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COMPARING WATER SORPTION AND SOLUBILITY OF GIC AND RMGIC IN DENTAL RESTORATIONS

(An experimental project carried out by second year students during their pre-clinic activity in dental biomaterials)

Departamento de Odontología

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Introduction

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- **GIC** = Glass ionomer cement
- **RMGIC** = Resin-modified glass ionomer cement. GIC + resin polymers
- Both commonly used fo preventative sealants
- Mixtures of silicate gla ionomers

Introduction

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- GIC and RMGIC differ in composition, and therefore the setting reaction is also different
- GIC sets by acid-base reaction
- RMGIC sets by both acid-base and light-curing
- Different strengths, aesthetic outlook, chemical and mechanical properties

Introduction

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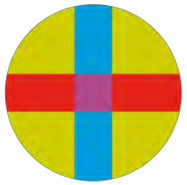
- 2 defining properties of GIC and RMGIC:

Water sorption

Water solubility

Water Sorption



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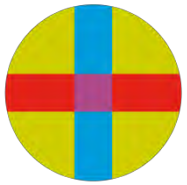
- Water sorption = water uptake by the material matrix due to diffusion
  - Hydrolytic degradation of material
  - Reduced mechanical properties and strength

Water Solubility

- Water solubility = unreacted monomers and fillers dissolve out of material
  - Changes in dimension
  - Reduced strength
  - Biocompatibility issues

Water Sorption



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- Water sorption = water uptake by the material matrix due to diffusion
  - Hydrolytic degradation of material
  - Reduced mechanical properties and strength

Objective

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?Water sorption and water solubility differences between GIC and RMGIC?

Materials and Methods

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- GIC Preparation
  - Riva Self Cure (SDI, Australia)
- RMGIC Preparation
  - Riva Light Cure (SDI, Australia)
  - Photac Fil Light Cure (3M ESPE, Germany)
- Silicone disc-shaped mold
  - 2 mm x 6 mm
- Digital weighing scale

Materials and Methods

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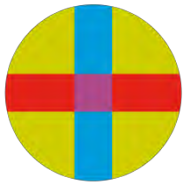
Materials and Methods



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- Percentage of Water Sorption =
  - (saturated mass/dried mass)/dried mass x 100
- Percentage of Water Solubility =
  - (initial mass/dried mass)/dried mass x 100

Results - Sorption

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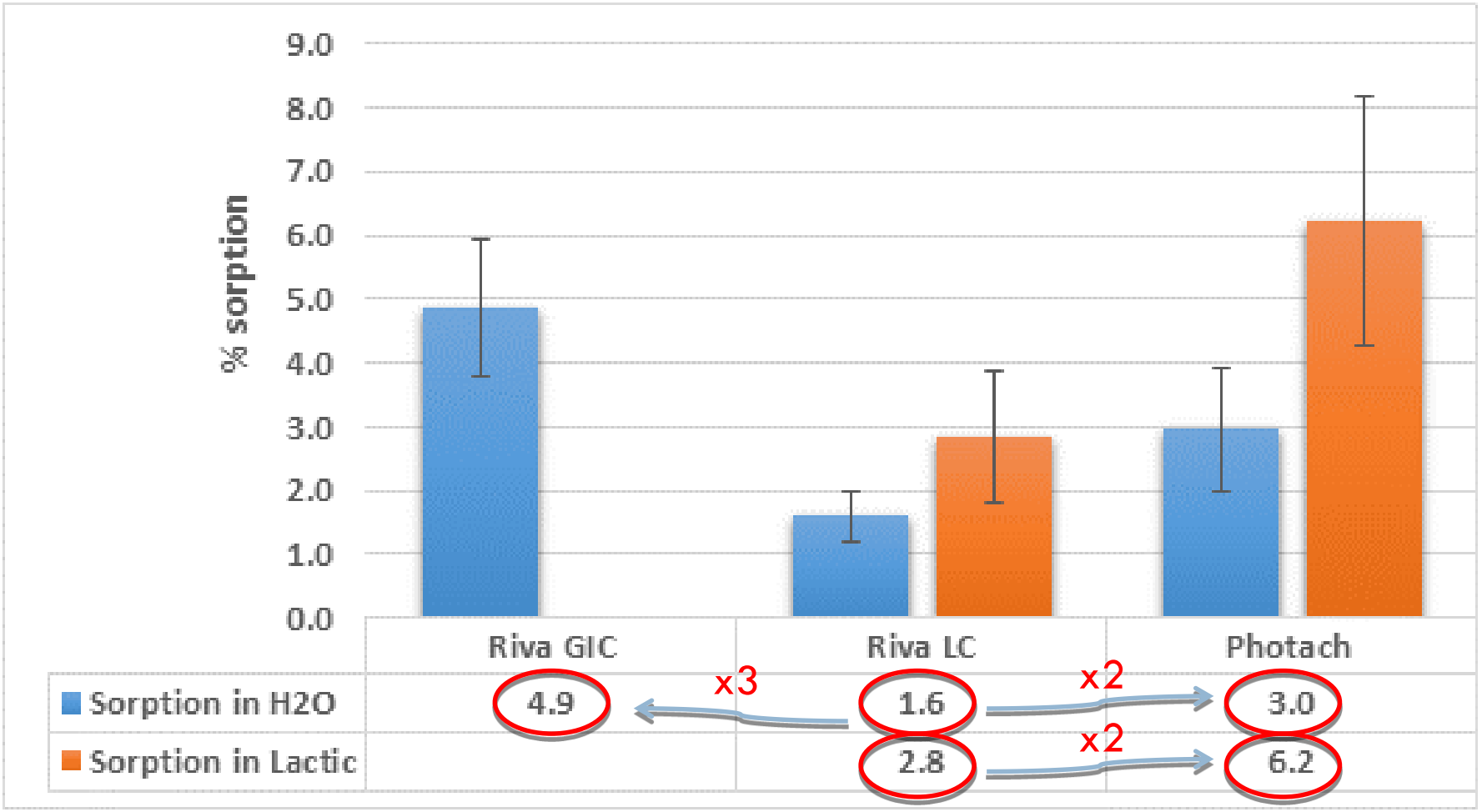

Results - Solubility

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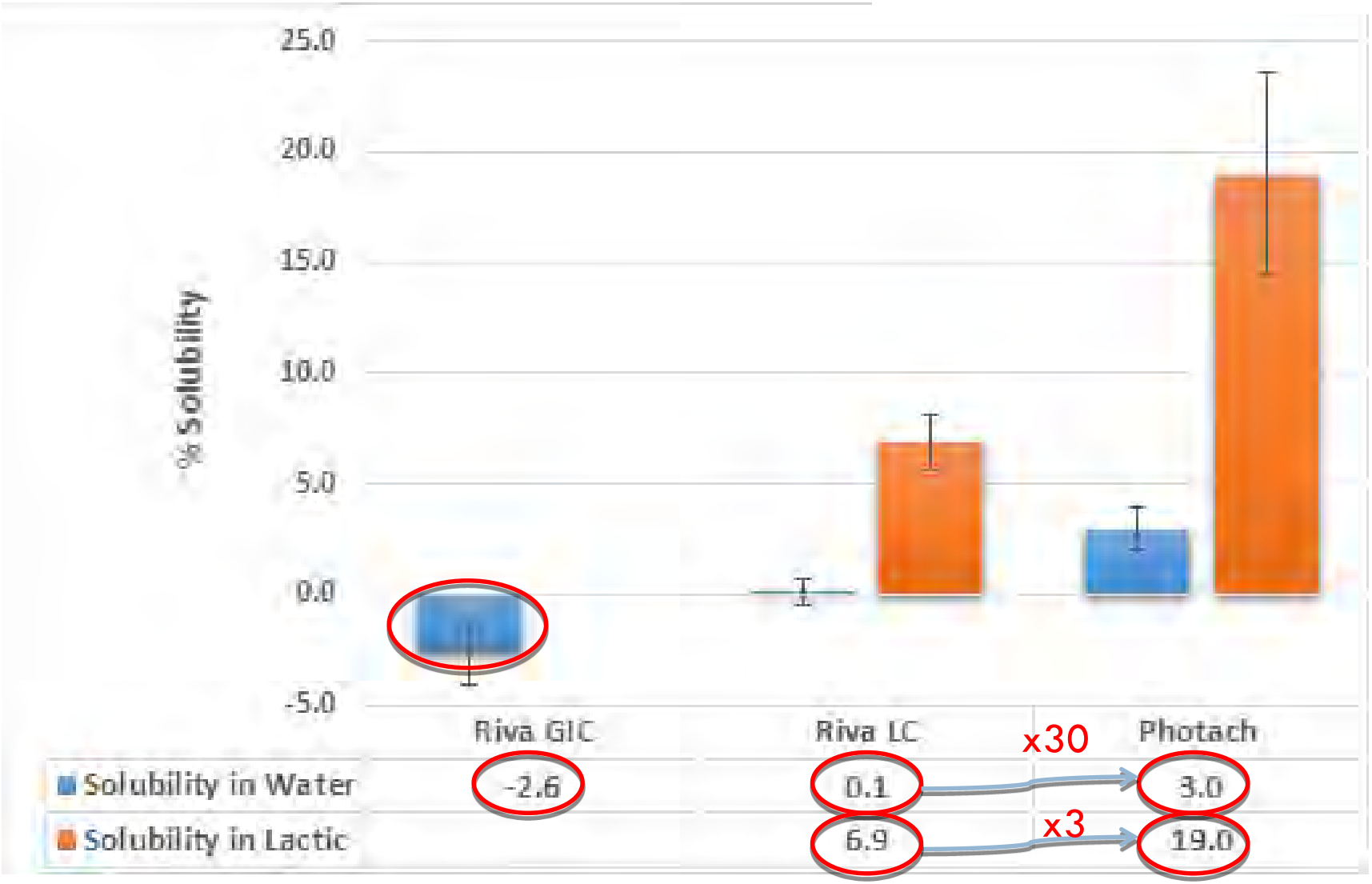

Conclusion

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- GIC > RMGIC in terms of sorption (after water storage)
- GIC completely dissolve in acidic conditions (Lactic acid); thus RMGIC is more appropriate for restoration and as luting agent
- GIC can be better as liner or sandwich composite restoration techniques

Discussion

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- GIC showed greater water sorption because it has a longer setting time
  - Up to 7 days after application of GIC
  - Adv: No shrinkage, microleakage, releases fluoride, no bonding agent needed
  - Disadv: Low strength, "*unbalanced*" in water while setting
- GIC showed little water solubility because the water absorbed is incorporated and used for setting reaction.

Discussion

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- RMGIC sorption was low initially because of the fast polymerization setting reaction
  - Part acid-base reaction, part polymerization
- RMGIC solubility was low also, because the polymerization reaction protected the material matrix from eluting
  - Adv: Tough material for direct restoration, better aesthetics and longevity than GIC
  - Disadv: Not for occlusal surface restoration, HEMA release (biocompatibility issues)

Bibliography

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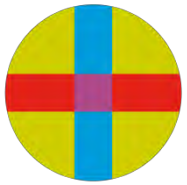
- 2. Cefaly DF, Wang L, de Mello LL, et al. Water sorption of resin-modified glass-ionomer cements photoactivated with LED. Braz Oral Res 2006 ; 20(4):342-6

- 3. Yoshida K, Tanagawa M, Tsuta M. In-vitro solubility of three types of resin and conventional luting cements. J Oral Rehabil. 1998; 25(4): 285-91.

Thank you !



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