Digital Full Denture (Competition day 2 – 6 hours)

Objective: Design and assemble a complete upper removable denture.

Milestones: Monolithic tooth bridge design, pocketed base design, dual-material printing, resin tank maintenance, and bonding.

Assessment Summary: Judgement of aesthetics and Measurement of functional occlusion.

Module D: Full Zirconia Restoration (Competition day 3 and 4 – 10 hours total)

Module D1 (6 hours): Desktop scanning of a prepared #16 or #26, CAD design, and MillBox nesting for 5-axis zirconia milling.

Module D2 (4 hours): Seating the sintered crown, anatomical contouring, A2 staining, and final glazing.

Assessment Summary: Measurement of shade matching and marginal integrity and Judgement of morphology.

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Instructions to the Competitor

Module A: Clinical Scan to 3D Printed Appliance

Competition day 1 | Duration: 6 hours | Focus: Clinical Simulation, Data Acquisition, CAD Design, and Additive Manufacturing.

Step 1: Clinical Preparation and Setup

- Organize the workstation and treat the dental dummy head as a live patient.
- Demonstrate professional hygiene by donning the required PPE: laboratory coat, mask, safety glasses, and gloves.
- Explain the intraoral scanning procedure to the "patient" and apply a protective patient drape.

Step 2: Intraoral Scanning (Aoralscan 3i)

- Create the scan order for a maxillary, removable orthodontic appliance.
- Perform a high-fidelity scan of the upper and lower arches, ensuring all terminal molars and critical anatomy are captured.
- Utilize a dental mirror for proper soft-tissue retraction during the scan.
- Capture a precise bite registration to ensure accurate digital articulation. Verify the bite in the Pre-Design step using the heat map function.
- Export case data as .obj and save the files to the desktop using folder name WSC2026_Skill42_Module[X]_CompID[Y]. Place them in a sub-folder titled “Scans”

Step 3: CAD Design (exocad)

- Set up the case for splint and model design.
- Import data into exocad and define the appropriate/balanced path of insertion.
- Occlusal Refinement.
    - Model Alignment and Orientation:
        - Use the "Rearticulate models virtually" step.
        - The maxillary arch must be aligned to the default Bonwill triangle/Balkwill angle parameters.
        - The occlusal plane must align perfectly with the virtual articulator’s horizontal reference plane.
    - Anatomical Bite Opening:
        - Initialize the Virtual Articulator Window using the Artex template.
        - Open the bite using the Incisal Pin / Opening of Bite slider until a minimum clearance of 2.0 mm is achieved between the closest opposing posterior cusps.
        - The "Use Incisal Table" box must be checked to lock this vertical dimension.
    - Dynamic Function Settings:
        - Run the dynamic articulation simulation using the standard parameters: Condylar Guidance Angle: 30° Bennett Angle: 15°
        - Execute the full simulation path (Protrusive, Left Lateral, Right Lateral).
- Design a Maxillary, Flat-Plane Stabilizing Splint (Michigan Style) with canine guidance and posterior disclusion.
- In Static Occlusion, every mandibular buccal cusp and incisal edge should make distinct, pinpoint contact with the flat plane of the splint.

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- In Dynamic Occlusion:
    - Canine Guidance: During lateral excursions, only the mandibular canines should guide the movement on the working side. All posterior teeth should instantly disclude (show zero contact).
    - Protrusive Guidance: The central incisors must smoothly guide forward movement, discluding all posterior teeth.
- Establish smooth, anatomical borders:
    - Facial/Labial extension: Must cover the incisal/occlusal third of the teeth (approximately 2.0 mm to 3.0 mm past the incisal edge)
- Palatal extension: Must extend 6.0 mm to 8.0 mm apically from the gingival margin, following a uniform, smooth scalloped or straight boundary.
- Utilize the following undercut relief settings. Manually adjust as needed after applying software settings.
    - Offset - 0.03 mm
    - Draft Angle - 1.0°
    - Allow Undercuts up to: 0.25 mm
    - Intaglio Smoothing - 5%
- Ensure a uniform material minimum thickness of 1.5 mm and an occlusal minimal thickness of 2.0 mm.
- Design a 3D-printable seating model for the splint. Including the following in the design:
    - a base
    - stabilizer posts
    - text with the module number and Competitor ID
- Place the finished design files in the folder WSC2026_Skill42_Module[X]_CompID[Y]. Place them in a sub-folder titled “Designs”

Step 4: Additive Manufacturing (AccuFab CEL)

- Prepare the print files using AccuWare software
- Use the provided USB flash drive to transfer the files to the printer
- Print the splint using the SH01 resin and the model using DM12 resin.
- lect optimal support placement to minimize damage to the internal fitting surfaces. Nest the splint at a 20° ramp.
- Use of both the small and large resin tank is allowed.
- Immediately after the print cycle, you must thoroughly clean the resin tanks with 97% isopropyl alcohol to prepare for subsequent modules.

Step 5: Post-Processing and Finishing

- Wash and cure the objects using the FabWash and FabCure units. Use of nitrogen during curing is optional.
- Remove supports from model and splint.
- Seat the splint on the printed model.
- Finish and polish the splint to a high-shine, patient-ready standard.

Module B: Digital Wax-Up (Aesthetic Restoration)

Competition day 1-3 | Focus: Morphology, Symmetry, and Anatomical Accuracy.

Step 1: Case Analysis

- Review the provided digital scan of prepped teeth (13, 12, 11, 21, 22, 23) alongside the physical, unprepared study model.
- Use manual calipers or rulers as needed to measure the morphology of the physical model.

Step 2: CAD Design (exocad)

- Perform a digital wax-up of the anterior segment (13–23).
- Match the design as closely as possible to the physical study model's original morphology.
- Ensure proper marginal integrity and anatomical transitions between the prepped surfaces and the design.

Step 3: Submission

- Export the finalized design as an STL file and save the files to the desktop using folder name WSC2026_Skill42_Module[X]_CompID[Y] for scoring via digital overlay.

Module C: Design to Print Upper Full Denture

Competition day 2 | Duration: 6 hours | Focus: Complete Removable Prosthetics and Assembly.

Step 1: CAD Design (exocad)

- Set up the case for a Maxillary full denture for 3D printing.
- Import the scans from the folder on the desktop titled WSC2026_Skill42_Module3, sub-folder "Scans"
- Orient the model to minimize severe undercuts in the anterior labial notch while utilizing the tuberosity regions for mechanical retention.
    - Settings:
    - Draft Angle (Blockout Angle): Set between 0.0° to 1.0° max.
    - Allow Undercuts Up To: Set between 0.05 mm to 0.10 mm.
- Using the Model Analysis tool to plot critical landmarks. Accurately place identification markers on:
    - The Incisive Papilla
    - The Mid-Palatal Suture Line
    - The center of both Maxillary Tuberosities
    - The Vibrating Line.
- Utilize the virtual articulator to establish the occlusal scheme.
- Design a monolithic tooth bridge and a pocketed denture base.
- Anterior teeth must be arranged so the dental midline aligns perfectly with the model's incisive papilla line. The canine-to-initiation line must follow the curvature of the ridge.
- The occlusal plane must be set parallel to the camper's line (or the virtual articulator's template plane).
- The functional cusps of the upper posterior teeth must be centered directly over the crest of the residual ridge to ensure chewing forces do not tip the denture.
- Set denture base minimum thickness to 2.0 mm uniformly across the palate.
- Must be designed with a rounded, anatomical border between 2.5 mm and 3.0 mm thick to properly fill the vestibular space without over-extending into moving tissue.
- Set the Glue Gap / Radial Cement Gap between 0.05 mm to 0.08 mm.
- Ensure the design meets all physiological and aesthetic parameters for a complete denture.

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- Place the finished design files in the folder WSC2026_Skill42_Module[X]_CompID[Y]. Place them in a sub-folder titled "Designs"

Step 2: Manufacturing

- Prepare the print files using AccuWare software
- Use the provided USB flash drive to transfer the files to the printer
- Print the base in DT01 resin and the tooth bridge in CB11 resin.
- Use of both the small and large resin tanks are allowed.
- Process both components through washing and curing cycles using the appropriate devices. Nitrogen curing is optional.
- Remove supports and smooth the surfaces.

Step 3: Assembly and Finishing

- Clean the bonding surfaces and use the provided bonding agent to secure the tooth bridge into the base.
- Verify the fit using the provided articulated models and adjust the occlusion as required.
- Apply light-cure stain and glaze, ensuring no visible layer lines or processing defects remain.
- Deliver the denture on the articulated models for scoring.

Module D: Full Zirconia Restoration (Scan-Mill-Finish)

Competition day 3 and 4 | Duration: 10 hours (6 hours design/Mill + 4 hours finish) | Focus: Subtractive Manufacturing and Aesthetic Characterization.

Step 1: Data Acquisition (Competition day 3)

- Create the scan order for a single unit maxillary first molar.
- Scan the vertex articulated model (prepared #16 or #26) using the DS EX Pro EP desktop scanner.
- Export case data as .stl and save the files to the desktop using folder name WSC2026_Skill42_Module[X]_CompID[Y]. Place them in a sub-folder titled "Scans"

Step 2: CAD Design (exocad – Competition day 3)

- Set up the case for a maxillary first molar single unit zirconia crown in accordance with the model.
- Import the scan files.
- Design a full-contour zirconia crown.
- Use the bite optimization if needed.
- Set proximal contacts at -0.05 mm and the occlusal relationship to 0.25 mm out of occlusion.
- Place the finished design files in the folder WSC2026_Skill42_Module[X]_CompID[Y]. Place them in a sub-folder titled "Designs"

Step 3: Subtractive Manufacturing (MillBox and Upcera A52 – Competition day 3)

- Use the provided USB flash drive to transfer the files to the Mill PC in the Competitors shared workspace.
- Nest the crown into a pre-shaded ST-ML A2 zirconia puck using MillBox. Place your Competitor number in the intaglio of the crown for identification.
- Operate the Upcera A52 mill; technicians may assist with hardware troubleshooting only.
- Cut the crown from the puck and remove sprues before placing it in the GT1 Pro sintering furnace for overnight sintering.

Step 4: Aesthetic Finishing (Competition day 4)

- Remove the sintered crown and verify the fit, contacts, and occlusion on the prepared model.
- Characterize the restoration to match shade A2 using the stain and glaze kit.
- Perform a final glaze firing and deliver the restoration on the articulator for scoring.

Other

General clinical and technical standards

- Patient Interaction: Treat the dental dummy head as a live patient by explaining the scanning process, ensuring the patient is comfortably positioned, and utilize a patient drape.
- PPE Requirements: Competitors must wear a laboratory coat, mask, safety glasses, and gloves (nitrile or latex) during all clinical and manufacturing phases.
- Scanning Protocol: Use the Aoralscan 3i intraoral scanner with proper retraction techniques using a dental mirror to ensure data completeness and avoid excessive rescanning.
- Tooth Numbering: The FDI Two-Digit Tooth Numbering system must be used throughout the competition for all documentation and design work.

Manufacturing and maintenance

- 3D Printing Equipment: Competitors are provided with one AccuFab CEL printer and two resin tanks.

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- Resin Swap and Hygiene: When transitioning between modules (e.g., module A to module C), Competitors must thoroughly clean resin tanks using 97% Isopropyl Alcohol to avoid cross-contamination between resins.
- Milling and Sintering: Upcera technicians are available for hardware/software troubleshooting of the A52 mill and GT1 Pro sintering furnace; nesting in MillBox is the Competitor's responsibility. All crowns for module D1 must be placed in the Upcera GT1 Pro sintering furnace by the end of Day 3 for overnight sintering.
- Shining 3D Technical Support: On-site technicians are restricted to hardware/software troubleshooting and may not assist with design or technical decisions.
- 3D Printing and Milling Failure Policy: If a printed part or milled crown fails due to Competitor error (e.g., poor support placement), a second attempt is permitted if time allows. However, a 2.00 point deduction will be applied to the module's total score for a second attempt. A re-mill will only be allowed once all Competitors have milled their first crown.

Workspace protocols and hygiene

- Shared Workspace Protocol: The area containing the sink, steam cleaner, and sandblaster is limited to one Competitor at a time.
- Access: If the shared workspace is currently occupied, all other Competitors must wait at their personal workstation until it is unoccupied. If two Competitors arrive at the same time, we will use the randomly assigned workstation number as a tie breaker. The Competitor with the lowest station number will go first and the second Competitor will automatically be next in the queue.
- Time Limit: Usage is restricted to a maximum of 10 minutes per session.
- Hygiene: The station must be wiped down with a paper towel and left completely dry immediately after each use.
- Individual Workstation Care: Stations must be cleaned at the conclusion of every module, with specific attention paid to the 3D printer and washing/curing units.
- Tool Management: All hand-pieces, tools, and burs must be returned to their designated holders before the end of the session.

Data, IT, and professionalism

- Data Integrity and Naming: Save all designs and scans according to the mandatory naming convention: WSC2026_Skill42_Module[X]_CompID[Y].
- IT Security: Competitors must password-protect their Lenovo Ultra9 workstation. A master password must be provided to the Skill Management Team (SMT) in a sealed envelope for auditing, and screens must be locked whenever the station is left unattended.
- Workflow Efficiency: Competitors are encouraged to overlap tasks to optimize competition time.
- Professionalism Assessment: Competitors will be evaluated via Judgement (0–3 scale) on the following:
    - Resin Management: Thoroughness of tank cleaning/swapping.
    - Workspace Maintenance: Continuous cleanliness and end-of-module organization.
    - Tool Return: Proper organization of hand-pieces and burs.
    - Conduct: Adherence to IT security and professional laboratory behavior.

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