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Multiple Gingival Clefts from Faulty Flosspick Usage: A Case Report

牙線棒不當使用造成的牙齦割裂傷

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Introduction:

Frequent reinstruction and reinforcement in the use of floss are necessary because flossing is a difficult skill to master. An alternative of manual flossing with flosspick seems to be an easier way for interdental cleaning. Standard oral hygiene procedures, whether toothbrushing or flossing, may lead to frequent transient and minimal gingival injury. Injury may become significant if oral hygiene is performed improperly or in an overly aggressive manner. This type of injury may present as lacerations, abrasions, keratosis, recession. Here we presented a case report of multiple gingival clefts resulting from improper flosspick technique.

Clinical case:

A 14-year-old female patient was referred from pediatric dentist for idiopathic, atypical gingival swellings. Medical history was non-contributory. Successive gingival swellings were noted on radicular surfaces of many teeth and at some papillae, separating each other by gingival clefts at line angles. V-shaped gingival recessions appeared at DB line angles of #16,15,25,26 as well (Fig. 1). Bleeding on probing was limited to the posterior teeth of ULQ. Color and texture of gingival tissue were not far from normal. Probing depth = 6mm was detected at #36M and 46M. Minimal bone loss (#46M, 45M) without calculus deposition was seen on intraoral radiographs.

She used to clean her teeth with toothbrush and flosspick. Once flosspick was forced into the interdental area, she habitually used it in a sawing motion instead of scraping against the proximal surfaces with the string. The answer to the formation of these unpainful gingival clefts and V-shaped recession was thus unveiled. She was suggested to stop using flosspick for posterior teeth and was instructed to exercise proper flosspick and flossing technique(Fig. 3). Phase I periodontal therapy was performed as well (Fig. 4).

◂ **Fig. 1:** Initial intraoral view. Multiple gingival clefts were noted at line angles.

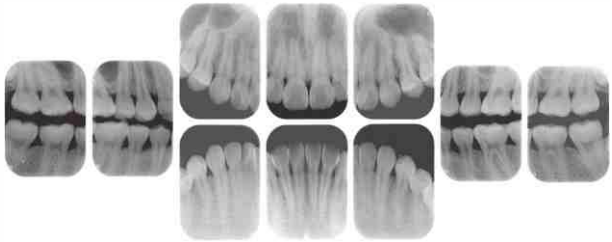

Fig. 2: Initial intraoral radiographs showed minimal bone loss and free of calcified deposition.

Fig. 3: After discontinuing flosspick for 15 days, gingival indentations were still prominent.

Fig. 4: Discontinuing flosspick for 46 days. Healing of gingival clefts was underway.

Discussion and Conclusion:

Oral hygiene agents and inexpedient procedures can be injurious to the gingival tissues. If physical trauma is limited, the gingival response is hyperkeratosis, resulting in a white leukoplakia-like, friction keratosis. In case of more violent trauma the damage varies from superficial gingival laceration to major loss of tissue resulting in gingival recession (Axéll & Koch 1982; Smukler & Landberg 1984). Dental flossing may cause gingival ulceration and inflammation primarily affecting the top of interdental papillae. The magnitude and number of gingival lacerations caused by faulty flosspick practice as in this case is rarely seen.

Because of the similarity in clinical appearance among traumatic lesions, a detailed and accurate history is often critical to the practitioner in the diagnosis of possible or probable traumatic injury. Occasionally, the challenge is to elicit relevant information from the patient. Patients may be unaware of the significance of potentially injurious habits.

Management of gingival injuries requires removal of the offending agent and symptomatic therapy. Periodontal plastic surgery, including gingival grafting, may be necessary when the injury results in permanent gingival defects. And modifying erroneous flossing technique is certainly a matter of paramount importance.

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壁報論文比賽作品

Comparing the efficacy of chinese herbal mouthrinses and chlorhexidine mouthrinses on supragingival plaque, teeth surface staining and ginigivitis inhibition.

比較中藥複方與氯己定漱口水對於控制口內牙齦炎及減少牙菌斑數量的臨床效果評估

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背景：

使用含有效抗菌物之漱口水是目前常用於牙齦炎及牙周病患者之輔助治療方法(1)。且因局部用藥、濃度高、副作用小而受到重視。但普遍用於臨床上，且認爲效果最顯著之氯己定漱口水，因其藥水口味不佳、口感差、可能引起味覺改變、少數有局部刺激和過敏反應、且長時間使用易使牙齒表面琺瑯質染色等副作用(2,3)，而受到部份患者抗拒。

因此，尋找具有相同抑菌及抗菌成份，且不具刺激性口感，同時又不造成牙齒染色之漱口水藥物，可爲大多數牙周病患者解決無法有效清除口內牙菌斑，而病情無法獲得控制之困擾。

中藥複方「牢牙散加味」，其主要成份有升麻、 地骨皮、羌活、龍膽草及青鹽、梅片等矯味劑，而這些主要成份均是本草綱目有記載之藥物，而且也大多有抗菌、抗發炎之性質。根據之前基礎研究結果顯示，含有中藥複方之漱口水對口腔病原菌之生長有明顯抑制效果，而且也沒有導致細胞突變之情形產生(4)。

本試驗主要目的即是檢測含中藥複方與氯己定漱口水，對於牙菌斑之控制及牙齦炎療效之臨床評估。

材料與方法：

本實驗設計採用隨機、雙治療方式。在長庚紀念醫院林口院區牙周病科中，隨機挑選出需接受牙周病治療的成年男性及女性病患，接受本臨床試驗。受試者需爲在口內後牙區（不包括第一小臼齒）因牙周囊袋過深或因牙齦下齲齒侵犯生物寬度等原因，而需接受牙周翻瓣手術之患者。由於這些患者在術後兩週內爲避免因機械式之潔牙方式影響術後翻瓣之固位，需依賴漱口水來照護術後傷口清潔。受試者在兩週內的試驗中將分別使用中藥複方與氯己定漱口水，使用期間分別爲一週。

一週後回診記錄口腔中牙齦指數（5）、牙菌斑指數(6)、牙齒染色指數(7)及口腔軟組織之情況。檢查後再次幫受試者進行牙齒清潔，包括：去除牙結石、牙菌斑及牙齒表面染色（若有發生的話）。第二週回診時拆除傷口縫線及敷料，並記錄口腔中牙齦指數、牙菌斑指數 、牙齒染色指數及口腔軟組織之情況。

結果：

在經過篩選且完成整個實驗過程的受試者人數爲十五位，其中有十二位是女性及三位男性，其年齡分佈爲25至48歲，平均年齡爲34.1。

比較第一小臼齒及前牙區域牙齒的牙齦發炎指數，使用氯己定漱口水及中藥漱口水一周後的牙齦發炎指數分別爲0.55±0.27(氯己定)與0.51±0.26(中藥)，都有良好控制，且相較於試驗前後在統計學上有顯著的差異。比較使用兩種漱口水後的牙齦發炎指數，則在統計學上無明顯之差異。

使用氯己定漱口水及中藥漱口水一周後，分別測量第一小臼齒及前牙區域牙齒的平均牙齒斑指數，兩者並無統計學上的差異。

檢查牙齒在使用兩種漱口水後，是否有外在染色的情形。計算第一小臼齒及前牙區域牙齒表面頰側與舌側的染色程度，兩組Modified Lobene Stain Index的平均值(Mean)分別爲0.64±0.32（氯己定)與0.53±0.33（中藥）。與基準值相較，試驗後牙齒外在染色再發生的現象都有降低，且在統計學上有顯著差異。而兩種漱口水相比，則無差異。

受試者在試驗後的回診檢查時，並無任何明顯的副作用產生，試驗期間也沒有任何受試者有不良反應的情形，但有些受試者反應氯己定漱口水氣味相對較爲刺鼻。

討論：

根據實驗結果顯示，使用兩種漱口水之後，相較基準值的牙齦發炎指數皆有改善。因此，在牙齦炎的抑制上，兩種漱口水在統計學上的皆有顯著效果(P<0. 05)，而兩組之間相比較，則無統計上的差異。因此，在本實驗中，

中藥複方漱口水與氯己定漱口水對於控制牙齦炎上，兩者在臨床上的效果相當。本實驗所使用的中藥複方漱口水其中的各個主要成份，大都具有抗菌及抗發炎的性質，而實驗的結果也顯示這些特質對於控制牙齦炎俱有臨床的效果。

在試驗期間，要求受試者僅使用漱口水來維持口腔衛生，即僅以化學方式來控制牙菌斑。然而，在使用兩種漱口水後，對於牙菌斑的控制情形，在臨床上並無法達到理想的狀態，兩組的牙菌斑指數分別爲3.43±0.72(氯己定)與3.64±0.52(中藥)。由於氯己定漱口水在抑制牙菌斑生長的效果已有諸多文獻報告證實，而在本實驗的結果顯示，即便是使用氯己定漱口水來控制牙菌斑生長，其牙菌斑指數在一周後仍高達3.43±0.72，這顯示僅使用化學方式來維持口腔衛生的潔牙效果在牙菌斑的抑制上並不如機械方式來的有效果。在進一步比較兩種漱口水之間抑制牙菌斑生成的效果，在統計學上沒有顯著的差異，因此，使用中藥漱口水在臨床的使用上仍建議需要配合牙刷、牙線等機械方式，才能夠有效地控制口內牙菌斑的生長。

本試驗所用之中藥複方漱口水其主要成份有升麻、地骨皮、龍膽草、羌活等,雖然根據「本草綱目」所述，都有抗菌及抗發炎等功用，但對於牙菌斑之抑制作用的效果竟是屬於何種機制：是直接的抑菌與殺菌作用,還是間接的干擾牙菌斑的形成，尚需在未來的研究中進一步探討。

結論：

在本此的試驗中顯示，中藥漱口水與氯己定漱口水在短期的使用中，兩者在臨床上對控制牙齦炎的效果並無統計學上的差異，且無不良反應或是副作用的產生，這對那些相信及習慣使用中藥，或是無法接受氯己定漱口水氣味的的人，在目前市售中眾多種類的口腔衛生保健產品上又多了一項選擇。

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表1 使用兩種漱口水後牙齦指數與基準值之比較

組別	n	Median(Min., Max.)	Mean±SD	Sig.[3]
氯己定漱口水[1]	15	0.49(0.18, 1.09)	0.55±0.26	0.031
中藥漱口水[2]		0.42(0.21, 1.00)	0.51±0.26	0.002

[1]市售氯己定漱口水含濃度0.12%氯己定
[2]市售含中藥複方成分漱口水。
[3]利用威爾卡森檢定(Wilcoxon Test)分別比較使用不同成分的漱口水一周後，與基準值的牙齦指數的差異顯著性。

表2 使用兩種漱口水後牙齒染色指數與基準值之比較

組別	n	median	Mean±SD	Sig.[3]
氯己定漱口水[1]	15	0.609(0.033, 1.24)	0.64±0.32	0.64±0.32
中藥漱口水[2]		0.54(0.013, 1.17)	0.53±0.33	0.53±0.33

[1]市售氯己定漱口水含濃度0.12%氯己定
[2]市售含中藥複方成分漱口水。
[3]利用威爾卡森檢定(Wilcoxon Test)分別比較使用不同成分的漱口水一周後，與基準值的牙齦指數的差異顯著性。

表3 使用兩種漱口水後牙齦指數與基準值之比較

組別	參數	Median(Min., Max.)	Mean±SD	Sig.[3]
氯己定漱口水[1]	牙齦指數	0.49(0.18, 1.09)	0.55±0.26	0.590
中藥漱口水[2]		0.42(0.21, 1.00)	0.51±0.26	
氯己定漱口水[1]	牙齒染色指數	0.609(0, 1.24)	0.64±0.32	0.384
中藥漱口水[2]		0.54(0, 1.17)	0.53±0.33	
氯己定漱口水[1]	牙菌斑指數	3.56(1.75, 4.22)	3.43±0.72	0.455
中藥漱口水[2]		3.69(2.78, 4.44)	3.64±0.52	

[1]市售氯己定漱口水含濃度0.12%氯己定
[2]市售含中藥複方成分漱口水。
[3]用曼 - 惠特尼 U 檢定(Mann-Whitney U test)分別比較使用不同成分的漱口水一周後，兩組間各項參數是否有統計上的差異。

圖一A ：病患術前之正面口內觀

圖一B：病患在使用含中藥複方成分漱口水一周後之正面口內觀

圖一C：病患在使用含氯己定漱口水一周後之正面口內觀

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Biomechanical Research of TiNb Alloys with Electrochemical Treatment Using Finite Element Method

電化學處理之鈦鈮合金生物機械模擬分析

潔明牙醫診所 吳啓明

Abstract:

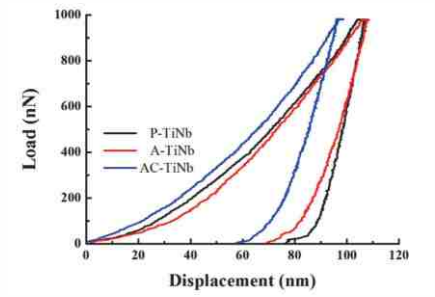
In the present study, atomic force microscopy, contact angle instrument and the nano-indentation were conducted to evaluate the effects of oxide layers on TiNb alloys with and wiout surface treatment (TiNb, A-TiNb and AC-TiNb). In addition, the biomechanical properties of TiNb, A-TiNb and AC-TiNb were evaluated by finite element (FE) computer simulations. The results revealed that the rough surface and wettability property of TiNb alloy could be obtained after surface treatments. Furthermore, the surface properties of TiNb, A-TiNb and AC-TiNb are all relative the surface treatments. The elastic modulus of AC-TiNb was reduced to be closed to that of bone tissue. The gradual mechanical properties existed on the TiNb treated samples. The phenomena that more stress shared by bone tissue with treated metallic screws were showed in FEM models. In conclusion, the oxide layers formed by anodization with cathodical pretreatment played an important role in enhancing the biocompatibility and biomechanical ability of TiNb alloys. These results demonstrated that new AC-TiNb alloys not only contain nontoxic constituents but have relatively surperior biomechanical capability as well.

Keywords: Nano-indentation, atomic fore microscopy, contact angles and FEM

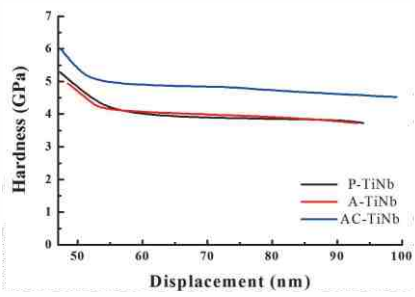
Introduction:

In order to realize the properties of TiNb alloy with and without anodization followed by cathodic pretreatment, the surface properties of the alloys will be evaluated by atomic fore microscopy (AFM) and contact angle measurement. Furthermore, the nanoindenter with high resolution was utilized to evaluate the mechanical properties (elastic modulus) of TiNb alloys with anodization followed by cathodic pretreatment. The three dimensional finite element analysis was performed to verify that the bone stress and strain were affected by the elastic modulus of implants. As mentioned above, for easy identification, TiNb with polishing, TiNb with anodization and TiNb with anodization following cathodization were denoted as P-TiNb, A-TiNb and AC-TiNb, respectively.

Results and Discussion:



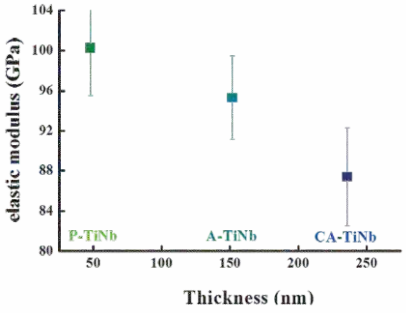
Typical loading-unloading versus depth curves in 1000 nN tests for all sample groups



Hardness versus depth curves for all sample groups

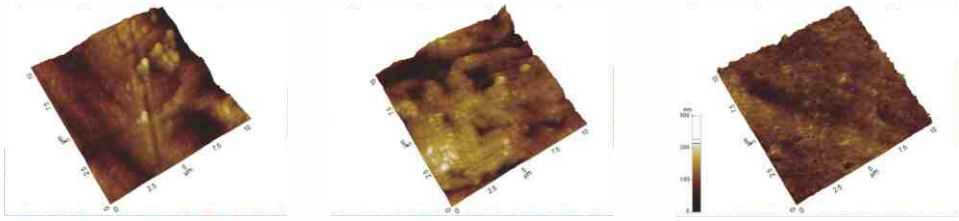
cp-Ti　　TiNb.　　AC-TiNb.

Equivalent stress distribution of the implant under axial load



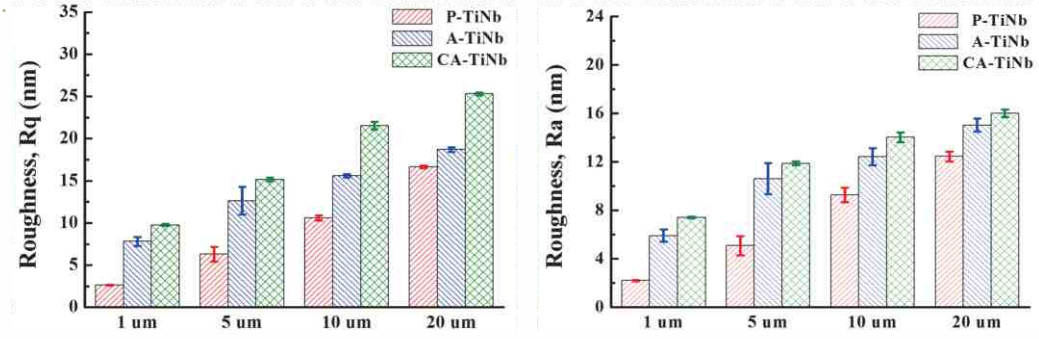
The modulus versus coating thickness with different treatments

AFM images (10 ×10 scanning size,



TiNb sample groups: P-TiNb.　　TiNb sample groups: A-TiNb.　　TiNb sample groups: CA-TiNb.

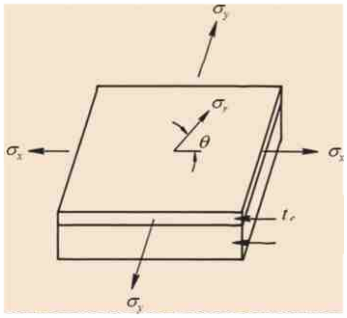
Surface roughness characteristics of TiNb sample groups with different scanning sizes.



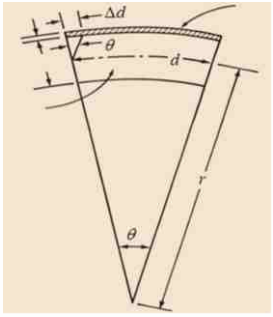
Materials and Methods:

The Ti and Ti-Nb alloys in these experiments were 1-mm-thick plates with a diameter of 14.5 m

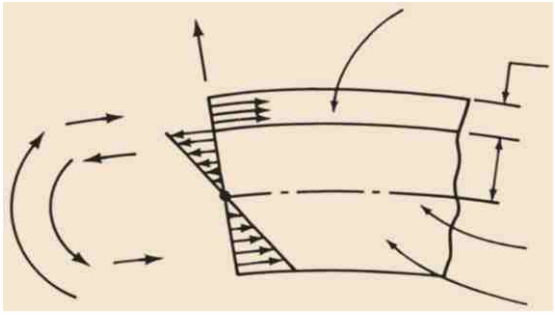
- Theoretical design
- Sample pretreatment
- Low temperature plasma proceduresd
- Measurement of contact angle
- Clotting time assay
- Amino-group deposition and quantity
- Protein immobilization
- Surface characterization
- Nanoindention
- Contact angle measurement
- Finite element model
- Statistical analyses



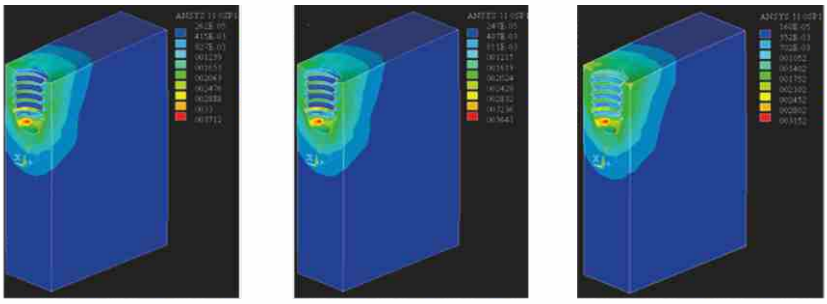
Biaxial stress in a thin film deposited on a rigid substrate.



Cross-sectional view of a thin film under compression on a bent substrate



A schematic diagram showing the stress distribution in film and substrate and the corresponding forces and bending moments



cp-Ti TiNb. AC-TiNb.

Equivalent strain distribution of cancellous bone under axial load

Conclusin:

In the present investigation, the mechanical properties of TiNb alloys were modified by electrochemical treatment. The properties of the TiNb alloy specimens were determined by electrochemical measurement and material analyses. The effects of titanium hydride compounds on the formation of porous structural oxide film during electrochemical surface treatment are examined by XPS, TF-XRD and SEM. Oxide films are formed during anodization following cathodic pretreatments. TiH1.971 is formed by cathodic pretreatment. The TiH1.971 is directly dissolved following anodic treatment. Additionally, the porous TiNb that was formed by the dissolution of TiH1.971 were modified to porous oxide films. Hydrogen charging is important in forming porous oxide films. Anodization following cathodic pretreatment not only yields a thick oxide film, but also produces porous structures. Implanting bioactive TiNb into a porous oxidation film promotes bone-interface contact, improving osseo/osetointegration.The oxide layers on the surface of TiNb alloys are formed using anodization with cathodical pretreatment. The surface physical behaviors and mechanical properties presented in this study are strongly correlated to the the thickness of oxide layers. The rougher surface and hydrophilic property can be produced after surface modification. The elastic modulus of TiNb alloy approached to that of bone tissue after surface modification. Materials with lower stiffness favor equal sharing of loads between the surrounding bone tissue and metallic screw. The anodization with cathodical pretreatment could enhance the performances of biocompatibility and biomechanical ability on the TiNb alloys surface from these observations. These results demonstrate that the TiNb alloys using anodization with cathodical pretreatment would be the potential biomaterials.

Contact angle and surface free energy data of TiNb sample groups			
	P-TiNb	A-TiNb	CA-TiNb
q_{water}	78.4±1.9	59.6±4.8	44.0±2.4
g_{sv}	43.7	55.0	62.2
W_{sL}	112.8	126.5	134.6

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壁報論文比賽作品

Endodontic treatment of young permanent tooth with dens invaginatus

牙根未發育完成的牙中牙牙髓治療方式—病例報告

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前言

牙中牙(dens invaginatus)是一種發育結構上的異常，是由於較深層的enamel organ進入dental papilla所造成，在成人牙中發生的比例約爲0.3%-10.0%，最常發生的位置依序爲上顎側門齒、下顎第二小臼齒[1]。牙中牙可以由X光片來診斷，並有很高的比例是遺傳自父母。由於dens invaginatus常連通cavity 與pulp chamber，所以常有較高的比例牙齒會因這個發育上的異常而喪失活性。這可能是因爲牙中牙與牙髓接近的連結、齲齒、或是先天發育的缺陷早已經存在。年輕恆牙因牙中牙而喪失牙髓活性導致牙髓炎、牙根尖膿腫或蜂窩組織炎等急性症狀的情形十分常見，且大部分發生時恆牙牙根仍未發育完全[2]。

如果牙髓在牙根尚未完全行程或牙根尖尚未完全閉合時就被破壞，往往也會干擾或改變正常牙根的發育。所以治療這樣牙齒的目的主要是希望牙根可以繼續生長。治療牙根未完全閉合的年輕恆牙，最大的問題是無法在牙根處達到一個良好的封填(optimal apical seal)，而apexification主要的目的便是使用氫氧化鈣刺激牙周膜細胞形成硬組織障蔽(hard tissue barrier)，並因此降低牙根尖遭細菌感染的機會，保留牙根尖細胞的活性使牙根有機會繼續生長直到牙根尖關閉[3]。

近年來，越來越多的醫師改用MTA取代氫氧化鈣作爲根管治療的藥物，主要是因其產生的硬組織障蔽(hard tissue barrier)較爲緻密，且具有較好的生物相容性以及可預測的硬化時間[4,5,6]。

在2009年，Ling-Huey Cbueb等人[7]蒐集了23個年輕恆牙牙髓壞死(大多是小臼齒的牙中牙斷裂造成)的案例，使用MTA apical plug technique，但差別在於根管內並不使用任何器械(files)或藥物(如3-Mix antibiotic paste)，已rubbe,dum將牙齒隔離後只用2.5%NaOCl沖洗10-15分鐘，待根管止血後便放入氫氧化鈣，上面以Caviton暫時填補，待臨床症狀消失後便改放置MTA，以X光片追蹤待牙根持續生長後，MTA上的根管便以gutta-percha points充填，牙冠處再以樹脂或銀粉復形。追蹤6-30個月後這些牙齒均得到臨床上無症狀且X光片顯示無感染以及牙根持續生長的結果。

本篇病例報告是討論數個因牙中牙(dens invaginatus)造成牙髓感染的年輕恆牙上，使用上述改良過的MTA apical plug technique治療後，所達到的癒後與追蹤報告。

案例報告

CASE 1 患者基本資料

姓名	姓別	出生年月日	看診年齡	治療部位
彭○○	女	91/10/03		右上第二小臼齒

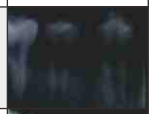
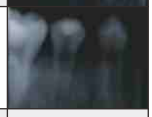
治療過程

日期 (date)	患者主訴 (chief complain)	診斷 (Impression)	治療過程 (treatment)	X光片
102/10/30	右上牙齒疼痛臉腫	Imp: cellulitis	Open chamber , NaOCl irrigation, Ca(OH)2 dressing + cotton + Caviton sealing	
102/11/28	無疼痛， 但牙齦有腫		NaOCl irrigation Ca(OH)2 dressing + cotton + Caviton sealing	
102/12/21	無症狀		NaOCl irrigation Ca(OH)2 dressing + cotton + Caviton sealing	
103/01/17	無症狀		NaOCl irrigation MTA + cotton + Cavtion	
103/01/24	無症狀		Remove cotton & Cavtion CRF	

CASE 2 患者基本資料

姓名	姓別	出生年月日	看診年齡	治療部位
林〇〇	男	91/09/15		右下第二小臼齒

治療過程

日期 (date)	患者主訴 (chief complain)	診斷 (Impression)	治療過程 (treatment)	X光片
102/07/24	右下牙齒疼痛臉腫	Imp: Periapical abscess	Open chamber , NaOCl irrigation →Ca(OH)2 + cotton + Caviton sealing	
102/09/06	無疼痛， 但牙齦有腫		NaOCl irrigation , Ca(OH)2 + cotton + Caviton	
102/10/23	無症狀		Ca(OH)2 dressing	
103/11/20	無症狀		MTA + cotton + Caviton	
103/11/29	無症狀		Remove cotton & Caviton CRF	

CASE 3 患者基本資料

姓名	姓別	出生年月日	看診年齡	治療部位
鄭OO	男	90/04/06		右下第二小臼齒及左下第二小臼齒

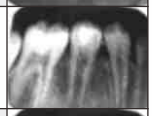
治療過程

日期 (date)	患者主訴 (chief complain)	診斷 (Impression)	治療過程 (treatment)	X光片
101/09/25	右下牙齒疼痛臉腫	Imp: pulpitis periapical abscess	Open chamber , NaOCl irrigation →Ca(OH)2 + cotton + Caviton dressing	
101/10/08	無疼痛，但牙齦有腫		Ca(OH)2 dressing	
101/11/30	無症狀		Ca(OH)2 dressing	
102/03/15	無症狀		MTA + cotton + Caviton	
102/04/02	無症狀		Remove cotton & Caviton CRF	
102/07/25	左下牙齒疼痛臉腫	Imp: pulpitis periapical abscess	Open chamber , irrigation →Ca(OH)2 dressing	
102/08/30	無疼痛，但牙齦有腫		Ca(OH)2 dressing , cotton + Caviton	
102/09/27	無症狀		Ca(OH)2 dressing	
102/10/25	無症狀		Ca(OH)2 dressing	
102/11/22	無症狀		MTA dressing + CRF	
102/11/29	無症狀		Remove cotton & Caviton CRF	

CASE 4 患者基本資料

姓名	姓別	出生年月日	看診年齡	治療部位
葉OO	男	89/05/15		右下第二小臼齒

治療過程

日期 (date)	患者主訴 (chief complain)	診斷 (Impression)	治療過程 (treatment)	X光片
98/07/03	右下牙齒疼痛臉腫	Imp: pulpitis periapical abscess	Open chamber , NaOCl irrigation →Ca(OH)2 + cotton + Caviton dressing	
98/08/12	無疼痛，但牙齦有腫		NaOCl irrigation →Ca(OH)2 + cotton + Caviton dressing	
98/09/25	無症狀		Ca(OH)2 dressing	
98/10/30	無症狀		Ca(OH)2 dressing	
99/01/06	無症狀		Open chamber , NaOCl irrigation →Ca(OH)2 + cotton + Caviton dressing	
99/02/27	無症狀		MTA dressing + CRF	

討論

在2008年，Erdem等人[8]提出了MTA apical plug technique，他們在四個因外傷導致年輕恆門牙牙髓壞死的案例上，使用橡皮帳隔離牙齒後，測量working length，再用Hedstroem files (Dentsply, UK)以及5% NaOCl沖洗去除牙髓後，在放置氫氧化鈣一到二星期後，使用5% NaOCl沖洗並去除氫氧化鈣後，使用MTA plug放置MTA進入根管內。他們認爲根管內只須暫時放置氫氧化鈣dressing以達到disinfection，之後便可以放置MTA以達到更好的封填效果，減少細菌的再次入侵。而改良過的MTA apical plug technique，則是更進一步連file也不使用只用NaOCl沖洗以保留更多的牙髓組織。

根據先前學者的研究[9]，牙根的發育需要兩種細胞：epithelial cells of Hertwig's root sheath以及odontoblasts，前者存在於未成熟牙根的根尖處，即使牙根尖已經受感染，他們仍不會被破壞。而epithelial cells of Hertwig's root sheath可以刺激mesenchymal stem cells分化爲odontoblasts並接著形成牙根的dentin。而mesenchymal stem cells主要來自未成熟恆牙殘餘牙髓，或是未成熟牙的apical papilla（又稱爲stem cells from the apical papilla [SACP]），也因爲這樣的特性，使用較保守的方式不以file破壞根尖的牙隨組織來治療未成熟恆牙可能是提高治療成功率的原因。

剛萌出的恆牙常因外傷、齲齒或是先天發育的異常（如牙中牙）造成牙髓感染，而牙根尚未完全閉合的恆牙，牙髓通常具有良好的血液供應而且富含stem cells，可以提供受傷的牙髓組織有較好的修復能力。所以治療牙髓受感染但牙根尖未關閉的年輕恆牙，一般建議採取較保守的方式以達到較好的apexogenesis。[10]

本篇病例討論中，病患求診年齡約在10-12歲，均因牙中牙牙齒斷裂造成牙髓壞死、牙根尖膿腫或是蜂窩性組織炎等臨床症狀來求診，此時該牙牙根均未完全發育(open apex)，經由保守的治療方式(改良過的MTA apical plug technique)，都達到令人滿意臨床及X光片結果。

結論

因牙中牙斷裂造成牙髓感染的年輕恆牙，使用較保守的治療方式，維持剩餘牙髓組織的活性，使牙根持續生長以及牙根尖持續關閉，並利用MTA行程較緻密的組織障蔽減少再次感染，提高該牙的使用年限並減少被拔除的命運。

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