Clinical and Mechanical Considerations of Resign Bridges for Immediate Loaded Implants

Neugebauer J.*, Karapetian V.*, Boessler C.*, Haessler D.**, Zoeller J.E.*

* University to Cologne, Germany
** Oppenheim, Germany

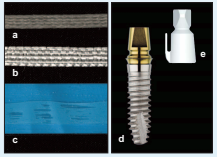
Introduction

Immediate loading in the posterior arch requires a quick and reliable fabrication of the superstructure during the implant placement. By placing the super-structure at the end of the surgery the implants can be splinted at the first day of incorporation. Complications like pain or difficult check of the precision of the superstructure due to the postoperative swelling are avoided. The temporary prosthesis is needed during the first three month until the implants reach osseointegration.

Material and Methods

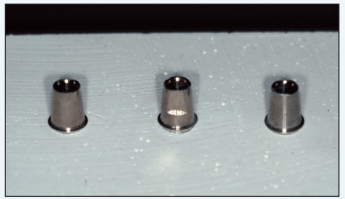
An In-Vitro-study was performed to evaluate the mechanical stability for different combinations of fibres and auto curing resins (ProtempGarant, 3M-Espe, Seefeld, Germany) in combination with XiVE Implants and TempBase with TempBase Cap (FRIADENT, Mannheim, Germany).
The following materials were tested: Connect, Girrbach, Pforzheim, D, FibreCor, Jeneric/Pentron, Wallingford, CT, USA, Ribbond, Ribbond, Seattle, WA, USA. The mechanical data showed different results due to the design of the bridges.

Different materials for the stabilization of resin based temporary superstructure. Due to the different material properties various packaging and compositions are delivered.



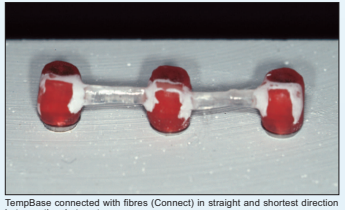
a. Cross-woven fibre: Connect
b. Meander-woven fibre: Ribbond
c. Non-woven impregnated fibres: FibreCor
d. XiVE Implant D 3.8 with TempBase
e. XiVE TempbaseCap

Fabrication of Superstructure

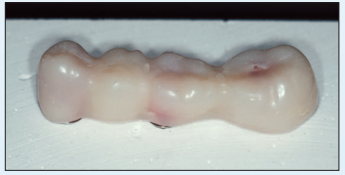


Three abutments for 4-unit-bridge, two abutments aligned against the middle abutment with the flattening to shape an S for the fibres.

Prototype of TempBase-Cap which are aligned in S-shape direction for the use with Ribbond.

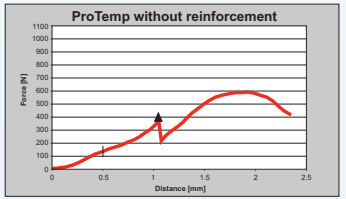


TempBase connected with fibres (Connect) in straight and shortest direction between the abutments.

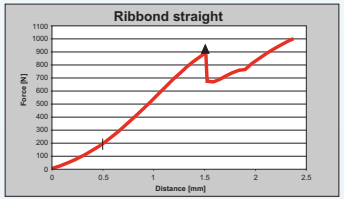


Standardized four unit acrylic bridge with two pre-molar and two molar crowns on three implants

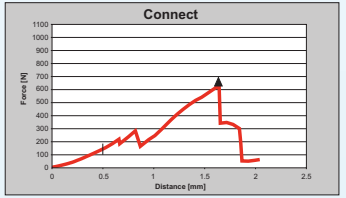
Results



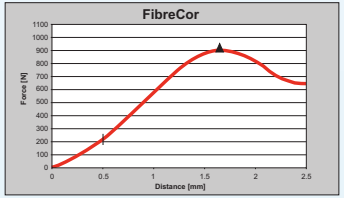
Early plastic deformation of 0.5 mm with an average load of 140 N. Pretty stable superstructure after fracture of resin.



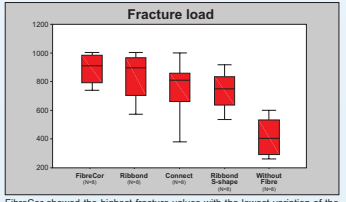
Decreased plastic deformation of 0.5 mm with an average load of 200 N. Still stable superstructure after fracture of resin due to elastic fibre.



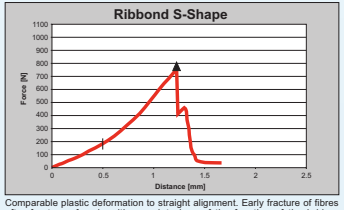
Decreased plastic deformation of 0.5 mm with an average load of 146 N. Early in-fractures and fracture of fibres with loss of function of the bridge.



Most decreased plastic deformation of 0.5 mm with an average load of 222 N. Elastic behavior after fracture of resin with long lasting function of bridge.



FibreCor showed the highest fracture values with the lowest variation of the fracture values. Ribbond straight and Connect had the highest variation in the fracture load.



Comparable plastic deformation to straight alignment. Early fracture of fibres after fracture of resin with complete loss of the function of the bridge.

The Protemp material without reinforcement showed the lowest fracture stability with 415 N ± 130 N. The reinforcement with Connect showed 754 N ± 198 N and Ribbond 838 N ± 163 N fracture load. The best values showed FibreCor with 898 N ± 97 N. The recommendation of the Ribbond to use the S-shape formation showed a fracture load of 736 N ± 132 N. The initial plastic deformation was observed with the lowest values for the bridge without reinforcement and the Connect fibres. The Ribbond showed an decreased plastic behavior. FibreCor showed the best value with the lowest plastic deformation. The behavior after the facture showed a stable situation for the bridge without reinforcement, Ribbond straight and FibreCor. Connect showed a fracture of the complete bridge. FibreCor inforcement showed an elastic behavior after the fracture. The S-Shaping of the fibres lead to a high tension and a fracture of these fibres.

Discussion

The mechanical evaluation showed a high value for all materials. The statistical analysis showed a significant difference only between FibreCor-reinforced and the bridge without fibre-reinforcement.
The various materials require different approaches for the handling. FibreCor needs a ceramic scissors; Ribbond has to be treated with special cloves and a special scissor. Under clinical relevant condition the Ribbond-material can only be used if it is pre-conditioned with a bonder before application to avoid a contamination of the material with saliva or blood.
The function of temporary bridges is encreased due to the mechanical stability because the auto curing resin is stabilized even if an fracture occur. The mechanical stabilization is not longer achieved if a fracture occurs. The patients have to be checked to not increase the risk of micro-movements on immediately loaded implants. The different materials shows small differences in the load characteristics.

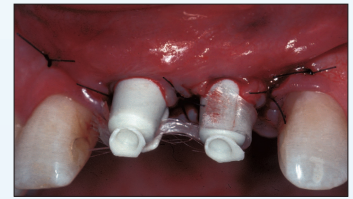
Summary

The reinforcement increases the stability of chair side fabricated bridges by auto curing resin. Some of these materials are designed for mainly prosthodontic use and show limitation during the clinical application under surgical environment. The mechanical stabilization is possible to connect immediately loaded implants. The reduced stabilization in comparison to metal reinforced bridges requires regular recall to avoid micro-movement on the implants.

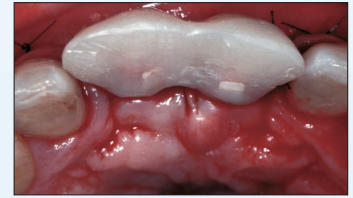
Clinical Relevance

- FibreCor shows the lowest plastic initial deformation
- FibreCor has the highest mechanical stability
- FibreCor shows the lowest variation in fracture loads
- FibreCor bridges are functioning even after a fracture
- Woven fibres have less mechanical stability within a Protemp-bridge
- S-Shaping reduce the stability of a bridge

Clinic



Clinical situation after splinting of two TempBaseCaps with FibreCor and shortening of the retention.



Temporary restoration with ProtempGarant to splint two implants for non functional loading of two XiVE®-implants

References

Wichnalek N, Metallfreie Artglass-Ribbond-Brücken, Quintessenz Zahntech 1999, 25, 9, 983-992

Melle B, Lenz E, Raser G, Sorge HC, Experimentelle Untersuchungen zur Bewertung metallfreier, faserarmierter Brücken, Quintessenz Zahntechnik 1999, 5, 1, 71-82

Samadzadeh A, Kugel G, Hurley E, Aboushala A, Fracture strengthe of provisional restorations reinforced with plasma-treated woven polyethylene fiber, J Prosthet Dent 1997; 78: 447-450

Behr M., Rosentritt M., Lang R.,Handel G., Flexural properties of fiber reinforced composite using a vacuum/pressure or a manual adaptation manufacturing process, Journal of Dentistry 28 (2000) 509-514

Behr M., Rosentritt M., Latzel D., Kreisler T., Comparison of three types of fiber-reinforced composite molar crowns on their fracture resistance and marginal adaptation, Journal of Dentistry 29 (2001) 187-196

18th Annual Meeting
of the Academy of Osseointegration
February 27 - March 1, 2003
Boston, Massachusetts

Dr. Jörg Neugebauer
Medical Center University to Cologne
Clinic and Teaching Hospital for Dental Surgery and for Oral-, Maxillo and Plastic Facial Surgery
Kerpener Strasse 32, D-50937 Cologne, Germany
E-mail: Joerg.Neugebauer@medizin.uni-koeln.de