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THE INFLUENCE OF PIT AND FISSURE SEALANT ON FLUIDITY

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Relevance. Occlusal caries remains one of the most prevalent dental diseases worldwide, accounting for up to 70–80% of carious lesions in children and adolescents. The complex anatomy of pits and fissures creates ideal conditions for plaque retention, making fissure sealant application a highly effective preventive intervention. Properly applied sealants reduce caries incidence by 70–90% within the first 2–3 years. However, longitudinal studies report partial or complete sealant loss in 20–40% of cases after 5 years, primarily due to compromised marginal integrity and microleakage. A critical determinant of successful sealant penetration is fluidity (inversely related to viscosity). Unfilled sealants (viscosity 0.5–5 Pa·s) exhibit the highest wettability and capillary penetration (90–100% into 500 µm fissures) but demonstrate greater volumetric shrinkage (4–8%) and lower wear resistance (20–50 µm/year). Filled sealants (viscosity 10–100+ Pa·s) offer reduced shrinkage (1–3%), higher compressive strength (200–350 MPa), and superior retention (10–15% higher at 5 years), but require active application techniques to achieve complete penetration. Fissure morphology is critical: I-type and IK-type (narrow slit-like configurations) require low-viscosity unfilled systems, while U-type and V-type (shallow and wide) can accommodate filled materials. Gravitational flow testing (ISO 6876:2012, ISO 4049:2019) provides a validated, simple method for rheological characterization. Clinical selection must consider fissure anatomy, patient caries risk, occlusal loading, and material handling characteristics. No single sealant type is universally optimal; evidence-based selection according to the proposed algorithm ensures maximum preventive efficacy and longevity.

Aim: to investigate the influence of viscosity on the flowability of three sealants used in Belarus (Fissurit FX, Fissulite, Seal It) and to determine the optimal material based on clinical and economic effectiveness.

Materials and methods. Five samples of each sealant were tested. A precisely weighed amount (9.50–9.60 mg, measured to 0.1 mg precision) was placed on a horizontal laboratory glass plate. The plate was then rotated to a vertical orientation for 30 seconds. Flow area (mm^2) was measured before and after the test. Cost per 9.5 mg and an economic efficiency index (mm^2/Br) were calculated.

Results and discussion. Seal It demonstrated the highest flowability (1.32 mm^2), followed closely by Fissurit FX (1.30 mm^2). Fissulite showed markedly lower flow (0.26 mm^2), indicating high viscosity and limited fissure penetration, particularly unfavorable for deep I-type and IK-type fissures. Regarding cost-effectiveness, Seal It achieved the highest efficiency index (4.20 mm^2/Br) due to optimal balance of cost (0.314 Br) and maximum flow. Despite its lowest price (0.190 Br), Fissulite showed minimal efficiency (1.37 mm^2/Br).

Conclusions. The high viscosity of Fissulite limits its preventive potential. Seal It and Fissurit FX possess optimal flowability for effective fissure sealing. Clinical performance (flow and penetration) has a greater impact on economic value than material cost alone. Seal It represents the most favorable option for preventive dental applications under the tested conditions.