樹脂表面光亮劑(Brightener III)應用在齒色填補材之物性測試

Application of a resin composite surface brightener (Brightener III) on properties of tooth-colored filling materials.

中文摘要

齒色牙科填補材中的玻璃離子體有硬化初期無法限制水分進入的缺陷，有必要在表面塗抹保護劑以減少初期的潮濕高敏感性，而樹脂複合材有不耐磨耗、易吸水膨脹之缺點，塗抹保護劑可減緩磨損粗糙所引發的變色。本研究旨在探討一種新型光聚合式樹脂表面光亮劑 Brightener III;應用在四種具代表性齒色牙科填補材〔傳統玻璃離子體(Fuji II)、樹脂改良型玻璃離子體(Fuji II LC)、樹脂複合材(3M Z-100 及 CLEAFIL AP-X)〕表面所產生的機械性質影響。實驗組表面依照臨床步驟塗抹一層 Brightener III;，控制組則不作任何表面處理。以 Vickers 微硬度機進行上述填補材塗抹 Brightener III®前後表面硬度分析，以迴轉式盤對盤形式的磨耗試驗，檢驗塗抹 Brightener III;前後重量損失率變化，以電位控制滴定儀(卡氏庫侖法)分析填補材塗抹 Brightener III;前後，浸泡去離子水不同時間下內部水分含量的改變，並以 SEM 觀察 Brightener III;與不同齒色牙科填補材交接面形態的差異。Brightener III;之微硬度值接近 Hv30，其中原本最軟性的 Fuji II 塗抹後表面硬度明顯變大 18.8%($p<0.05$)。SEM 顯示 Brightener III;爲一不含無機填料之均質物，與填補材交接面之密貼性和成份中是否含樹脂有明顯相關：主成份含樹脂基質之複合材及光硬化型玻璃離子體呈現良好接觸，而成份爲純酸鹼反應之玻璃離子體的交接面則出現具孔隙之分離現象，顯示機械性倒凹尚不足以形成良好黏合。磨耗測試顯示所有填補材經 Brightener III;塗抹後，重量損失率之降幅均減緩，特別是 Z100 及 Fuji II 經磨耗 25000 轉後之差異更明顯，顯示 Brightener III;爲一抗剝落之表面處理劑，其披覆確實改善了四種填補材的抗磨耗性質。Z100 及 APX 在水中浸泡 2 週後，並不因塗抹 Brightener III;而使內部水分有意義地增減，而 Fuji II LC 在水中浸泡 1 小時後，塗抹組跟控制組相比，含水量已明顯降低，在浸泡 10 天後，內部含水量已經相差 10000 ppm 以上，相同地 Fuji II 塗抹組在浸泡 1 小時後吸水率下降，7 天後其降低率與控制組差 2 倍之多，顯示 Brightener III;的塗抹對玻璃離子體之水分總含量有明顯減少功能，確實降低了水分的浸滲。綜合以上顯示，表面保護劑 Brightener III;提升了填補材之相對耐磨度，經鹵素光聚合形成保護膜後有助於降低玻璃離子體之相對吸濕膨潤度，可期對於機械性質之增強大有助益。

英文摘要

It is known that the glass ionomer existing in the tooth-colored dental restorative materials at the initial harden stage has the defect of water penetration; a coating of the surface protective film is, thus, needed to reduce the initial high sensitivity of

wetness. Since the inherent drawbacks, such as the wear un-resistance and easily water-absorbed expansion, are usually found in the compound resin, uses of the protective brighter onto the surfaces of the dental restorative materials can effectively overcome them. Aimed at improvements of these problems, a newly light-activated resin composite surface brightener, namely Brightener III is introduced and further investigated by testing its mechanical properties in this study. The specimens of 10 mm in diameter and 2.0 mm in thickness were made from four typical tooth-colored filling materials: the conventional glass ionomer (Fuji II), the resin-modified glass ionomer (Fuji II LC), the resin composite (3M Z-100) and the resin composite (CLEAFIL AP-X). All specimens were made by the manufacturers' instructions with the clinic procedures. The controlled specimens remained unprotected; while the experimental specimens were coated with the light-activated surface brightener Brightener III for protection. The micro-hardness analysis of the filling materials with and without the brighteners was conducted by the Vickers. The disc on disc wear test was adopted to investigate the rate of weight-loss for the specimens with coatings. The potentiometeric titration method or called the Karl-Fisher method was used to measure the change of the water content for the glass ionomer in the de-ioned water at different time periods. Besides, the SEM was also used to observe the different shapes of adjacent zones between the Brightener III and different tooth-colored dental restorative materials. Micro-hardness test showed that the Brightener III has an Hv value of 30 approximately and the Fuji II group has the dominant hardness.improvement SEM results showed that the Brightener III is a single homogeneous layer material without inorganic filler. Test groups with the resin matrix it have a dominant effect with respect to the glass ionomer (Fuji II). Some separation phenomena exist in the attaching phase between the Brightener III and the glass ionomer of the acid-base reaction. It revealed that the adhesion of its mechanical undercut is not well enough. The disc on disc wear test showed that after those filling materials were coated with the Brightener III, their decreasing rates of the weight loss are all reduced especially for the cases of Z100 and Fuji II at a revolution of 25000 cycles. It revealed that the Brightener III is a good surface protective layer of anti-abrasion and has significantly improved the wear resistance of the four filling materials due to its coating effect. The potentiometeric titration test showed that the water content of the Z100 and APX with the coating of the Brightener III dipped in water for two weeks does not change significantly. However, the water content of the Fuji II LC case dipped in water for one hour has dominantly reduced as compared with the controlled group. Moreover, after dipped in water for ten days, its water content has a reduction effect of 10000 ppm. Similarly, the case of Fuji II has the same trend

and its water content reduces to two times to that the controlled group. It revealed that the water content of the glass ionomer has greatly decreased due to the use of the Brightener III®. In summary, the Brightener III with low-viscosity and high mobility enhanced the relative wear resistance of the four evaluated materials when comparing with those unprotected groups. This light-activated protective film had a sound effect to decrease the wet-absorbed expansion of the GI and RMGI. Therefore, tooth-colored restorative materials with the application of Brightener III could improve their mechanical properties effectively.