

ผลของฟลูออไรด์จากวัสดุบูรณะฟันต่อความแข็งผิวของเคลือบฟันและเนื้อฟัน

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EFFECT OF FLUORIDE RELEASED FROM RESTORATIVE
DENTAL MATERIALS ON HARDNESS OF ENAMEL AND DENTIN

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อัญชณา พานิชัตตรา : ผลของฟลูออไรด์จากวัสดุบูรณะฟันต่อความแข็งผิวของเคลือบฟันและเนื้อฟัน (EFFECT OF FLUORIDE RELEASED FROM RESTORATIVE DENTAL MATERIALS ON HARDNESS OF ENAMEL AND DENTIN) อ. ที่ปรึกษา : อ.ทพ.ดร.สุจิต พูลทอง , อ. ที่ปรึกษาร่วม : รศ.ดร.เอมอร เบญจวงศ์กุลชัย: 363 หน้า. ISBN 974-03-1338-8

ปัจจุบันมีการใช้วัสดุบูรณะฟันชนิดสีเหมือนฟันที่สามารถปลดปล่อยฟลูออไรด์อย่างแพร่หลาย โดยเชื่อว่าการปลดปล่อยฟลูออไรด์อย่างต่อเนื่องนั้นมีผลในการป้องกันฟันผุได้ การวิจัยนี้มีวัตถุประสงค์เพื่อเปรียบเทียบผลของฟลูออไรด์ที่ปลดปล่อยจากวัสดุบูรณะฟันชนิดต่างๆต่อความแข็งของผิวเคลือบฟันและเนื้อฟันที่ระยะต่างๆห่างจากวัสดุ การทดลองทำโดยใช้เคลือบฟัน 116 ชิ้นและเนื้อฟัน 108 ชิ้น จากฟันกรามน้อยแท้ ต่อมาเตรียมโพรงบนชิ้นผิวเคลือบฟันและเนื้อฟันขนาด 3X3X1 มม. เพื่อทำการอุด จากนั้นแบ่งเป็น 4 กลุ่มโดยใช้วัสดุบูรณะดังนี้ คือ กลุ่ม 1 และ กลุ่ม 2 อุดด้วยวัสดุอุดสีเหมือนฟันคือ เรซินคอมโพสิต (Resin composite, Clearfil APX, Kuraray, Osaka, Japan) โดยใช้สารยึดติด (Dentin adhesive, Clearfil Liner Bond 2, Kuraray, Osaka, Japan) เป็นกลุ่มควบคุมทางลบและทางบวก, กลุ่ม 3 อุดด้วยวัสดุชนิดเรซินมอดิไฟด์กัลลาสไอโอโนเมอร์ซีเมนต์ (Resin modified glass ionomer cement, Fuji LC, GC, Tokyo, Japan), กลุ่ม 4 อุดด้วยโพลีเอซิลิคมอดิไฟด์เรซินคอมโพสิตหรือคอมโพเมอร์ (Polyacid modified resin composite or Compomer, F2000, 3M, Minnesota, USA) นำชิ้นฟันทั้งหมดมาทำการวัดค่าความแข็งผิวฟันแบบจุลภาคก่อนโดยใช้เครื่องวัดความแข็งผิวฟันแบบจุลภาค แล้วจึงนำชิ้นฟันทุกกลุ่มแต่ละชิ้นไปแช่ในสารละลายดีมินเนอไรเซชัน (Demineralization solution) 10 มิลลิลิตร ซึ่งมีค่า pH 5.0 เป็นเวลา 24 และ 72 ชั่วโมง เพื่อทำให้เกิดการเปลี่ยนแปลงแบบธรรมชาติ แต่ในสารละลายดีมินเนอไรเซชันของกลุ่มที่ 2 ซึ่งเป็นกลุ่มควบคุมทางบวกจะผสมด้วยฟลูออไรด์ 10 พีพีเอ็ม (ppm) แล้วจึงนำมาวัดค่าความแข็งผิวฟันแบบจุลภาคใหม่รอบวัสดุอุดฟัน หลังจากนั้นนำชิ้นฟันไปตัดตามขวางเพื่อนำมาวัดค่าความแข็งผิวฟันได้พื้นผิวโดยใช้เครื่องวัดความแข็งผิวแบบนาโนโดยใช้หัวกดเบอร์กอวิช (Berkovich indenter) เพื่อประเมินค่าความแข็งผิวจากความลึกของรอยที่เกิดจากการกดในบริเวณที่ห่างจากวัสดุอุดเป็นระยะทางทีละ 50 ไมครอนเป็นจำนวน 6 จุด และลงตามแนวขนานกับแถวเดิมอีกเป็นจำนวน 4 แถว จากนั้นนำชิ้นทดลองไปวิเคราะห์ธาตุฟลูออไรด์ในบริเวณห่างจากวัสดุอุด 100 ไมครอนทั้งด้านพื้นผิวและภาคตัดขวาง โดยใช้เครื่องวิเคราะห์ธาตุ (Energy Dispersive Spectrometer) จากกล้องจุลทรรศน์อิเล็กตรอนแบบส่องกราด (Scanning electron microscope) ผลการวิจัยพบว่า ค่าความแตกต่างของความแข็งผิวเคลือบฟันและเนื้อฟันระหว่างก่อนและหลังการแช่กรดในกลุ่มต่างๆมีความแตกต่างกันโดยมีนัยสำคัญที่ระดับความเชื่อมน้อยละ 95 ในกลุ่มของวัสดุชนิดเรซินมอดิไฟด์กัลลาสไอโอโนเมอร์ซีเมนต์และโพลีเอซิลิคมอดิไฟด์เรซินคอมโพสิตพบว่าค่าความแตกต่างของความแข็งผิวเคลือบฟันและเนื้อฟันระหว่างก่อนและหลังการแช่กรดมีความแตกต่างกันโดยมีนัยสำคัญที่ระยะห่างจากวัสดุอุด 100 และ 300 ไมครอน ส่วนในการวัดความแข็งผิวฟันได้พื้นผิวโดยใช้เครื่องวัดนาโนพบว่ามีการเปลี่ยนแปลงของพื้นผิวแตกต่างกันในช่วงระยะ 50 ถึง 100 ไมครอนเมื่อเปรียบเทียบกับ 300 ไมครอนโดยมีนัยสำคัญที่ระดับความเชื่อมน้อยละ 95 ในกลุ่มของวัสดุชนิดเรซินมอดิไฟด์กัลลาสไอโอโนเมอร์ซีเมนต์และโพลีเอซิลิคมอดิไฟด์เรซินคอมโพสิตเมื่อใช้การวิเคราะห์ธาตุพบฟลูออไรด์ที่บริเวณใกล้กับวัสดุมีปริมาณสูงกว่าบริเวณที่ห่างจากวัสดุโดยมีความสัมพันธ์กับค่าความแข็งผิวฟัน จากการศึกษาสรุปได้ว่าวัสดุชนิดหลังฟลูออไรด์สามารถช่วยลดการเปลี่ยนแปลงแบบธรรมชาติได้ในระยะ 100 ไมครอนเมื่อพิจารณาจากการเปลี่ยนแปลงความแข็งผิวฟันและความสามารถในการช่วยลดการผุขึ้นอยู่กับชนิดของวัสดุ

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ลายมือชื่ออาจารย์ที่ปรึกษา
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ANCHANA PANICHUTTRA : EFFECT OF FLUORIDE RELEASED FROM RESTORATIVE DENTAL MATERIALS ON HARDNESS OF ENAMEL AND DENTIN. THESIS ADVISOR : Dr. SUCHIT POOLTHONG, THESIS CO-ADVISOR : ASSOCIATE PROFESSOR Dr. EM-ON BENJAVONGKULCHAI, 363 pp. ISBN 974-03-1338-8.

Nowadays fluoride releasing restorative materials are widely used in an attempt to prevent secondary caries. The purpose of this study was to investigate the effect of fluoride released from different materials on the hardness of human enamel and dentin as a function of distance. The 116 enamel and 108 dentin specimens prepared from freshly-extracted non-carious permanent premolars were divided into 4 groups. Cavities (3X3x1 mm) were prepared on the surface of each specimen. In groups I and II, the prepared cavities were filled with resin composite (Clearfil APX, Kuraray, Osaka, Japan) using dentin adhesive (Clearfil Liner Bond II, Kuraray, Osaka, Japan) to use as negative and positive controls. In groups III and IV, the prepared cavities were filled with resin modified glass ionomer cement (Fuji LC, GC, Tokyo, Japan) and polyacid modified resin composite (F2000, 3M, Minnesota, USA). Surface microhardness of all specimens were measured prior to the forming of artificial caries lesion using microhardness tester. Then all the specimens were immersed in demineralization solution at pH 5.0 for 24 and 72 hours to form artificial caries lesion. The specimens in group II were immersed in demineralization solution with fluoride 10 ppm. After caries-induced procedure, surface microhardness of all the specimens were measured. Then the specimens were cross-sectionally cut to measure the subsurface hardness with nanohardness tester using Berkovich indenter. The investigated areas were the areas adjacent to the restored material by running a mapping of a nanoindentation hardness test, 4 rows of 6 indentation with a separating space of 50 microns. Finally the experimented specimens were analyzed with scanning electron microscope using EDS (Energy Dispersive Spectrometer) technique to quantify fluoride content both on the surface and subsurface of the experimented specimens. The results showed that there were statistical differences ($P < 0.05$) between the series of 100 and 300 microns of groups III and IV which the cavities were filled with resin modified glass ionomer and polyacid modified composite. Nanohardness test exhibited the statistically difference in the subsurface of enamel and dentin within 50 up to 100 microns compared to 300 microns in the same group. The EDS found that fluoride quantity was higher in the area adjacent to the restoration and related to the high hardness area. The conclusion was fluoride releasing materials had effected on preventing artificial caries in the area within 100 microns and also depend on the type of materials.

Field of study Oral Biology

Academic Year 2544

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