壁報論文比賽作品欣賞

診所組 NO.1

以OSFE完成class D鼻竇增高暨植牙之案例發表

方洺諭醫師、黃立忠醫師

前言

Tatum 於 1986 年繼 Bonye & James 之後提出了侵犯性較少的 Osteotome Sinus floor elevationtechnique（OSFE）。 此法主要是藉由平頭或凹頭式 Ostoetome 敲擊鼻竇底層骨頭 ， 撐高鼻竇黏膜 ， 充填骨粉於內以增加骨質厚度。[1]（圖1）

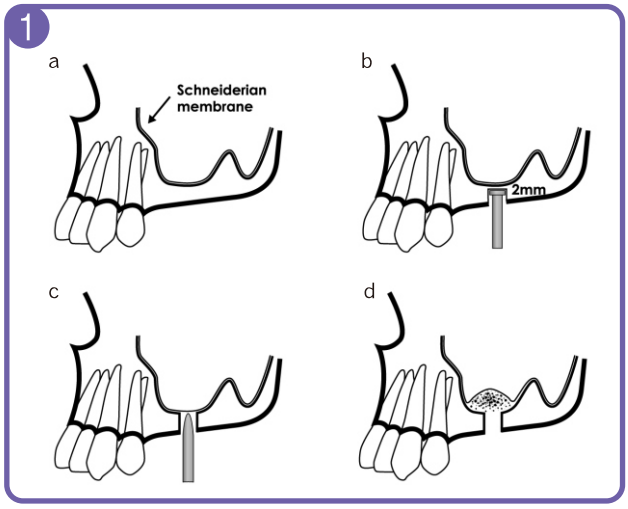

圖 1：Tatum於1986年提出之OSFE示意圖。
a.初始狀態。
b.以骨鑽（2mm圓鑽或先鋒鑽）鑿孔。
c.再以Osteotome破骨，逐漸稱大植牙槽。
d.再填充骨粉。

在 1996年一場鼻竇共識論壇中[2]，曾以待植牙區的骨質厚度為依據 ， 做為不同鼻竇增高術式選擇的參考標準，分別敘述於下：

（1）如果骨質厚度（ Residualboneheight：RBH ）為 classC（ RBH 厚度在 4~6mm）； 或 classD（RBH厚度在1~3mm）；建議以側窗式（LWSL）伴隨同時植牙，或待骨質成熟後再植牙為建議方式（圖2 a）。

（2）ClassB（RBH：7~9mm）：則以OSFE術式伴隨同時植牙為建議方案。

（3）ClassA（RBH：>=10mm）：則植牙無鼻竇增高之必要。

然而，因為現在植體設計的進步，對於以上的原則已漸漸不適用了 。 一來，因植體表面微米及奈米級設計已大大提升骨細胞對他們的親和性 ， 而植體螺紋設計也進展至具有self-tapping，甚至cutting的效果，按筆者與同仁的經驗， 發覺以上的原則常因施作手術醫者的喜好而不同。 如 ：有些醫者不論何種條件一律用側窗式鼻竇增高術

式（即使RBH有6mm之厚），而另一些醫者則偏好OSFE術式（即使RBH只有1-2mm之厚）（圖3a-d），而愈來愈多的醫者偏好使用粗短設計的植體，因此在一定條件下是無須應用鼻竇增高術式的。在此，筆者將為大家分享：RBH為class C 或D以OSFE成功完成植牙的案例。

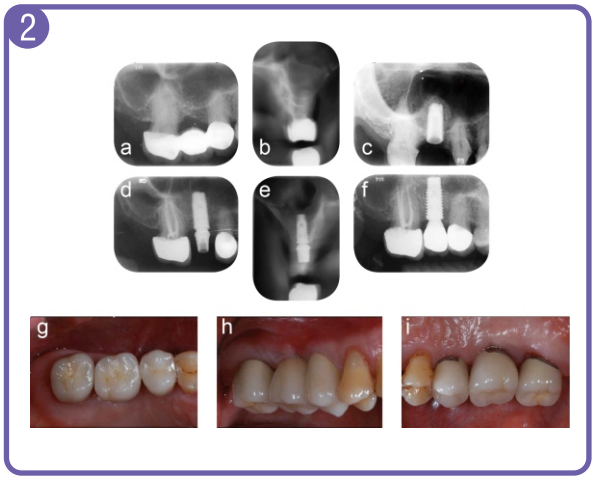

圖2：患者由於繼發性齲齒決定要更換牙橋，並於缺牙區植牙。
a,b.初始X光片顯示牙堉骨層約2~4mm的厚度，應屬於classC或D的RBH。
c.以OSFE並伴隨植牙後之X光片顯示植體在二維空間中被骨粉包埋之情形。
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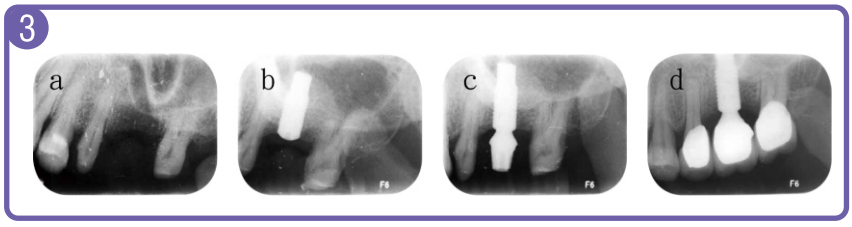

圖3：雖然此區之RBH屬於classD（≦3mm），由於植體系統的進步，術者仍施以OSFE並植牙完成治療的情形。
a.初始狀況：可觀察其RBH及骨層因氣室化而變短之情形。 b.手術後可見到骨粉包埋植體（此為megagen之EZ植體系統）的情形。 c.六個月後二階露出手術後之情形。 d.完成贋復後骨質良好之情形。

臨床方法以下的方法，敬請讀者不吝多加指正：先確認好欲植牙區Residual Bone Height（RBH）的高度，（圖2a、b）再於植牙部位之頰側及顎側施以局部麻醉，以正中牙床切開術切開植牙區，並翻開皮瓣（full thickness）。在大部分的情形下並不做垂直切開的減壓切線（vertical release incision），以減少對軟組織血液流灌的影響。

鼻竇增高術區的骨質暴露後，先以圓鑽（round bur）做定位車鑽，後再以lance drill先鋒鑽鑽下一定深度（RBH減去1mm的深度）後，插入Guide pins確認方位、角度。若不正確或不理想，則可再用先鋒鑽修正再確認；或繼續以鑽針擴大時修正方位或角度。若鑽入方位、角度正確時，則可以逐步用漸粗Osteotomes（本人是2.0mm、2.5mm、3.0mm的Osteotomes）擴大壓實骨質。此時植牙區位已初步完成，本人會以2.0mm Osteotome擊破鼻竇底層骨質，再以RBH加上2-3mm的長度逐步以2.5mm及3.0mm的Osteotomes將植牙區的底部撐高，後再多次反覆填塞所選的骨粉

藉以撐起鼻竇黏膜（Schneiderian membrane）以形成拱起狀（dome）的區域，後再續以3.5mm的Osteotome擴大、增深、壓實植牙區域外，並再多次充填適量骨粉以作為後面包埋植體周圍之用。待判斷足量骨粉已填入植牙槽及鼻竇黏膜之間後，則以4.0mm Osteotome，作為植入4.5mm植體的 final Osteotome 擴大增深植牙槽。若預備植入5.0mm的植體，則可用4.5mm的 Osteotome 作為nal Osteotome。當然，若屬於極其疏鬆的骨質，則可以分別以小一號或兩號的 Osteotome 作為final Osteotomes。最後，再放入植體將皮瓣縫合。筆者建議在放入骨粉或擴增之前，最好以Vasalva test測試，鼻竇黏膜是否破孔（Vasalva test乃是捏住患者鼻子，使患者自鼻部出氣，以檢視是否破孔。若破孔，則有氣體自植牙槽處噴出）。若無，則可順利放入骨粉及植入植體。若有，則作修補工作，此部份它章有詳細的敘述，在此不再贅述。

為了決定往後等待骨整合的時間，文獻上指出可測量植入植體的RFA（Rasonance frequency analysis）。若其初期穩定度（Implant stability quotient：ISQ）高，則可縮短等待時間；若低則可將等待時間延長一些。一般而言，6個月是最常建議的等待時間。另外，提醒讀者當逐步使用漸粗的Osteotomes時，敲入移出Osteotomes的壓力會漸增，要注意患者可以承受的程度，不可硬敲或硬拔。此時，應適時施以drilling的處置減壓，或以旋轉方式減少磨擦力拔出 Osteotomes，以繼續完成植牙的處置。有些人在破骨的階段之前，會以Trephine或Piezoelectric tip破骨，也是很好的方法，讀者亦可參考參考！

所有患者術後皆需要接受醫療人員指導術後照顧的注意事項，以避免併發症或副作用的發生，內容重點是不要造成口腔和鼻腔壓力差，且勿激烈運動。另外須開立處方：Amoxicillin 500mg tid 7-14天，再酌加 NSAID 的處方。至於拆線則可7-10日執行。

Complication

OSFE術後併發症主要有鼻竇黏膜破孔、感染、出血、鼻竇炎及良性陣發性姿勢性暈眩症（Benign paroxysmal positional vertigo：BPPV）等等。BPPV的症狀主要是頭部做角度改變的時候，患者會突發性的暈眩或噁心。有時會在幾天或數週內自行痊癒，但有時會持續不退。這個名稱是Dix & Hallpike於1952年創立的，並為此症立下了診斷的方法及療法。[3] 後來，Schuknecht（1993）提出BPPV的致病機轉：是因耳內橢圓囊斑的內耳石掉落後半規管的底部造成的[4]。通常在發病後 6 個月內，BPPV會自癒，但在這段時間中，其徵狀時好時壞。對患者的生活亦會造成很大的困擾。因此牙醫師必須要具備BPPV臨床徵狀的診斷能力，以便對有可能受此折磨的患者儘速轉診至耳鼻喉科醫師，以期早期診斷，早期治療，如此將可減少患者的痛苦，及醫糾發生的風險。

結論

OSFE術式比起側窗式鼻竇增高術 ，具有侵犯性小副作用低的好處，在臨床上，已廣被植牙醫師所使用。失敗率的降低可藉由適應症條件的篩選、執行次數的增加及特殊器械的使用來協助達成。 雖然，它可以讓上顎後牙區骨質骨量不理想的區域獲得理想植牙的結果，但仍須注意其併發症的發生。術前病史的詢問、術中患者狀況的掌握、術後的叮嚀及照顧尤須嚴格執行，才能讓此術式的優點充分發揮。

References

1. Tatum, H.J. (1986) Maxillary and sinus implants reconstructions. Dental Clinics of North America 30: 207–29
2. Jensen OT, Shulman LB, Block MS, Iacone UJ. Report of the sinus consensus conference of 1996. Int J Oral Maxillofac Implants 1998; 13 (Suppl): 11–32.
3. Dix MR, Hallpike CS. _e pathology, symptomatology and diagnosis of certain common disorders of the vestibular sys- tem. Ann Otol Rhinol Laryngol 1952: 61: 987–1016.
4. Schuknecht HF. Pathology of the Ear. 2nd ed. Philadelphia, PA: Lea & Febiger 1993: 248–253.

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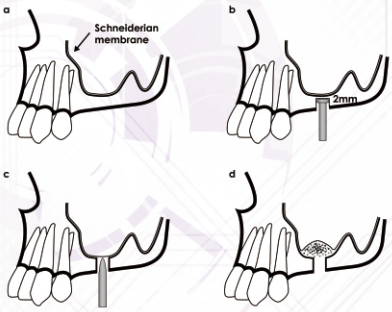

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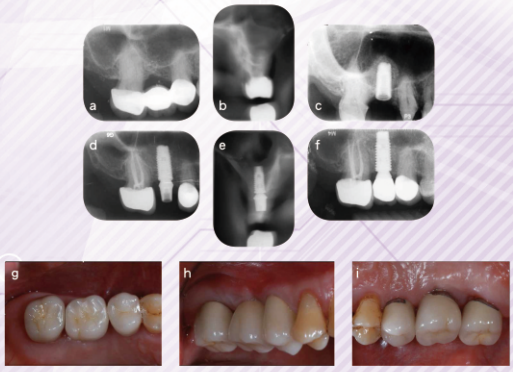

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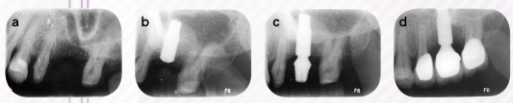
然而，因為現在植體設計的進步，對於以上的原則已漸漸不適用了。一來，因植體表面微米及奈米級設計已大大提升骨組胞對他們的親和性，而植體螺紋設計也進展至具有self-tapping，甚 至cutting的效果，按筆者與同仁的經驗，發覺以上的原則常因施作手術醫者的喜好而不同。如：有些醫者不論何種條件一律用側窗式鼻竇增高術式（即使RBH有6mm之厚），而另一些醫者則偏好OSFE術式（即使RBH只有1-2mm之厚）（圖3 a-d），而愈來愈多的 醫者偏好使用粗短設計的植體，因此在一定條件下是無須應用鼻竇增高術式的。在此，筆者將為大家分享：RBH為class C 或D以OSFE成功完成植牙的案例。



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所有患者術後皆需要接受醫療人員指導術後照顧的注意事項，以避免併發症或副作用的 發生，內容重點是不要造成口腔和鼻腔壓力差，且勿激烈運動。另外須開立處方：Amoxicillin 500mg tid 7～14天，再酌加NSAID的處方。至於拆線則可7～10日執行。

Complication

OSFE術後併發症主要有鼻竇黏膜破孔、感染、出血、鼻竇炎及良性陣發性姿勢性暈眩症（Benign paroxysmal positional vertigo：BPPV）等等 。BPPV的症狀主要是頭部做角度改變的時候，患者會突發性的暈眩或嘔心。有時會在幾天或數週內自行痊癒，但有時會持續不退。這個名稱是Dix & Hallpike於1952年創立的，並為此 症立下了診斷的方法及療法。[3]後來，Schuknecht（1993）提出BPPV的致病機轉：是因耳內橢圓 囊斑的內耳石掉落後半規管的底部造成的。[4]通常在發病後6個月內，BPPV會自癒，但在這段時間中，其徵狀時好時壞。對患者的生 活亦會造成很大的困擾。因此牙醫師必須要具備BPPV臨床徵狀的診斷能力，以便對有可能受 此折磨的患者儘速轉診至耳鼻喉科醫師，以期早期診斷，早期治療，如此將可減少患者的痛 苦，及醫糾發生的風險。

結論

OSFE術式比起側窗式鼻竇增高術，具有侵犯性小副作用低的好處，在臨床上，已廣被植 牙醫師所使用。失敗率的降低 可藉由適應症條件的篩選、執行次數的增加及特殊器械的使用 來協助達成。 雖然，它可以讓上顎後牙區骨質骨量不理想的區域獲得理想植牙的結果，但仍 須注意其併發症的發生。術前病史的詢問、術中患者狀況的掌握、術後的叮嚀及照顧尤須嚴 格執行，才能讓此術式的優點充分發揮。

References

1. Tatum, H.J. (1986) Maxillary and sinus implants reconstructions. Dental Clinics of North America 30: 207–29
2. Jensen OT, Shulman LB, Block MS, Iacono UJ. Report of the sinus consensus conference of 1996. Int J Oral Maxillofac Implants 1998; 13 (Suppl):11–32.
3. Dix MR, Hallpike CS. _e pathology, symptomatology and diagnosis of certain common disorders of the vestibular sys- tem. Ann Otol Rhinol Laryngol 1952; 61: 987–1016.
4. Schuknecht HF. Pathology of the Ear. 2nd ed. Philadelphia, PA: Lea & Febiger 1993: 248–253.

壁報論文比賽作品欣賞

診所組 NO.2

咬合功能及生長對豬齒槽骨的影響
The impact of growth and occlusal function on pig alveolar bone

葉光大,DDS,MDS,PhD
華盛頓美學牙醫診所

Introducton

Alveolar bone supports teeth during chewing through a ligamentous interface with tooth roots. Although tooth loads are presumed to direct the development and adaptation of these tissues, strain distribution in the alveolar bone at different stages of tooth eruption and periodontal developmental is unknown. Meanwhile, the supporting alveolar bone was expected to develop a dominant trabecular orientation (anisotropy) only after occlusal loading. This study investigates the biomechanical effects of tooth loading on developing alveolar bone as a tooth erupts into occlusion. Mandibular segments from miniature pigs, Sus scrofa, containing M1 either erupting or in functional occlusion, were loaded in compression. Simultaneous recordings were made from rosette strain gages affixed to the lingual alveolar bone and the M2 crypt. Overall, specimens with erupting M1s were more deformable than specimens with occluding M1s (mean stiffness of 246 vs. 944MPa, respectively, p=0.004). The major difference in alveolar strain between the two stages was in orientation. The vertically applied compressive loads were more directly reflected in the alveolar bone strains of erupting M1s, than those of occluding M1s, presumably because of the mediation of a more mature periodontal ligament (PDL) in the latter. The PDL interface between occluding teeth and alveolar bone is likely to stiffen the system, allowing transmission of occlusal loads. Alveolar strains may provide a stimulus for bone growth in the alveolar process and crest. Occlusal function did not lead to increased alveolar structural anisotropy. The impact of occlusal function on cancellous bone anisotropy may need a more extensive period of time to demonstrate.

Materials and Methods

In vitro alveolar strain was measured in left side mandibular segments of 7 miniature pigs with erupting first molars (M1) and 6 miniature pigs with functional M1s. Pigs with erupting M1s were 12weeks of age and pigs with functional M1s were 22weeks. Rosette strain gages were affixed posterior to M1 on the anterior wall of the M2 crypt and on the lingual cortex adjacent to the posterior M1 cusps. Stiffness was calculated as the slope of the linear region of the stressstraincurve between 200-440N. Applied stresses were estimated by dividing compressive loads by the M1 cross-sectional area. Overall specimen strains were calculated as the change in distance between compression platens divided by the pre-test distance. Histology of the M1 periodontium was performed on the erupting (N=3) and occluding M1s (N=3). Specimens were cut from mandibles postmortem and decalcified in 8% EDTA or solution. Decalcified tissues were paraffin embedded and sectioned sagittaly at 7μm. Sections including the entire length of the tooth root were stained with Hemotoxylin and Eosin (H&E) and TRAP, examined using light microscopy. Bone apposition speed was measured by bone marker apposition rate (MAR) after injecting calcein, alizarin red, tetracycline and demeclocyclin bone markers sequencially into the pig bodies. Specimens were scanned on a Scanco Medical μCT 20 at a 22 μm voxel resolution for structural analysis.

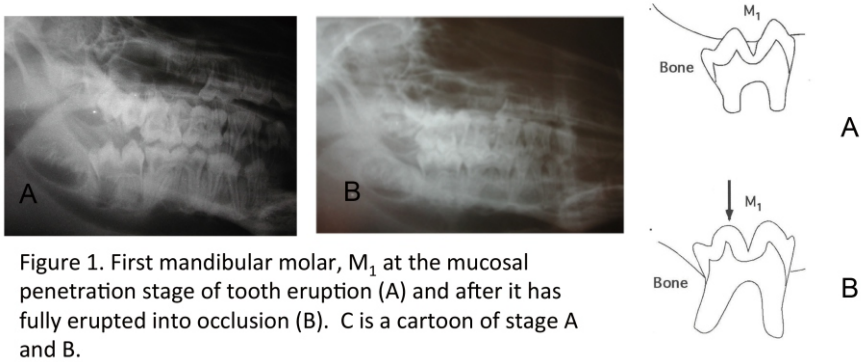

Figure 1. First mandibular molar, M_1 at the mucosal penetration stage of tooth eruption (A) and after it has fully erupted into occlusion (B). C is a cartoon of stage A and B.

Results

Bone Structure

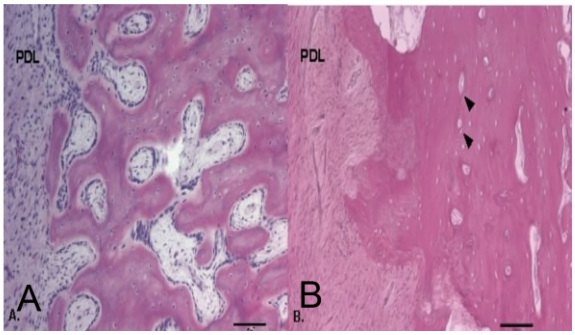

Figure 3. Reticular fibrolamellar bone from the midroot region of a 13 week erupting M_1 (A) and 23 week, occluding M_1 (B). The younger bone appears more porous with thinner woven bone trabeculae, whereas the older bone appears denser with filling in of primary osteons (arrows).

- In both groups, the bone distal to the M_1 showed mainly of reticular fibrolamellar structure.
- However the woven bone matrix appeared thicker in the older group than in the younger group.
- No secondary osteon (bone remodeling) was found in both groups.

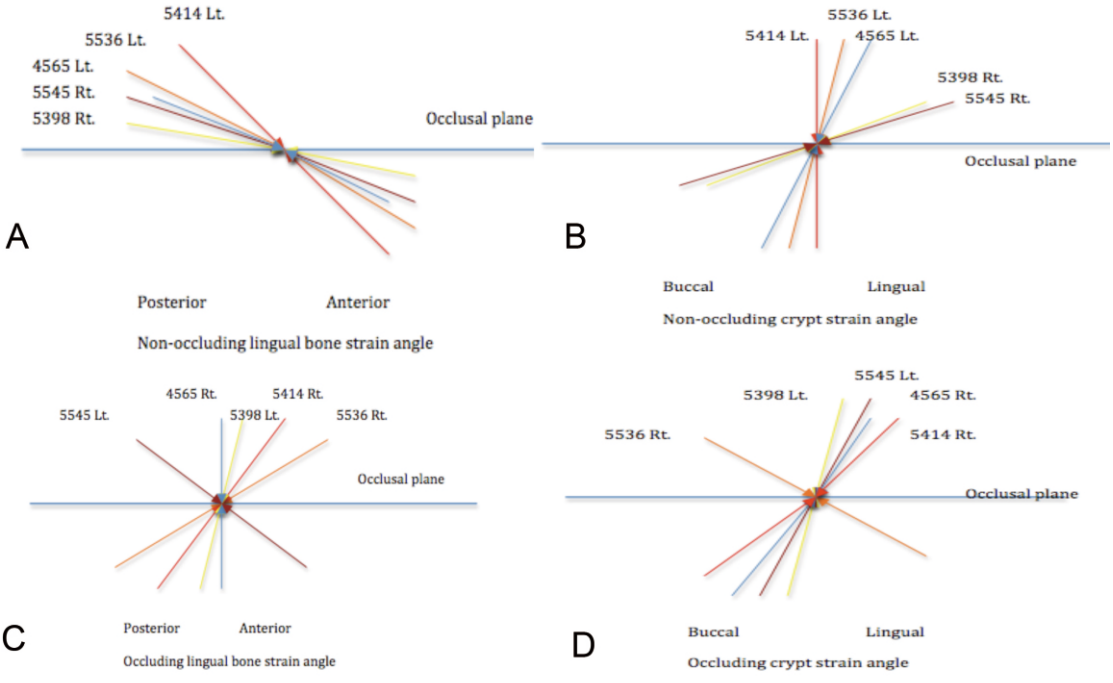

Figure 4. Orientations of minimum principal strain (Min), compression. Strain orientations for the lingual gage (A) and crypt gage (B) in specimens with erupting M_1s. Strain orientations for the lingual gage (C) and crypt gage (D) in specimens with occluding M_1s.

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A: Connectivity of cancellous bone.
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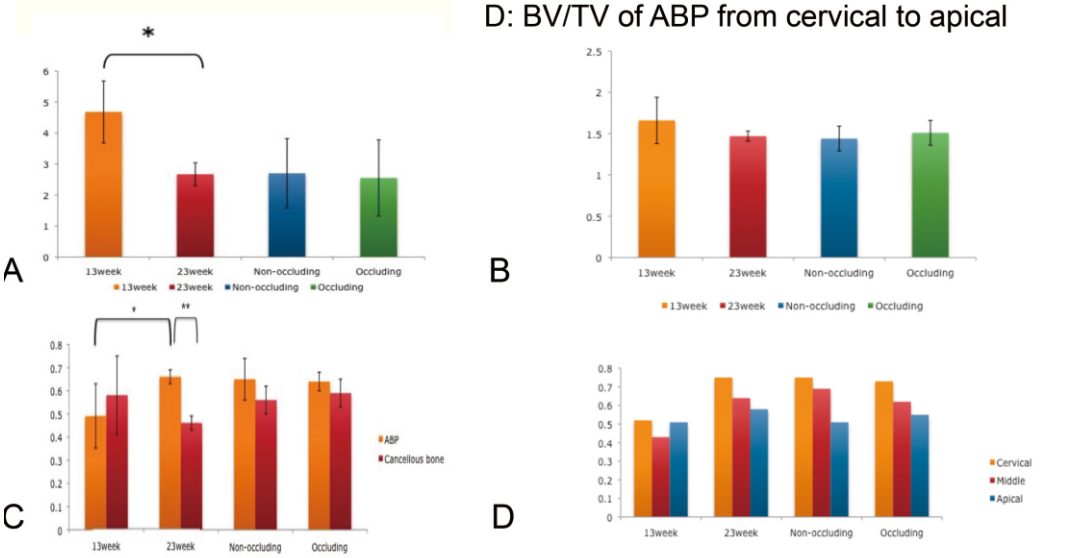

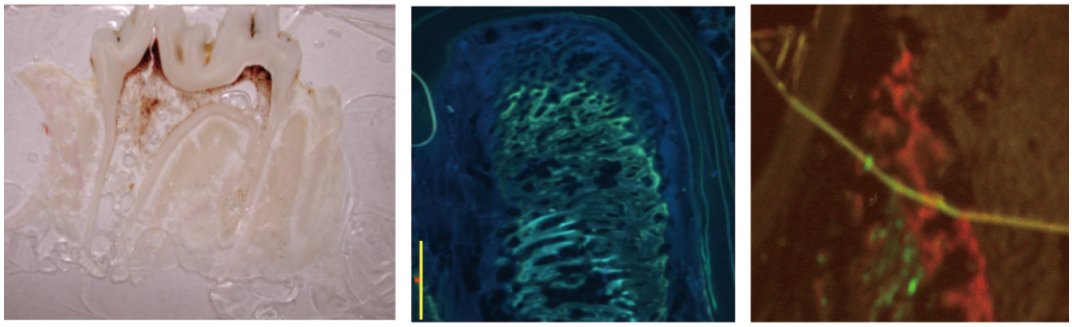

Figure 7. Bone mineral apposition rate (MAR) measurements.

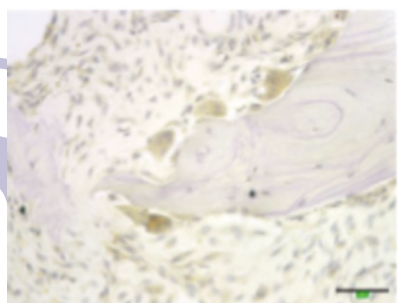

Figure 8. Osteoclast cells

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Conclusions

1. Growth and occlusal function led to higher stiffness an lower bone strain.
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References

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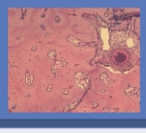
The impact of growth and occlusal function on pig alveolar bone

咬合功能及生長對豬齒槽骨的影響



葉光大, DDS, MDS, PhD
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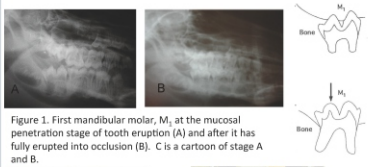

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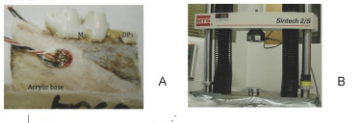
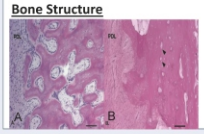


Figure 2. Bone samples were collected from the diastema and distal to the erupting and occluding M_1 (A). Rosette strain gages affixed. B: samples were loaded under MTS/ Sintech materials testing machine. C: Stiffness measurement.

Results

Bone Structure



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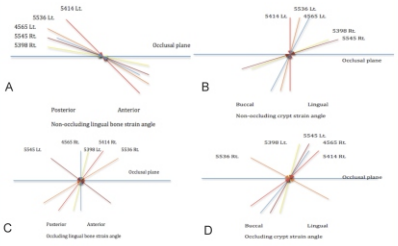

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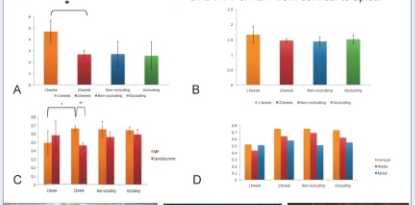

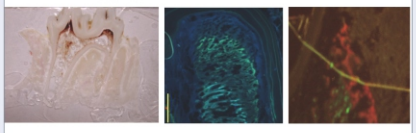

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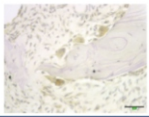

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診 所 組 NO.3

Treatment choices of Primary Anterior Teeth: A survey of Taiwan Dentists

Shu-Wei Wu ， Yen-Kuang Lin ， Cheng-Yu Hsieh ， Pzong-Ping Tsai ， Chia-Lan Hsiang
葡萄藤兒童牙科，Department of Pediatric Dentistry of Taipei Municipal Wan-Fang Hospital，Taipei Medical University ，Taiwan Academy of Pediatric Dentistry

吳淑薇

Background & Aim

Due to advances in dental material technology , there aremore treatmentoptions for restoration of primary anterior teeth . Thisstudy was designed to survey the differences between pediatricand general dentists regarding treatment choices of primary anterior teeth in Taiwan.

Design

The questionnaire was developed using SurveyMonkey, an online surveytool. Subjects were invited to participate in the study through face to face, e-mail or message involved website.
Participants were required to answer a total of 23questions, according to the type of restorations for treating primary anteriorteeth, factors thatinfluenced their choice of treatment, and treatment choices of primary anterior teeth through the presentation of clinical case. The statistical analysis was performed with SPSS software (Version19.0) .

Result

Of the 943 electronic surveys distributed, 296 (31%) were completed, of which 139 (47%) werepediatric dentists and 157 (53%) were general dentists. Althoughpediatric and generaldentists selected most common restorations in the same order of preference, thereare significantdifferences in the proportions between the two groups (圖6).
Parents were the main factor that influenced their choice of restoration. (圖8)

The dislodgement of primary anterior teeth restorations was the major concern for the majority of respondents (73%)(圖 9). When presented with cases of varying severity of caries, there are significant differences between pediatric and general dentists choices. (圖 7)

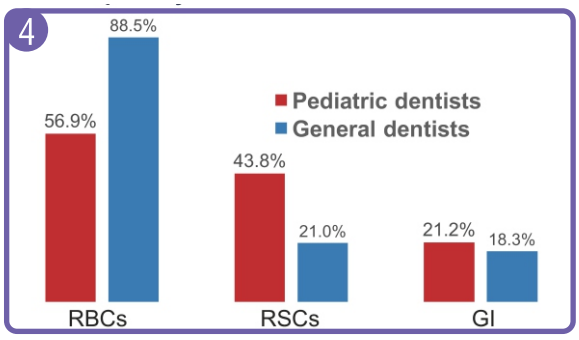

圖 4:Three of the most common choices forprimary anterior teeth restorations

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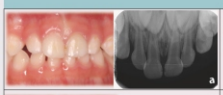
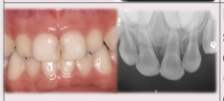
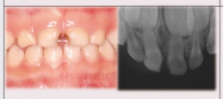
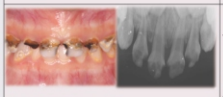
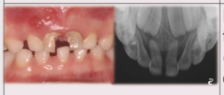
Varying severity of caries		General dentists	Pediatric dentists	AAPD guideline
	Inter-proximal caries	RBCs (49.0%)	RBCs (69.0%)	RBCs
	Multiple surfaces caries (NO Incisal edge involved)	RBCs (54.1%)	RSCs (59.6%)	Full coronal restoration
	Multiple surfaces caries (Incisal edge involved)	RBCs (46.5%)	RSCs (59.6%) Open faced SSC (25.9%)	Full coronal restoration
	Need pulp therapy (NO Gumboil or fistula)	No treatment (44.6%) RBCs (27.4%)	Open faced SSC (49.7%) RSCs (28.8%)	Full coronal restoration
	Need pulp therapy (Gumboil or fistula)	No treatment (39.5%) RBCs (27.4%)	Open faced SSC (46.8%) RSCs (21.4%)	Full coronal restoration

圖 5:Dentists' choice for primary anterior teeth restorations. (varying severity of caries)

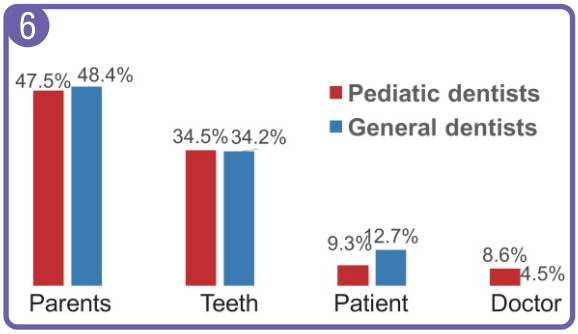


圖 6: The main factor that influence your choice of restoration.

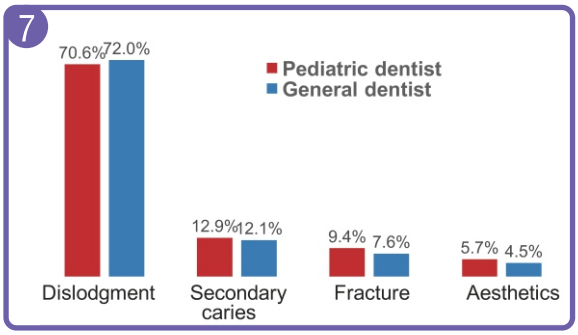


圖 7:Dentists' major concern for primary anterior teeth restorations.

Conclusion

There are significant differences between pediatric andgeneraldentists in treatment choice of primary anteriorteeth. Pediatricdentists treatment choices conform toThe American Academy ofPediatric Dentistry guideline.

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Background & Aim

Due to advances in dental material technology , there are more treatment options for restoration of primary anterior teeth . This study was designed to survey the differences between pediatric and general dentists regarding treatment choices of primary anterior teeth in Taiwan .

Design

The questionnaire was developed using SurveyMonkey, an online survey tool. Subjects were invited to participate in the study through face to face, e-mail or message involved website.
Participants were required to answer a total of 23 questions, according to the type of restorations for treating primary anterior teeth, factors that influenced their choice of treatment, and treatment choices of primary anterior teeth through the presentation of clinical case. The statistical analysis was performed with SPSS software (Version 19.0) .

Result

Of the 943 electronic surveys distributed, 296 (31%) were completed, of which 139 (47%) were pediatric dentists and 157 (53%) were general dentists. Although pediatric and general dentists selected most common restorations in the same order of preference, there are significant differences in the proportions between the two groups (Figure 1). Parents were the main factor that influenced their choice of restoration. (Figure 2)

Fig.1 Three of the most common choices for primary anterior teeth restorations

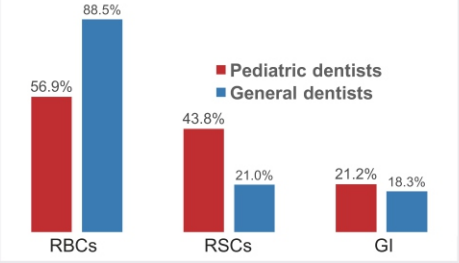
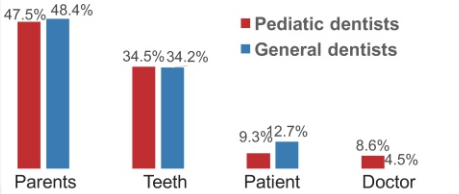


Fig. 2:The main factor that influence your choice of restoration



The dislodgement of primary anterior teeth restorations was the major concern for the majority of respondents (73%) (Figure 3) .When presented with cases of varying severity of caries, there are significant differences between pediatric and general dentists choices.(Table 1)

Fig .3: Dentists' major concern for primary anterior teeth restorations

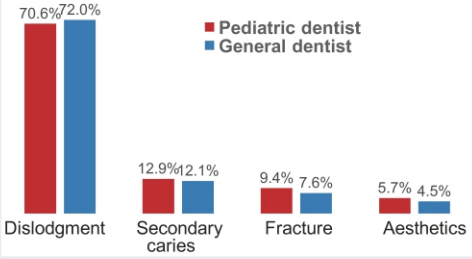
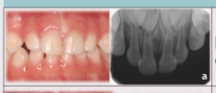
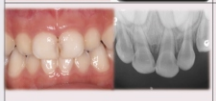
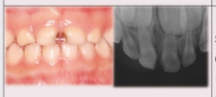
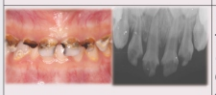
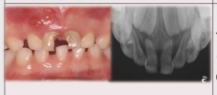


Table 1- Dentists' choice for primary anterior teeth restorations (varying severity of caries)

Varying severity of caries		General dentists	Pediatric dentists	AAPD guideline
	Inter-proximal caries	RBCs (49.0%)	RBCs (69.0%)	RBCs
	Multiple surfaces caries (NO Incisal edge involved)	RBCs (54.1%)	RSCs (59.6%)	Full coronal restoration
	Multiple surfaces caries (Incisal edge involved)	RBCs (46.5%)	RSCs (59.6%) Open faced SSC (25.9%)	Full coronal restoration
	Need pulp therapy (NO Gumboil or fistula)	No treatment (44.6%) RBCs (27.4%)	Open faced SSC (49.7%) RSCs (28.8%)	Full coronal restoration
	Need pulp therapy (Gumboil or fistula)	No treatment (39.5%) RBCs (27.4%)	Open faced SSC (46.8%) RSCs (21.4%)	Full coronal restoration

Conclusion

There are significant differences between pediatric and general dentists in treatment choice of primary anterior teeth. Pediatric dentists treatment choices conform to The American Academy of Pediatric Dentistry guideline.

壁報論文比賽作品欣賞

診所組 佳作

上顎門牙牙根斷裂患者之矯正治療病例報告

Orthodontic Treatment of upper center incisor root fracture ： Case Report

廖謹正、白天豪、林信吉
品安牙醫診所

前言

上顎前牙因外傷導致斷裂，在臨床是常見的狀況，而其處理原則也相當明確。但是，當牙齒因外傷、導致移位之後，矯正醫師如何去移動外傷過的牙齒，相關的文獻探討並不多。本次病例報告提出上顎根尖已封閉的門牙，發生牙根水平斷裂，經固定後，施以全口固定式矯正方式進行牙齒排列，經過兩年多的追蹤，牙齒仍保有活性的病例報告。

病例報告

上10歲8月女童因意外跌倒，多日後因疼痛才至門診就診。經檢查發現：

1.#11 severe buccal subluxation with mobility and percussion pain, EPT negative (R/O pulp necrosis)

2.#21 lingual block in with apical third fracture, without mobility , EPT positive(據家屬表示，#21位置並無改變)

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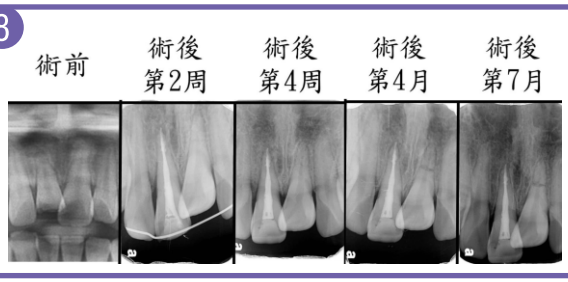

圖 8：門診治療
1. 當次門診進行#11復位及前牙區樹脂鋼線固定(020 SSW)
2. 陸續於後續門診完成#11根管治療
3. 一個月後移除固定鋼線
4. 每三個月定期回診，進行#21活行測試及X光檢查。

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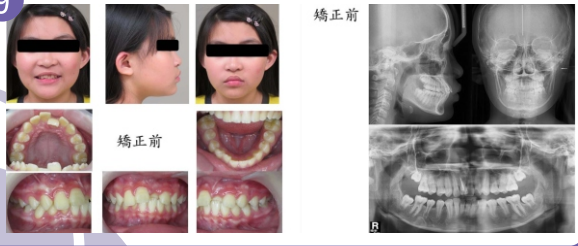

圖 9：外傷過後第八個月，父母親希望能以矯正方式改善門牙排列。經與家長討論，並告知 #11、#21的治療風險後，準備開始進行矯正。

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圖 10：矯正後說明圖
治療時間:2年4月
裝置：22 slot Damon system

討論

在術中第15個月以及矯正結束時進行電腦斷層拍攝，由斷層結果得知，#21雖有牙髓腔變小，但無牙根吸收的現象。矯正結束至今，追蹤時間為兩年4個月，#21 EPT測試仍有活性，且無發生牙根吸收狀況。

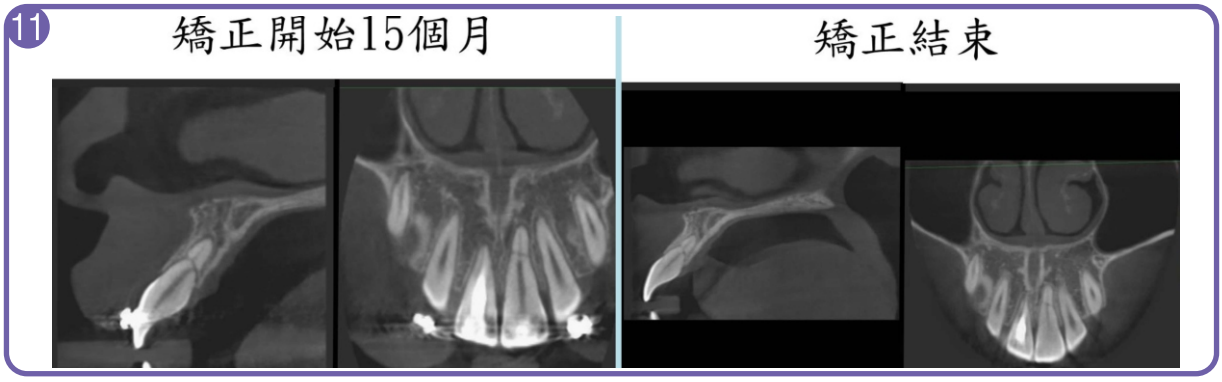

圖 11：矯正前後比照圖

牙根水平斷裂，好發在上顎前牙區，約10至20歲男性。多數發生在牙根已完全形成，斷裂部位頻率中段1/3最高，其次是根尖1/3以及牙冠1/3。而牙根水平的斷裂，有80%可以癒合。牙根斷裂面的修復，可以分為四種類型：硬組織修復、結締組織修復、硬組織與結締組織共同修復、以及肉芽組織修復。其中，以肉芽組織修復的預後最糟。

斷裂的牙根，仍然是有可能進行矯正移動的。Erdemir在2005年提出，當牙根斷裂可以產生硬組織修復，兩年後便可以進行矯正治療。而Healey也在2006提出類似案例。但也有學者提出矯正的風險。Malmgren 等學者在1982年針對曾經有過上顎門牙外傷的患者，在實施全口矯正治療後的研究，他們發現有51%的門牙會產生牙根吸收(吸收幅度由根尖2mm到超過牙根長度1/3)。因此，他們提出警訊，針對外傷的牙齒，在矯正前須注意有無牙根吸收的現象，如有，可能會導致嚴重吸收。而根據 Brinl 等學者，在1991年提出受過外傷的上顎門牙(牙根尖皆已封閉)，以活動裝置施以傾斜方式移動時，發現27.8%牙根發生吸收、7.3%牙髓活性測試無反應。因此，他們認為外傷結合矯正傾斜移動時，將會使牙齒更容易發生併發症，例如牙根吸收以及牙髓活性喪失。

此案例牙根已經封閉，斷裂面發生硬組織修復的可能性不高。外傷過後，經過八個月的追蹤，門牙皆相當穩定。在討論矯正治療計畫時，父母親希望藉由門牙後退的方式來改善唇形，但因無法確認#21修復狀態，最後只採用將牙齒排列整齊的方案。同時在治療計畫討論時，我們也將牙根吸收及拔牙的可能性與家長討論，確認同意後才施行矯正治療。

結論

藉由這個案例報告，我們相信，關於水平斷裂的牙根，藉由術前判斷有無牙根吸收，術中保持最小的矯正力量，矯正醫師仍然可以進行有限度的牙齒移動。當然，我們仍需要更多實證醫學的證明，來幫助我們提供更穩定的治療結果。