PENGARUH PITA FIBER POLYETHYLENE DI DASAR KAVITAS TERHADAP DISTRIBUSI STRES RESTORASI RESIN KOMPOSIT
KLAS I (KAJIAN in silico)
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PENGARUH PITA FIBER *POLYETHYLENE* DI DASAR KAVITAS TERHADAP DISTRIBUSI STRES RESTORASI RESIN KOMPOSIT KLAS I (KAJIAN *in silico*)

INTISARI

Restorasi resin komposit pada kavitas klas I menghadapi kendala berupa konsentrasi stres yang tinggi di area oklusal dan dinding kavitas akibat beban kunyah fungsional, yang dapat memicu deformasi dan kegagalan adhesi. Ketidakseimbangan distribusi stres antara bahan restorasi dan jaringan gigi menjadi faktor penting yang memengaruhi keberhasilan jangka panjang restorasi. Penempatan pita fiber *polyethylene* di dasar kavitas diduga dapat mengubah pola distribusi stres, sehingga tekanan yang diterima gigi dan bahan restorasi menjadi lebih merata. Penelitian ini menggunakan metode Finite Element Analysis (*Finite Element Analysis*, FEA) untuk mengevaluasi pengaruh penempatan pita fiber *polyethylene* di dasar kavitas terhadap distribusi stres pada restorasi resin komposit kavitas klas I.

Studi eksperimental dengan metode *in silico* dengan model gigi premolar rahang atas tiga dimensi yang dibuat menggunakan perangkat lunak Autodesk Inventor dan disimulasikan dengan ANSYS 2025 R1. Simulasi dilakukan dengan pembebanan vertikal sebesar 300 N dan 738 N pada fossa sentral. Analisis dilakukan pada empat model, yaitu gigi utuh, kavitas tanpa restorasi, restorasi resin komposit tanpa fiber, dan restorasi dengan pita fiber *polyethylene* di dasar kavitas. Nilai stres von Mises tiap lapisan dianalisis secara statistik menggunakan ANAVA dua jalur dan uji *Post Hoc* LSD dengan tingkat signifikansi $p< 0,05$.

Hasil penelitian menunjukkan bahwa penambahan pita fiber *polyethylene* pada dasar kavitas menurunkan konsentrasi stres dan menghasilkan pola distribusi stres yang lebih merata dibandingkan restorasi tanpa fiber ($p < 0,05$). Fiber *polyethylene* berperan sebagai *stress breaker* yang menyalurkan gaya ke area akar gigi, sehingga dapat memperbaiki distribusi stres pada sistem restorasi resin komposit kavitas klas I.

Kata kunci: pita fiber *polyethylene*, resin komposit, distribusi stres, Finite Element Analysis, von Mises.

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THE EFFECT OF POLYETHYLENE FIBER PLACED AT THE CAVITY FLOOR ON STRESS DISTRIBUTION OF CLASS I RESIN COMPOSITE RESTORATION (AN *in silico* STUDY)

ABSTRACT

Class I resin composite restorations face biomechanical challenges due to high stress concentration along the occlusal surface and cavity walls under functional occlusal loads, which may lead to deformation and adhesive failure. The imbalance of stress distribution between restorative materials and tooth structures plays a critical role in the long-term success of restorations. The placement of polyethylene fiber ribbon at the cavity floor is hypothesized to modify the stress distribution pattern, allowing more uniform transmission of occlusal forces within the restoration. This study aimed to evaluate the effect of polyethylene fiber placement at the cavity floor on the stress distribution of Class I resin composite restorations using the finite element analysis (FEA) method.

This *in silico* experimental study used a three-dimensional model of a maxillary premolar developed with Autodesk Inventor and simulated in ANSYS 2025 R1. Vertical loads of 300 N and 738 N were applied to the central fossa. Four models were analyzed: intact tooth, unfilled cavity, Class I cavity restored with resin composite without fiber, and cavity restored with resin composite reinforced with polyethylene fiber at the cavity floor. Von Mises stress values for each layer were statistically analyzed using two-way ANOVA followed by a *Post Hoc* LSD test.

The results demonstrated that the addition of polyethylene fiber at the cavity floor reduced stress concentration and produced a more homogeneous stress distribution compared with restorations without fiber ($p < 0.05$). Polyethylene fiber acted as a stress breaker, transferring forces toward dental root and improving the overall stress distribution within Class I resin composite restorations.

Keywords: polyethylene fiber, resin composite, stress distribution, finite element analysis, von Mises.