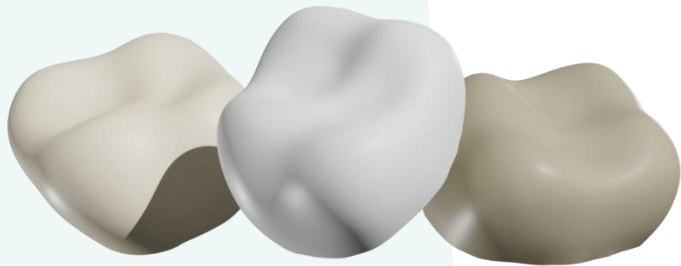


Ultra-Thin personalized PEEK crowns

for caries, MIH-hypomineralized, dentinogenesis imperfecta, and other sensitive cases in teeth

Intensive Course

12h – Theoretical + Hands-on



Filipe Samuel Silva

Version 1.0 (2024)

Dental crowns are fundamental for structural teeth protection, chewing function, face biomechanical function, aesthetics, caries management, sensitivity protection, teeth with structural imperfections and other anomalies' protection and restoration, and... much more.

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1. Dental crowns. Why are they needed?

Dental Crowns: Choices, Properties and Applications

2. Materials in the Market

Materials and their overall properties play a crucial role on crown's behaviour. Understanding them is fundamental for a better clinical performance.

- 2.1 Metal based
- 2.2 Ceramic based
- 2.3 Polymer based
- 2.4 Graded Materials
- 2.5 Natural Teeth
- 2.6 Comparative analysis
- 2.7 How to evaluate Materials – Tests, Standards and Regulations, and videos
- 2.8 Hand's on time – feeling, observing, and testing.

3. Mechanical Properties

Teeth, bone, restorative materials and crowns are primarily structural parts. Properties as elasticity, flexibility, yield and rupture strength, are fundamental for crown's durability.

- 3.1 Strength: Yield and Rupture
- 3.2 Ductility: elastic and plastic deformation
- 3.3 Ductility versus Fragility
- 3.4 Strength: Young's Modulus, Flexibility, Geometrical effects on flexibility
- 3.5 Impact
- 3.6 Mechanical properties of natural teeth
- 3.7 Main specifications of crowns for adults
- 3.8 Main specifications of crowns for children
- 3.9 Main specifications of crowns for MIH- Molar Incisor Hypomineralization, dentinogenesis imperfecta, and other anomalies sensitive cases
- 3.10 Main specifications of crowns for disabled adults (HIV, diabetes, pregnancies, ...)
- 3.11 Solutions in the market
- 3.12 Comparison between crown's materials mechanical properties and natural teeth materials mechanical properties

- 3.13 How to evaluate mechanical Properties-Tests, Standards and Regulations
- 3.14 Failure analysis clinic case studies and prevention, and videos
- 3.15 Hands on time – feeling, observing, testing

4. Wear, Abrasion, Attrition, Erosion Properties

Wear and chewing co-exist in teeth and affect almost all people. What crowns can do to prevent wear damage?

- 4.1 Wear
 - 4.1.1 Wear mechanisms
 - 4.1.2 Abrasion mechanisms
 - 4.1.3 Attrition mechanisms
 - 4.1.4 Erosion mechanisms
- 4.3 Comparison between crown's materials wear resistance and natural teeth wear resistance
- 4.4 How to evaluate Wear Properties (Tests, Standards and Regulations)
- 4.5 Bruxism and crown's materials properties
- 4.6 Failure analysis clinic case studies and prevention, and videos
- 4.7 Hand's on time – feeling, observing, and testing

5. Thermal Properties

Hot and soft drinks, ice creams, cold wind, and other thermal effects have a strong effect on failures of restorations and on pain on sensitive teeth (MIH, dentinogenesis imperfecta, etc).

- 5.1 Thermal properties and main variables to consider
- 5.2 Why thermal properties of crowns are important
 - 5.2.1 Importance on durability of restorations/crowns
 - 5.2.2 Importance on temperature sensitive teeth
- 5.3 Comparison between crowns materials and natural teeth thermal properties
- 5.4 How to evaluate thermal properties of materials - Tests, Standards and Regulations
- 5.5 Failure analysis clinic case studies and prevention, and videos
- 5.6 Hands on time – feeling, observing, and testing.

6. Fatigue Properties

All components/materials in mouth suffer from fatigue. Durability of crowns or restorative materials in general strongly depend on fatigue their resistance. Material properties as well as design specifications as geometrical design stresses and macro/micro stress concentrations are fundamental for crown's durability.

- 6.1 Mechanical fatigue
- 6.2 Thermal fatigue
- 6.3 Wear Fatigue
- 6.4 Thermal-mechanical and thermal-mechanical-wear fatigue
- 6.5 Design aspects affecting fatigue
- 6.6 Comparison between crown's materials and natural teeth fatigue properties
- 6.7 How to evaluate fatigue properties of materials - Tests, Standards and Regulations
- 6.8 Failure analysis clinic case studies and prevention, and videos
- 6.9 Hands on time – feeling, observing, and testing.

7. Chemical Properties and Biological properties in brief

Chemistry of materials strongly affect biological performance of crowns and restorative materials.

- 7.1 Some main chemical properties of different crown's materials and their effects on mouth biology.
- 7.2 How to evaluate chemical properties of materials - Tests, Standards and Regulations
- 7.3 Failure analysis clinic case studies and prevention
- 7.4 Hands on time – feeling, observing, and testing.
- 7.5 Clinic case studies and videos

8. Physical Properties in brief

Dental crown's physical properties play a crucial role in enhancing the aesthetics of a smile.

- 8.1 Colour and optical effects
- 8.2 Translucency, radiolucency, fluorescence, opalescence
- 8.3 Hands on time – feeling, observing, and testing.
- 8.4 Clinic case studies and videos

9. Failure Analysis Principles and Prevention

Assessing failure reasons is key for improvements in materials and processes and crowns placement protocol.

- 9.1 Failure analysis as a fundamental process of prevention
- 9.2 Steps for a good failure analysis evaluation
- 9.3 The new MDR 2017/745 EU regulation and implications for dentists on failure analysis processes
- 9.4 How do deal with legal failure analysis conflicts
- 9.5 Clinic Case studies and videos

10. Standard Versus personalized/customized crowns

No two teeth are alike, they are all different.

- 10.1 The adaptation role
- 10.2 The thickness role on occlusion
- 10.3 The thickness role on tooth preparation, anesthesia, sedation
- 10.4 The pain issue
- 10.5 The digital protocol
- 10.6 Clinic Case studies and videos

11. Application protocol of MicroPk™ pediatric crowns

Only the best for your children.

- 11.1 Main suggested applications
- 11.2 The digital protocol
- 11.3 The Crowns placement protocol
- 11.4 Errors to avoid
- 11.5 Clinic Case studies and videos

By:

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'Ranked among the 2% of most influential scientists in the world in biomedical materials and processes (Elsevier, Stanford University, USA)(2021-2024)'



Published more than 390 research papers indexed to ISI; 130 in dental field; H index: 45; Citations: > 8250; PI of more than 20 research projects (>10M€); > 25 PhD students (7 dental doctors); 5 World patents; R&D with Research Centers, Universities, Dental Clinics, Companies, from EUA, Brasil, Portugal, Netherlands, Finland, Germany, Belgium, Switzerland, Romania, Turkey, Italy, France, Estonia, Austria, Australia, India, ...; CEO of Extreme Materials-Dental Solutions (www.extremater.com);

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2 day (12h) Course provided for Universities, Associations, Clinics, Dentists.

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Ultra-Thin personalized PEEK crowns - for caries, MIH-Hypomineralized, dentinogenesis imperfecta, and other sensitive cases -

Materials for analysis and hands-on: PEEK, SS-Stainless Steel, Zirconia, Composites, Feldspathic porcelain, Lithium Disilicate, PMMA. **Types:** Some Standard and some Customized; **2 day course - 12h**, materials testing + crowns testing: Price: 450 €/student - minimum 20 attendants (includes Full kit/attendant)(see details below). Kits are sent previously by regular mail.

	Subject	Content	Theoretical contents	Materials and tests/equipments	Applications
Day1					
45 min	Materials	Theoretical	Material properties of different crown and restorative materials	Tooth/dentine/enamel. Materials (Zirconia, PEEK, SS, Gold, Porcelain, PFM, lithium disilicate, leucite reinforced glass ceramic, layered zirconia, composites.	Crowns and restorative materials in general
15 min.		Hands-on		Watching, touching and feeling	
75 min	Mechanical properties	Theoretical	Tooth and dental materials mechanical properties; Stress versus Load; Tensile/Compressive/Shear Axial/Bending/Torsion/Shear; Perforation; Combined stresses; Flexibility; Stress relief with graded transitions; Toughness; Stiffness; Creep and stress relaxation	Tooth/dentine/enamel. Materials (Zirconia, PEEK, SS, Gold, Porcelain, PFM, lithium disilicate, leucite reinforced glass ceramic, layered zirconia, composites. (Videos).	Crowns for children: Anterior teeth, Posterior teeth, Hypomineralized teeth (MIH), Caries, Endodontics/Root therapy, Conservative approaches, dentinogenesis imperfecta, ...
30 min		Hands-on		Tests of perforation (tensile)(compressive) with graded block; flexibility (bending) with bending tester; fracture with bending tester; Impact; shear after cementation.	
45 min	Wear properties	Theoretical	Friction, Wear, Attrition, Erosion, Abrasion mechanisms of crown and restorative materials.	Tooth/dentine/enamel. Materials (Zirconia, PEEK, SS, Gold, Porcelain, PFM, lithium disilicate, leucite reinforced glass ceramic, layered zirconia, composites. (Videos).	Wear behavior of natural teeth, crowns, and dental restorative materials
30 min		Hands-on		Materials: sand paper/roughness tester evaluation	
30 min	Thermal Properties Hands-on	Theoretical	Main Thermal Properties: Coefficient of thermal conductivity; Thermal diffusivity; specific heat capacity; Thermal Properties of enamel and dentine; Thermal properties of dental materials; Thermal properties and implications on sensitive and hypomineralized teeth; Thermal Expansion Coefficient (CTE) and implications on stress and micro-fracture and materials debonding	Dentine, enamel, Zirconia, PEEK, SS, lithium disilicate, PMMA, composite. Videos	Crowns for children with Hypomineralized teeth and other sensitive teeth; Dental filling and repair materials.
30 min		Hands-on		Heat conductivity evaluation of different materials (infrared thermometer, chronometer, heat and cold source); Thermal expansion of filling and repair materials (caliper and heat and cool source)	

20 min.	Chemical and Biological properties	Theoretical			Crowns for children
20 min	Physical Colour and Optics effects	Theoretical	Main Colour and optical effects: Colour, Translucency, radiolucency, fluorescence, opalescence.	Dental material's specimens for color measurement	Crowns for children
20 min		Hands-on		Measurement of color with digital Dental Shade Guide equipment; physical shade guide models; Qualitative translucency evaluation.	
Day2					
1h	Fatigue Properties	Theoretical	Mechanical fatigue, Thermal fatigue, Wear Fatigue, Thermal-mechanical and thermal-mechanical-wear fatigue; Design aspects affecting fatigue, Comparison between crown's materials and natural teeth fatigue properties; How to evaluate fatigue properties of materials - Tests, Standards and Regulations; Failure analysis clinic case studies and prevention, and videos	PEEK, Zirconia, other dental materials for fatigue stress concentrations	Crowns for children
15 min		Hands-on		Tests of fatigue stress concentrations effect on fracture.	
45 min	Standard Versus Customized;	Theoretical	Childs perception of dentists; The adaptation role; The thickness role on occlusion; The thickness role on tooth preparation, anesthesia, sedation; The pain issue.		Crowns for children
15 min	The digital flow	Theoretical	Intra-oral scanners – relevant aspects; Important parameters; other aspects to consider		Crowns for children
45 min		Hands-on		Scanning test on mandible model with intra-oral scanner	
30 min	MicroPk™ pediatric protocol	Theoretical	Main suggested applications; The digital protocol and important protocol steps; The Crowns placement protocol; Errors to avoid.		Crowns for children
90 min		Hands-on		Application of crowns on tooth models following the protocol	
60 min	Failure Analysis and MDR eu 2017/45	Theoretical	Important steps to take after component failure (fracture/debonding/wear/..). Dealing with legal conflicts. Some implications of the MDR eu 2017/45		Crowns for children

Full Kit

PEEK Personalized Crowns – From ultra-thin to other material choices, Properties and Applications

FULL Kit and Materials for hands-on training course



Materials included in the personal kit:

1. **Brushes** for cement application in crowns;
2. **Gel** for tooth surface preparation (roughness increase);
3. **Anatomic pads** for uniform pressure application on crowns;
4. **Abrasive strips** for eventual interproximal preparation;
5. **Spacers** for eventual interproximal space creation;
6. **Crowns** in PEEK, zirconia, PMMA;
7. **Tooth models** and respective crowns;
8. **Plyer** for crown's removal after testing;
9. **Alcohol** for materials cleaning;
10. **Dental materials** for different tests (wear, abrasion, flexibility, perforation, chemical, physical, translucency, adhesion; ...)

PEEK Personalized Crowns – From ultra-thin to other material choices, Properties and Applications

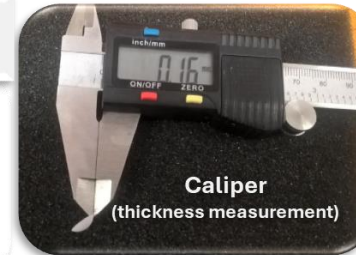
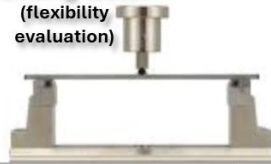
Equipments and devices used on Hands-On training

(to be shared on the group)

Tests to be performed:

1. Intra-oral scanner digitalization on mandible model (or human model);
2. Thickness evaluation of crowns;
3. Materials flexibility evaluation;
4. Materials translucency evaluation;
5. Materials resistance to wear/abrasion evaluation;
6. Materials colour evaluation;
7. Materials resistance to perforation evaluation;
8. Materials heat transfer evaluation;
9. Adhesion of PEEK evaluation;
10. Occlusion increase with different crowns choices;
11. Full protocol application on PEEK Crowns (MicroPk™)

Bending tester
(flexibility evaluation)



Caliper
(thickness measurement)



Roughness tester
(for material's wear/abrasion resistance)



Cements
(for crown's protocol application)



Temperature Infrared thermometer
(for materials heat transfer evaluation)

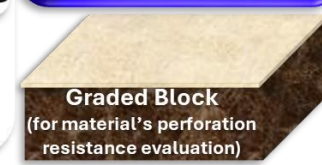
Colour measurement



Intra-oral scanner
(for digital 3D image acquisition)



UV Light
(for materials translucency evaluation)



Graded Block
(for material's perforation resistance evaluation)