



Introduction

Fracture Fixation



Conventional Fracture Fixation

Pins, screws, plates or casts

- Non-uniform force distribution
- Weak fixation on cancellous bone



Bone Adhesives

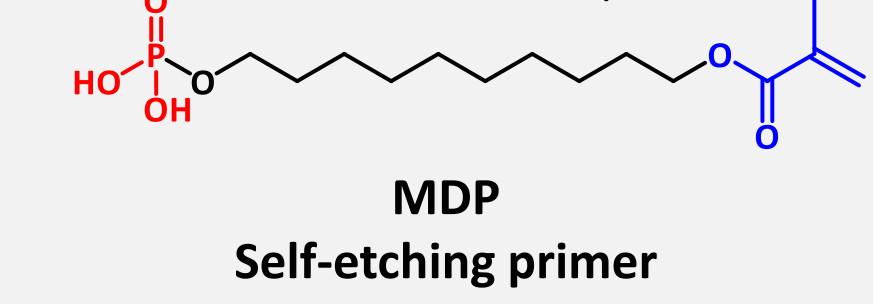
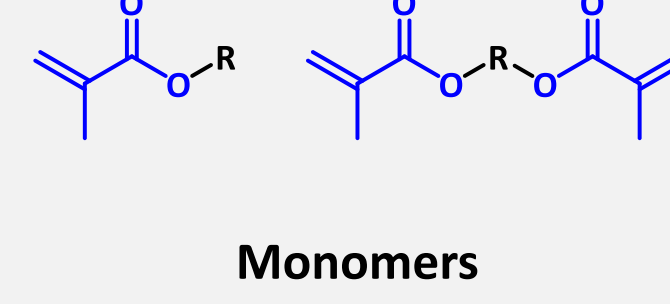
- + Short operation times
- + Homogenous force distribution
- + No removal operations

Due to high requirements (non-toxic, strong adhesion (> 5 MPa), easy preparation & applicability) no bone glues with high bonding strength are yet available.

Dental Restoratives



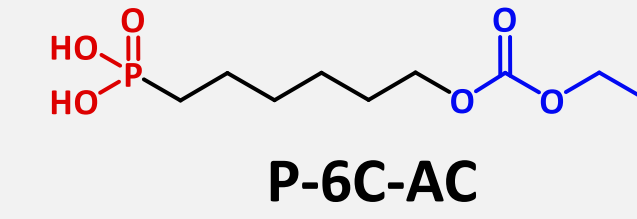
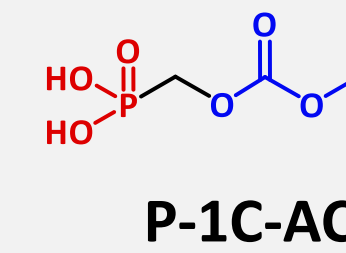
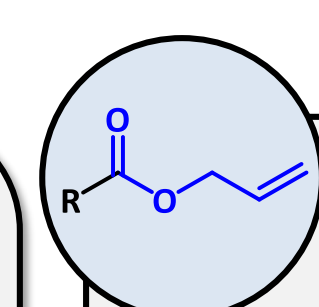
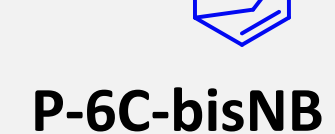
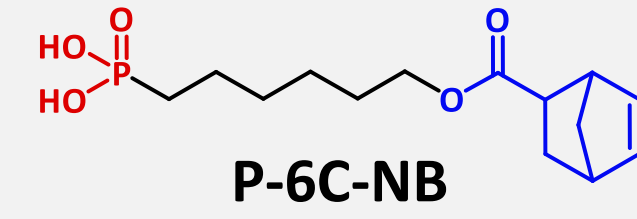
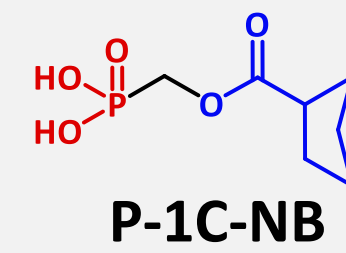
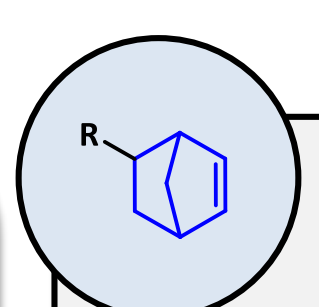
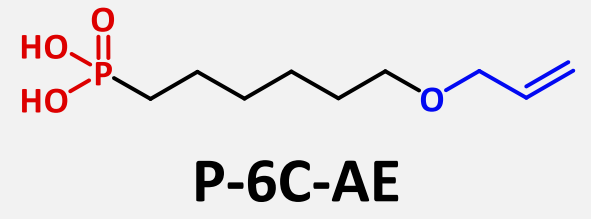
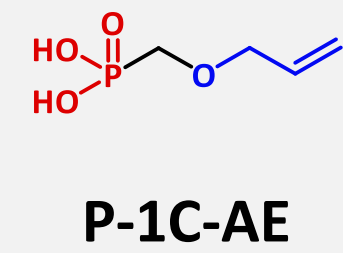
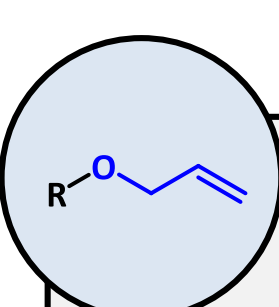
Self-etching Dental Adhesives



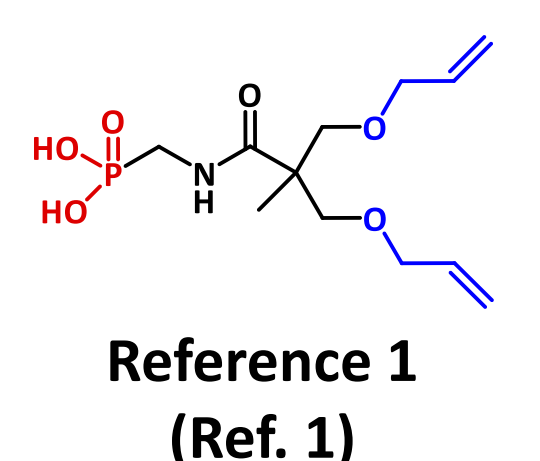
Photoinitiator,
solvent,
additives,...

High bonding strength on dentin (Adhese Universal®: 28.2 ± 2.1 MPa)

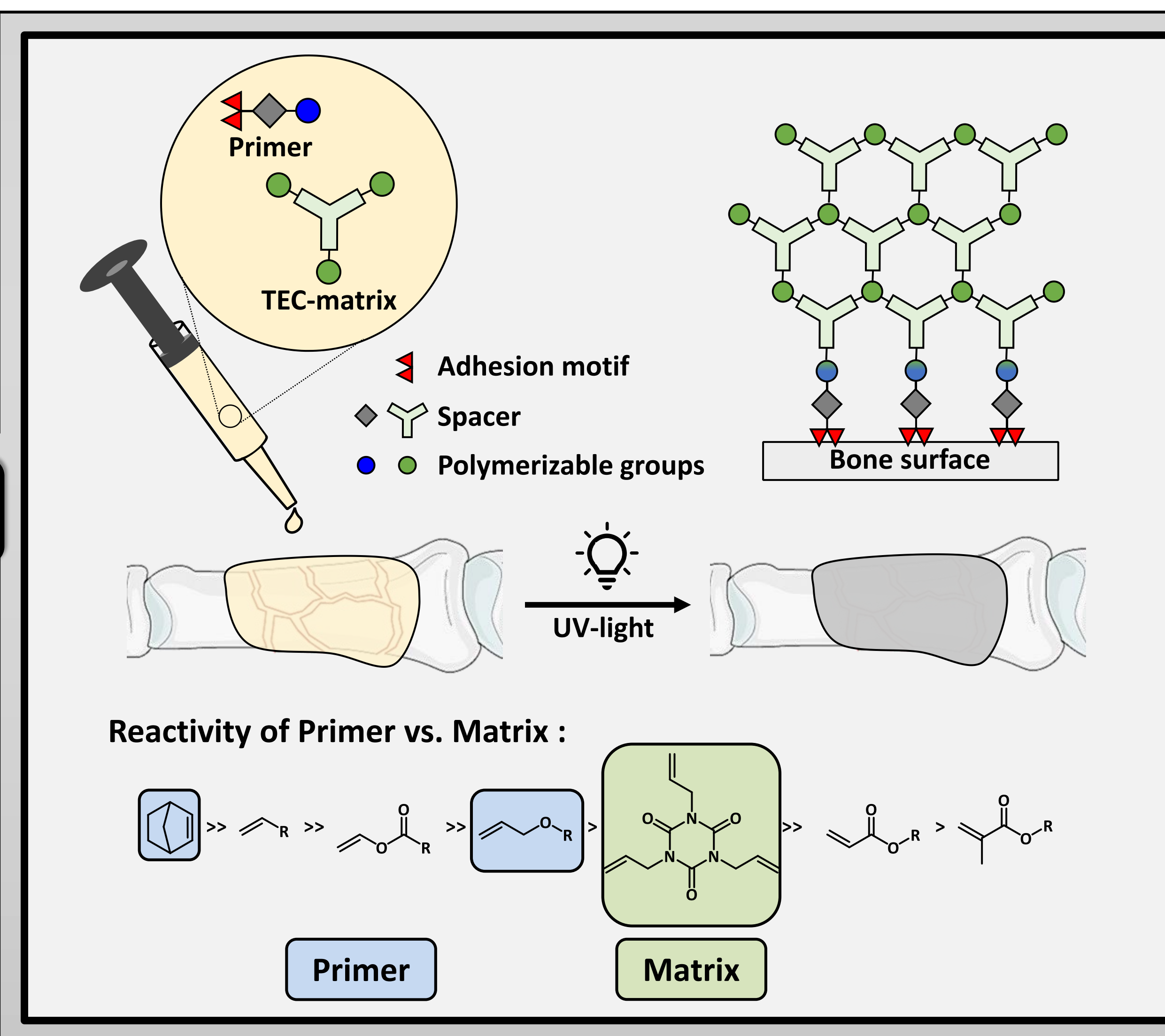
1-Step Bone Adhesive System



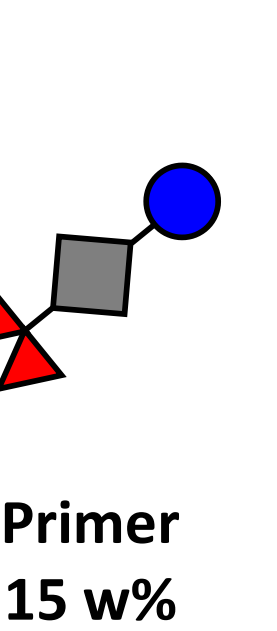
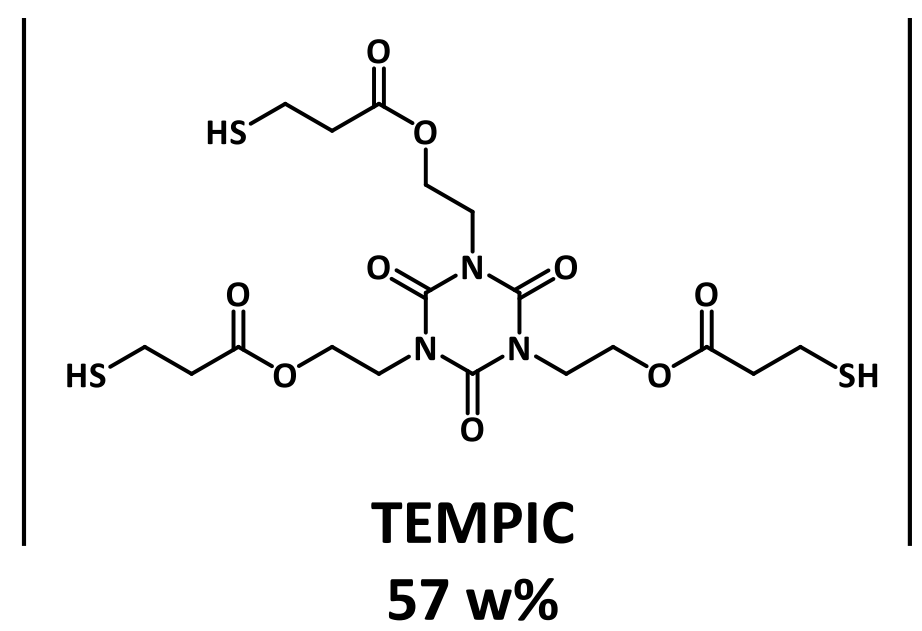
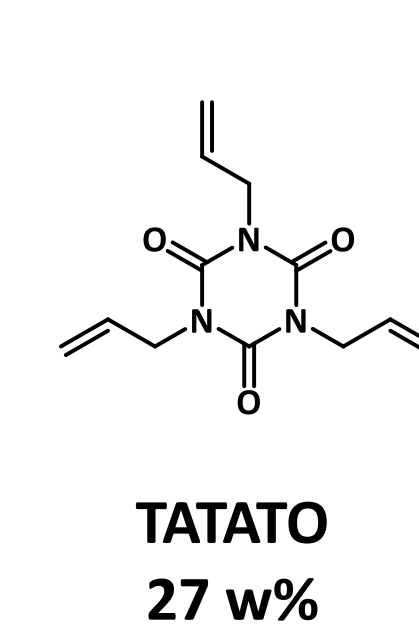
Reference Primer



- Used in multi-step adhesive system with fiber mesh
- Shear bond strength: 9.0 ± 0.7 MPa
- Not practicable in surgery

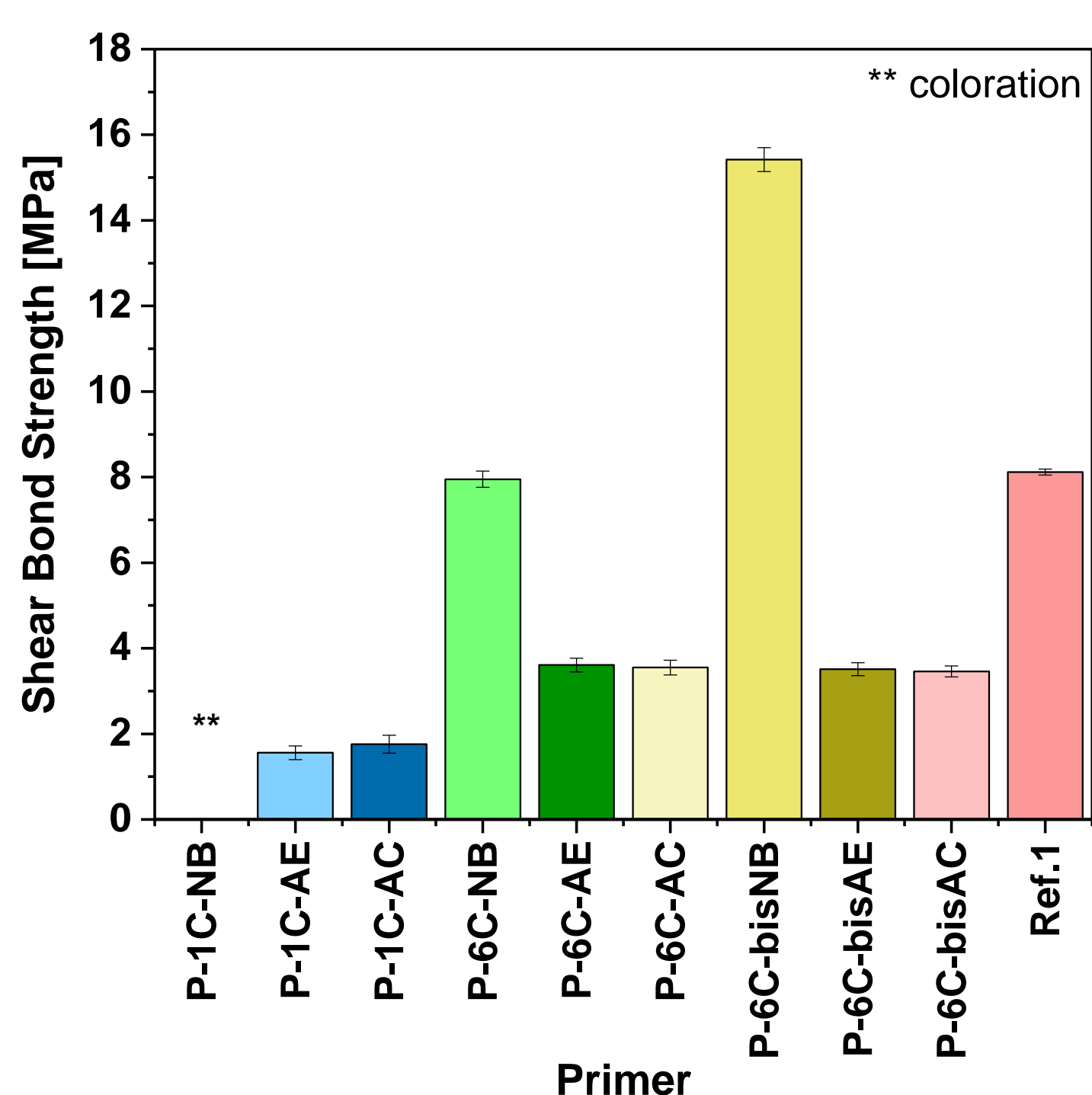
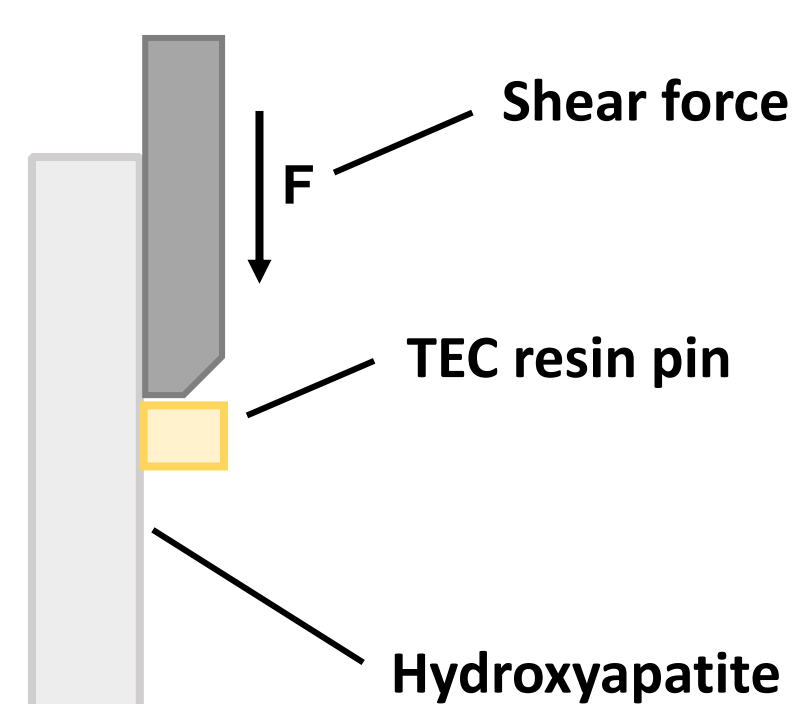


Formulation Components



Shear Bond Strength

Measurement Setup



Exceptional high strength obtained with 1-step system containing P-6C-bisNB on HAP surface.

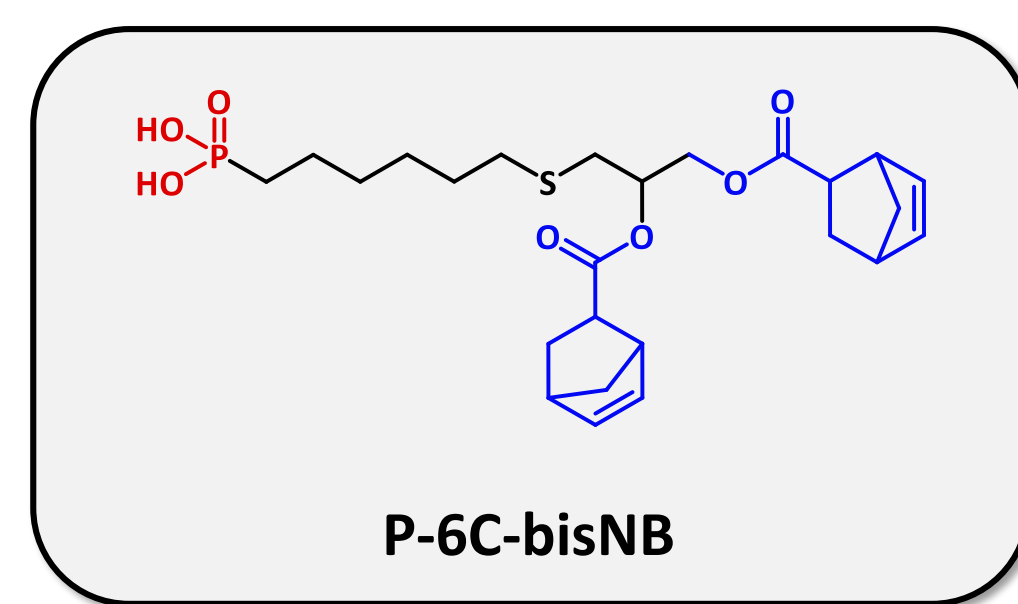


Fig.1: Shear bond strength measurement results of 1-step systems containing 15 w% of the different primer molecules on HAP surface.

Indentation Tests

Measurement Setup

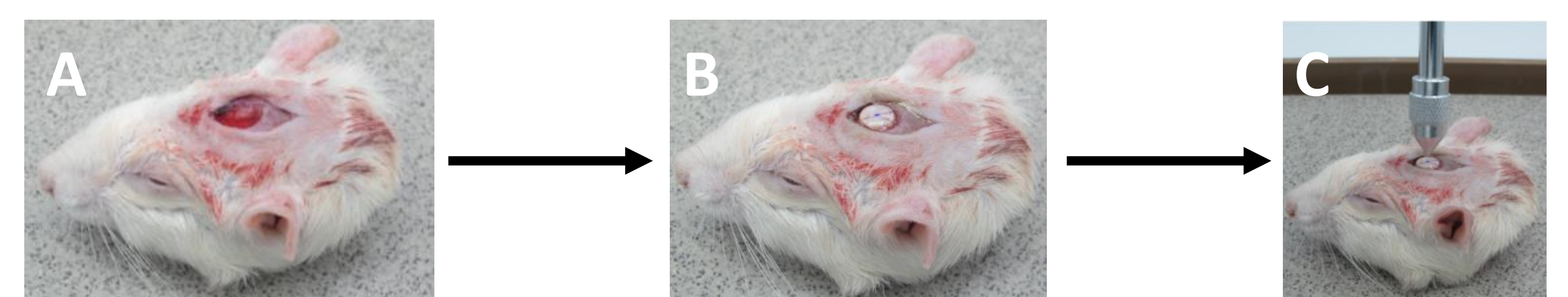
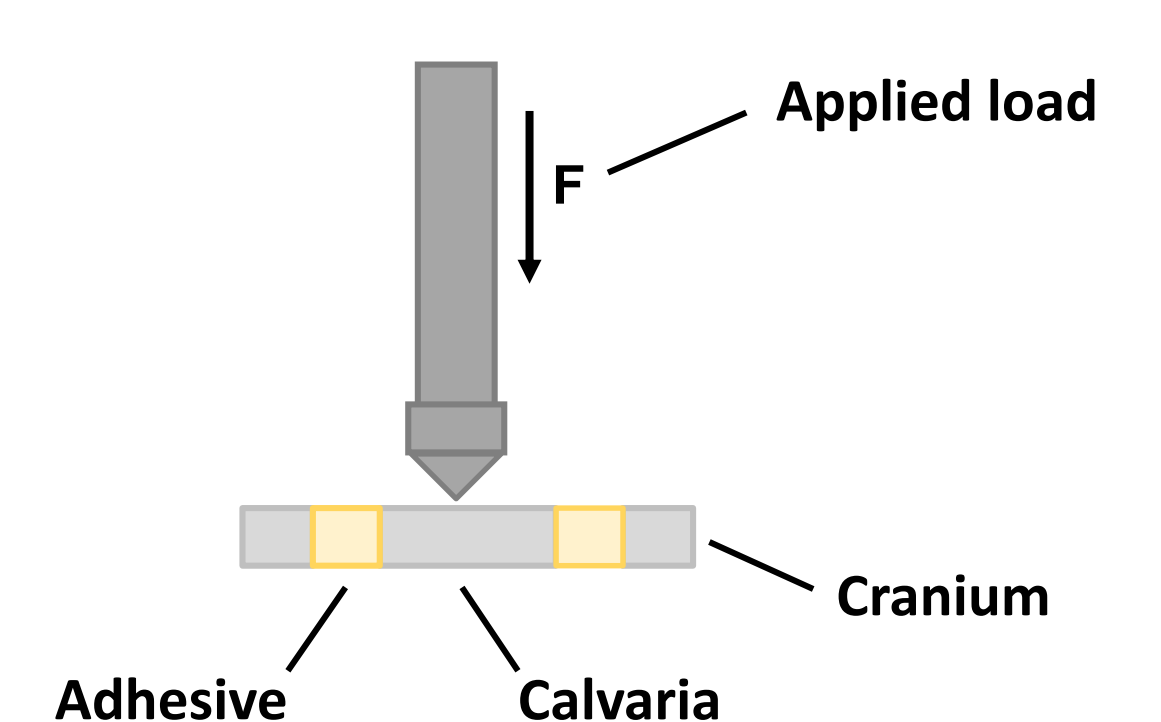
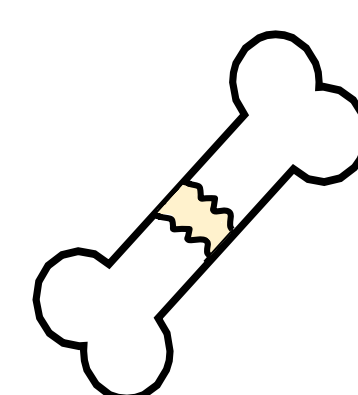
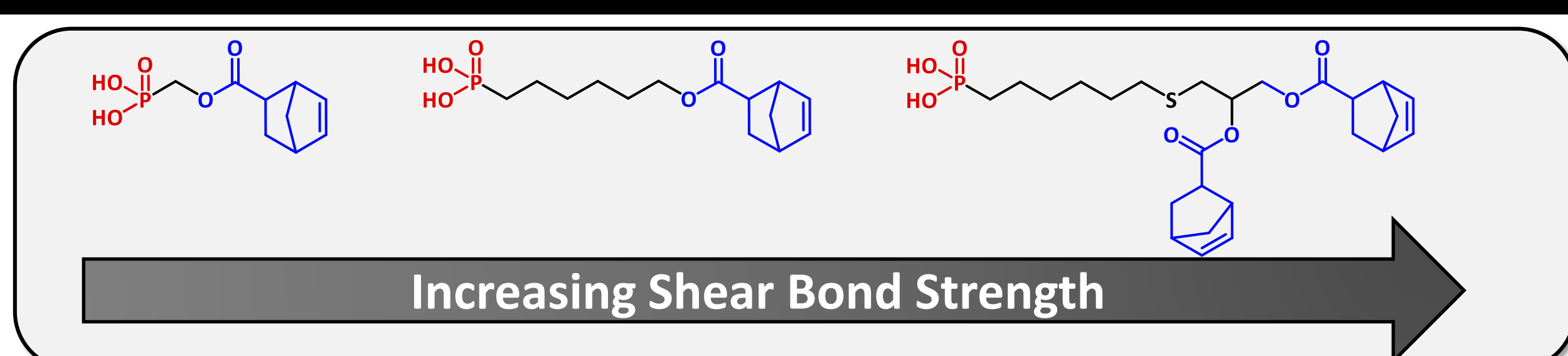


Fig.2: A) Removal of rat calvariae with a hole driller. B) Calvariae plates glued back in the cranium with the 1-step adhesive formulation containing P-6C-bisNB. C) Determination of stability by indentation tests via Force Gauge SF-30 digital force measuring device.

Calvariae fractured before the adhesive, demonstrating higher strength than the calvariae itself (8 N/mm²).

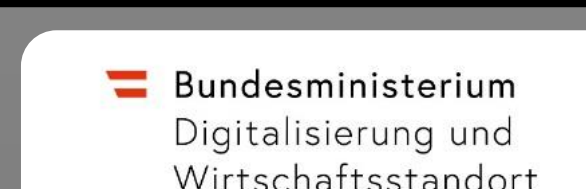
Conclusions



- First 1-step thiol-ene adhesive system
- Promising *ex vivo* tests
- Applications: comminuted fractures, fixation of small bone fragments, implant fixation

References & Acknowledgements

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 [4] Granskog, V.; Adv. Funct. Mater. 28, 1800372 (2018).



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