AE5（修復）
【2501】

Optical assessment of dentin de/remineralization from a phosphate-based desensitizer using optical coherence tomography

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Ⅰ. Object：

Optical coherence tomography（OCT）is a noninvasive imaging device that can provide cross-sectional images of internal biological structure. In addition to offering high resolution morphological images, the OCT signal can be used to estimate attenuation coefficient（μt）of enamel and dentin. Previous studies have demonstrated a strong correlation between μt determined by swept-source OCT（SS-OCT）signal and mineral changes of demineralized lesions. A new phosphate based desensitizer has been developed that contains zinc-fluoride glass. The purpose of this study was to evaluate demineralization inhibition effects of a new dentin desensitizer using SS-OCT.

Ⅱ. Materials & Methods：

Ten dentin slices prepared from caries free human premolars or molars were polished with #600 silicon carbide paper and slightly demineralized using artificial demineralizing solution（pH＝5.0）for 5 days. Two areas namely treated（T）and un-treated（UT）were assigned on the demineralized dentin surface as follows；The half of the surface on each slice was treated by the desensitizer containing zinc-fluoride glass（Zinc-F, GC）for 20 seconds according to the manufacturer's instruction（T）, while the other half surface was stayed as UT area. The dentin specimens were then randomly divided into 5 slices each and allocated one of the following treatment groups；（ⅰ）further demineralization group was immersed in the demineralizing solution at pH 5.0；（ⅱ）remineralization group was immersed in remineralizing solution（pH 7.0）. After the storage for 3 days, five cross-sectional images of dentin from each dentin slice were obtained using SS-OCT（IVS-2000, Santec）at 1330 nm center wavelength. For image analysis, image analysis software（ImageJ version 1.47n）was used to import the data of SS-OCT. A region of interest（ROI）from the surface（width 1000 μm×optical depth 500 μm）was selected and converted to a signal-intensity depth profile. The signal intensity within the ROI was integrated as the area under curve（AUC500）. The μt was also calculated on each average signal-intensity profile. The obtained values were statistically analyzed at significance level of α＝0.05.

Ⅲ. Results：

In the demineralization group, SS-OCT signal from T surface showed slight increase in AUC500 for T surface but no significant difference was observed（$p>0.05$）. However, μt for T surface was significantly lower than the UT surface（$p<0.05$）. Remineralization group showed no significant difference of AUC500 and μt between the T and UT surfaces（$p>0.05$）.

Ⅳ. Conclusion：

The new dentin desensitizer containing zinc-fluoride glass showed less signal attenuation in the demineralization group. The new desensitizer could decrease the further demineralization on dentin after the treatment.

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光コヒーレンス断層撮影法を用いたリン酸塩ベースの知覚過敏抑制材による象牙質脱灰/再石灰化の光学的評価

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I . Object :

Optical coherence tomography (OCT) is a noninvasive imaging device that can provide cross-sectional images of internal biological structure. In addition to offering high resolution morphological images, the OCT signal can be used to estimate attenuation coefficient (μ t) of enamel and dentin. Previous studies have demonstrated a strong correlation betweenμ t determined by swept-source OCT (SS-OCT) signal and mineral changes of demineralized lesions. A new phosphate based desensitizer has been developed that contains zinc fluoride glass. The purpose of this study was to evaluate demineralized inhibition effects of a new dentin desensitizer using SS OCT.

光干渉断層撮影法（OCT）は、内部の生物学的構造の断層画像を提供することができる非侵襲的撮像装置である。 高解像度形態画像を提供することに加えて、OCT 信号は、エナメル質および象牙質の減衰係数（μ t）を推定するために使用され得る。 これまでの研究では、掃引光源 OCT（SS-OCT）信号と脱灰病変部のミネラル変化との間に強い相関があることが実証されている。 フッ化亜鉛ガラスを含む新しいリン酸塩ベースの抑制材が開発されました。 本研究の目的は、SS-OCT を用いた新しい象牙質知覚過敏抑制材の脱灰抑制効果を評価することであった。

II. Materials & Methods :

Ten dentine slices prepared from caries free human premolars or molars were polished with #600 silicon carbide paper and slightly demineral-ized using artificial deminerelizing solution (pH=5.0) for 5 days. Two areas namely treated (T) and un-treated (UT) were assigned on the demineralized dentin surface as follows ; The halt of the surface on each slice was treated by the desensitizer containing zinc-fluoride glass (Zinc-F, GC) for 20 seconds according to the manufacturer's instruction (T), while the other half surface was stayed as UT area. The dentin specimens were then randomly divided into 5 slices each and allocated one of the following treatment groups ; (i) further demineralization group was immersed in the denimeralizing solution at pH 5.0 ; (ii) remineralization group was immersed in remineralizing solution (pH 7.0). After the storage for 3 days, five cross-sectional images of dentin from each dentin slice were obtained using SS-OCT (TVS-2000, Santec) at 1330 nm center wavelength. For image analysis, image analysis software (imageJ version 1.47n) was used to import the data of SS-OCT. A region of interest (ROI) from the surface (width 1000μ m x optical depth 500μ rn) was selected and converted to a signal-intensity depth profile. The signal intensity within the ROI was integrated as the area under curve (AUC500) . The μ m was also calculated on each average sjgnal-intensity profile. The obtained values were statistically analyzed at significance level of α =0.05.

齲蝕のないヒトの小臼歯または臼歯から調製した 10 枚の象牙質スライスを＃600 炭化ケイ素紙で研磨し、人工脱灰溶液（pH = 5.0）を用いて 5 日間わずかに脱灰した。 ミネラルが除去された象牙質表面は、処理された（T）および未処理（UT）の 2 つの領域が次のように割り当てられた；亜鉛フッ化物ガラス（Zinc-F、GC）を含む知覚過敏抑制材により、製造者の指示に従って 20 秒間処理された半分エリア（T）、他方の処理なしの半分エリア（UT）。次に象牙質試験片を無作為に 5 つのスライスに分け、以下の処置群の 1 つを割り当てた。（ｉ） 引き続き pH5.0 の脱金属溶液に浸漬した脱灰グループ;（ｉｉ）pH 7.0 の再石灰化溶液浸漬した再石灰化グループ。3 日間保存した後、1330nm の中心波長で SS-OCT（TVS-2000、Santec）を用いて各象牙質スライスからの象牙質の 5 つの断面画像を得た。画像解析のために、画像解析ソフトウェア（imageJ version 1.47n）を使用して SS-OCT のデータをインポートした。表面（幅 1000μｍ×光学的深さ 500μｍ）からの注目画像領域（ROI）を選択し、シグナル強度の深さプロファイルに変換した。ROI 内のシグナル強度は、曲線下面積（AUC500）として統合された。μｍはまた、各平均信号強度プロファイルで計算した。 得られた値を有意水準α = 0.05 で統計的に分析した。

III. Results :

In the demineralization group, SS-OCT signal from T surface showed slight increase in AUC500 for T surface but no significant difference was observed ($p>0.05$). However, μｔ for T surface was significantly lower than the UT surface ($p<0.05$). Remineralization group showed no significant difference of AUC500 and μｔ between the T and UT surfaces ($p>0.05$).

脱灰グループでは、T 表面からの SS-OCT シグナルは T 表面で AUC500 のわずかな増加を示したが、有意差はみられなかった（p> 0.05）。 しかしながら、T 表面のμｔは UT 表面よりも有意に低かった（p <0.05）。 T および UT 表面の間で、再石灰化グループは AUC500 およびμｔの有意差を示さなかった（p> 0.05）。

IV. Conclusion :

The new dentin desensitizer containing zinc-fluoride glass showed less signal attenuation in the demineralizaion group. The new desensitizer could decrease the further demineralizaion on dentin after the treatment.

亜鉛フッ化物ガラスを含有する新しい象牙質知覚過敏抑制材は、脱灰グループにおいて信号減衰が少なかった。 新しい知覚過敏抑制材は、治療後の象牙質のさらなる脱灰を減少させる可能性がある。

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