Case report: surgical endodontic therapy combined with regenerative technique for treatment of persistent apical lesion

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Introduction:

The development of inflammatory periapical pathosis comes from the infection of the root canal system (1)(2) where microbial invaders and/or their products invoke a complex, primarily protective, inflammatory response in the periradicular tissues (3).

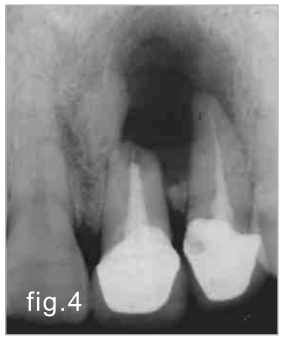
From radio-graphic findings ,without a histological report of a periapical lesion, the lesion could be a granuloma or cyst. The general consensus of endodontists is that pocket cysts and/or granuloma can heal after traditional endodontic therapy (9,10,11), the success rate ranges from 53 to 98% after treatment for the first time (4,5,6,7). For retreatment cases with periapical lesions the success rate is lower (8). However, only surgical intervention will result in healing of a true cyst . (12, 13, 14).

Apicoectomy comprehends a set of procedures recommended in persistent periapical diseases, where traditional endodontic therapy fails to obtain a favorable outcome. After the root end resection and the root end filling, the bony defect was optionally filled with regenerative materials, including bone graft material, nonresorbable and bioabsorbable membranes or the " Platelet Concentrate products " .(24)

Case report:

Mr. Leung, 34 years old, male, denied any foods and drugs allergy and any systemic disease. After being referred from the LCD, He visited the Dentistry clinic department of the Landseed Hospital complaining about pain in tooth #21#22, which presented a history of #21#22 endodontic treatment and crown restoration for 2 years.

After clinical and radiographic examination, an unsatisfying endodontic treatment was confirmed in the referred tooth. There was swelling on the buccal vestibule of tooth #21#22 (fig.1,2,3). There was a radiographic image showing a well-defined radiolucent image at the periapical region involving the tooth #21 #22 , combined with #21 external resorption (fig.4), A supernumerary teeth was shown between #11~#21 (fig.4) . The patient was submitted to computed tomography to confirm the size of the lesion, which was approximately 2x1.5x2 cm3 and a periapical cyst was suspected (fig.5) .The recommended treatment plan was to remove the crown of #21#22 followed by endodontic retreatment. However, the patient desired to save the teeth without damaging the crown, and he agreed to the apicoectomy procedure after explanation of the risks and the complications involved with the surgery.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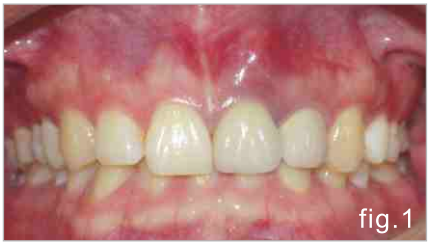
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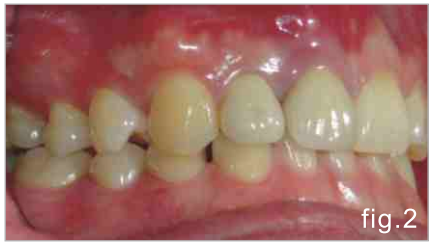
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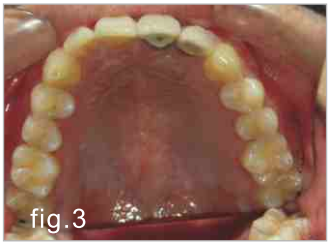
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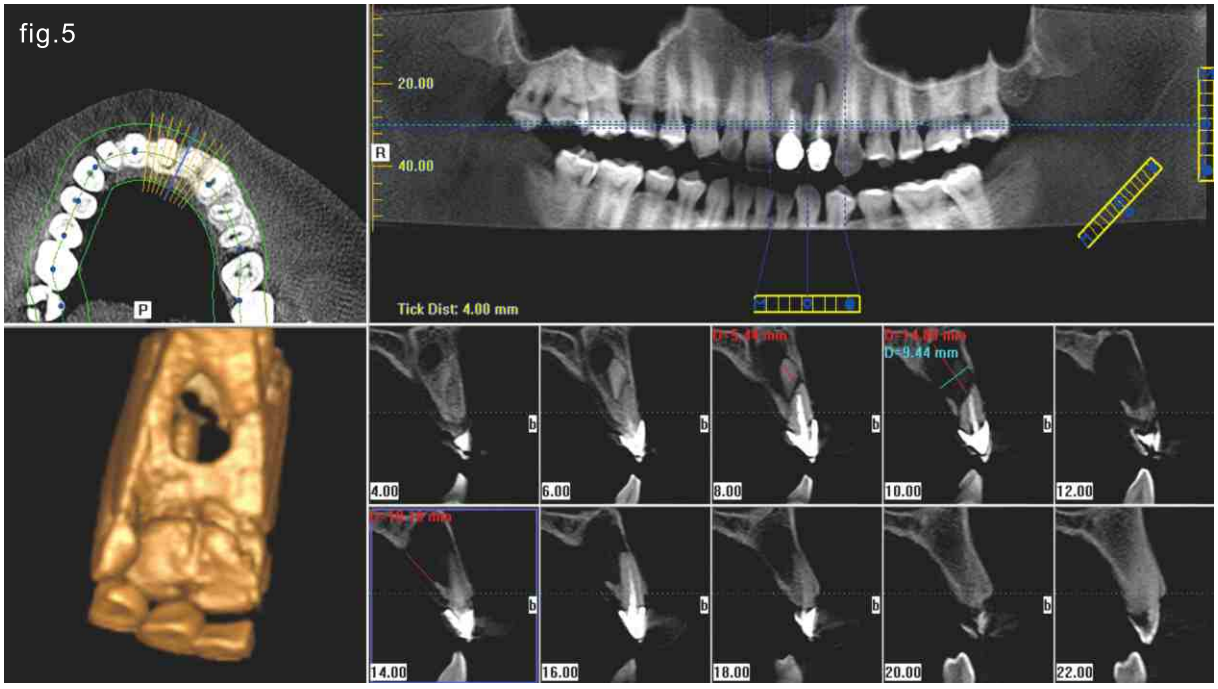


fig.5

學術專題

Treatment plan:

1.Apicoectomy of #21#22 with MTA retrograded filling

2.Cyst enucleation

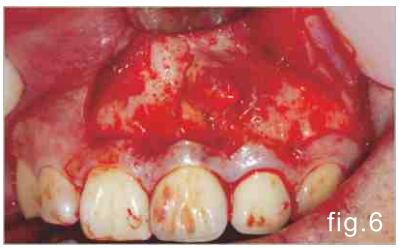
3.Extraction of the supernumerary teeth between #11 and #21

Surgical procedures:

Patient signed the informed consent issues that are specific to this surgery. Local anesthesia is performed with infiltration technique at both the buccal vestibule and the palatal site (#12~#23). Three anesthetic tubes were used. For esthetic reasons, the Ochsenbein–Luebke flap was chosen to avoid the recession following the surgery (16), starting from the distal surface of tooth #11 to the distal surface of tooth #23 with the scalpel blade size #15c. Reflected the flap with a gentle rocking motion and the periapical defect was exposed. In this case, the periapical lesion can be found through the bony defect on the buccal side (fig.6). Osteotomy with a surgical round bur was performed in order to widen the cavity and gain better access to the operation area (fig.7). After that carefully proceeded with the cyst enucleation and periradicular curretage, followed by the extraction of the supernumerary teeth. Carried out the Root end resection of #21 about 1mm in order to preserve the crown -root ratio, #22 was resected at 3mm from the apex. After the resection, root end preparation (3mm) was performed with the Ultrasonic micro-retrograded tip. The prepared area of #21#22 was later filled with mineral trioxide aggregate (MTA) cement . (fig.8,9,10)

The bone cavity was filled with the mixture of bone graft and the Choukroun's platelet-rich fibrin (PRF) (France, 2001), where the PRF was prepared before the surgery (fig.11). Separate the PRF into smaller pieces and mix it with the Sinbone graft in this time (fig.12). Since there was also a bony defect on the palatal site, while filling the bone graft material, a vacuum can be used to establish the proper contour of the palate during the material condensation. PRF was used as cover membranes on the both buccal and palatal side of the bony cavity (fig.13). Finally, the flap was repositioned, and the wound was sutured with 3-0 black silk (fig.15,16). Pathological report revealed that the lesion was a "Radicular cyst ".(fig.14)

At the one week recall visit, stitches were removed and the wound was irrigated with CHX solution (fig.17). At a one month recall visit, the patient did not report any symptoms and radiographic examination revealed decrease in the size of the bone cavity (fig.18,19). Three months follow up (fig.20). Two years follow up (fig.21). Four years follow up show that the hard tissue and the soft tissue were healed, the buccal and palatal plate were intact from the computed tomography image(fig.22,23,24).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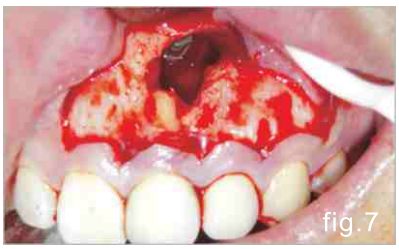
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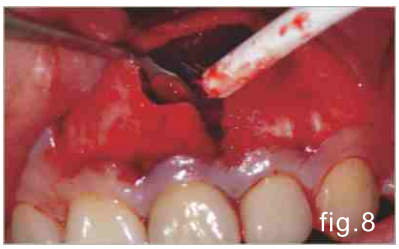
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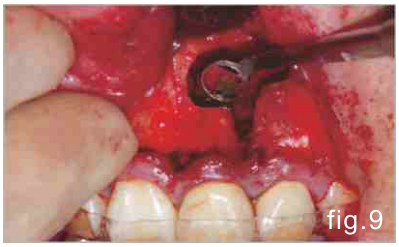
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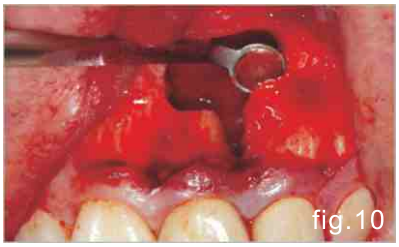
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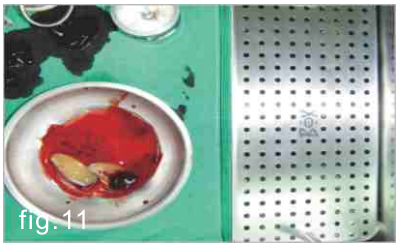
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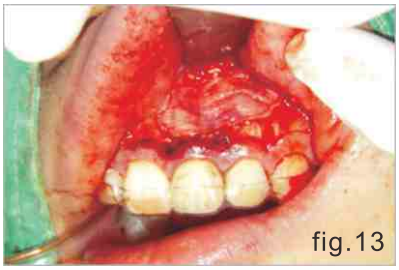
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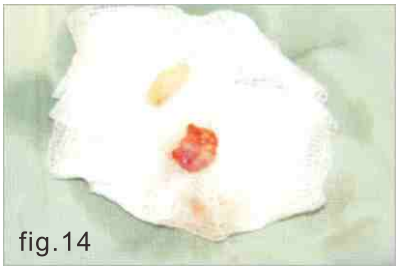
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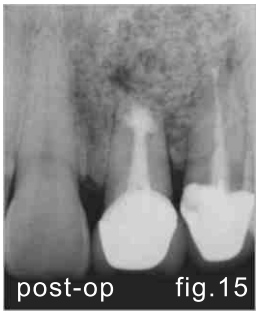
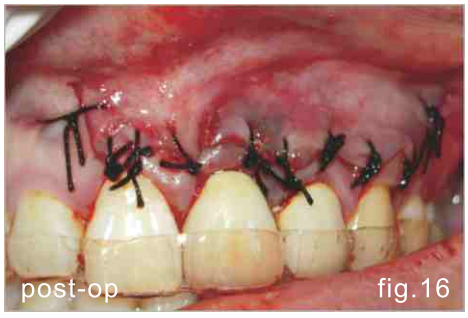
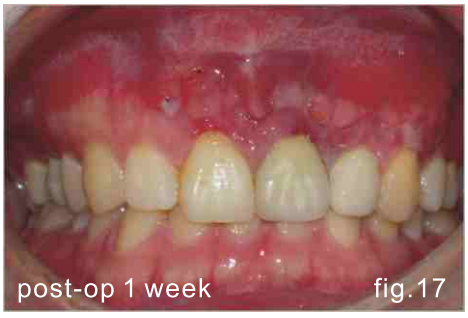
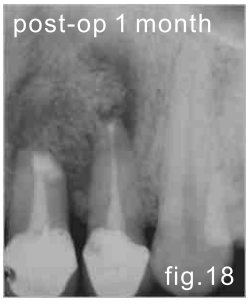
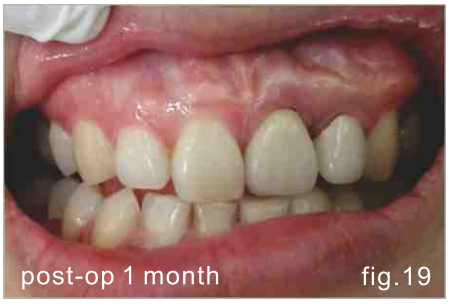
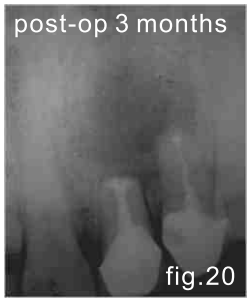

post-op fig.15

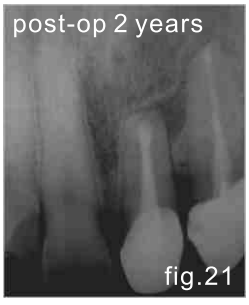

post-op fig.16

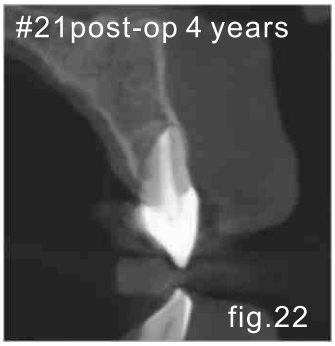

post-op 1 week fig.17

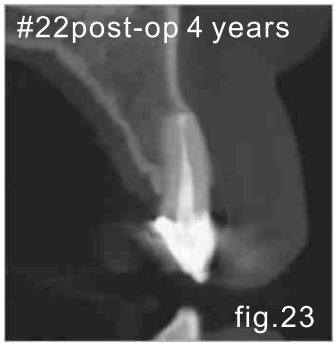

post-op 1 month fig.18

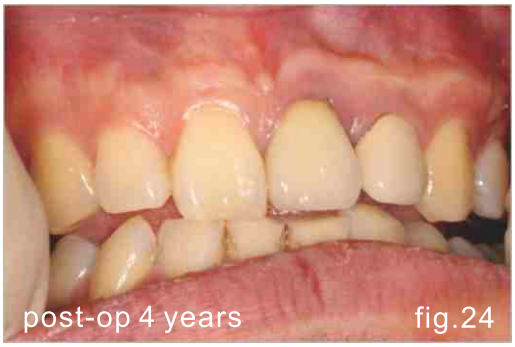

post-op 1 month fig.19


post-op 3 months fig.20


post-op 2 years fig.21


#21post-op 4 years fig.22


#22post-op 4 years fig.23


post-op 4 years fig.24

Discussion:

The purpose of periapical surgery is to remove the periradicular inflammatory tissue and ensure adequate sealing of the apical foramen. Thus reaching the goal of creating the best conditions for tissue health, regeneration and creation of new tooth structural support.

Five biologic factors contribute to persistent periapical radiolucency after root canal treatment(23):

1.Intraradicular infection persisting in the apical root canal system

2.Extraradicular infection

3.Extruded root canal filling or other materials

4.True cystic lesions

5.Scar tissue healing of the lesion

Periapical pathology, there was 12% abscess, 73% granuloma, 9% true cyst ,6% pocket cyst (21) . From the endodontic perspective, re-treatment should be performed before apical surgery, since there is evidence of greater healing rate (24) and increase 24% successful rate in cases(28). But processing of the external resorption may not be paused after a conventional root canal treatment, and the pocket cysts heal after endodontic therapy, but true periapical cysts may not heal after nonsurgical endodontic therapy that was indicated for the Apicoectomy (22).

3mm root end resection is normally performed to eliminate 93% lateral canal in that surgery (21), but apex sectioning of #21 would compromise this case , because of the lateral canal has already been resorbed by the external resorption, and 3mm resection will decrease force distribution and retention, as well as tooth stability within the alveolus.

If the source of the lesion comes from the infection of the root canal , Retrograde filling increases the success rate by 10~13% (14). MTA as a retrograde filling material is capable of hermetically sealing the apical portion of the root canal, and its biocompatibility can promote periapical tissue healing due to its low toxicity to those tissues(21)

A study conducted on tissue healing based on radiographic changes showed that there was a direct relationship between size of lesion and healing time.

"A lesion smaller than 1.5 cm with corticated margin, apical granuloma are suspected . A lesion larger than 1.5 cm with corticated margin, apical cyst are suspected "(31,32)

"A lesion smaller than 5 mm will approximately take 6.4 months to heal, a lesion of 6 to 10 mm will take 7.25 months and lesions larger than 10 mm will require in average 11 months to heal."(21). Using the regenerative technique, can shorten the healing time and that increase the stability of the tooth.

Fibroblast would come from the wound and the inner layer of the gingiva where the scar tissue formed. Even though blood clot in the bone cavity is a natural barrier to avoid the fibroblast migration, it seems that if both buccal and palatal/lingual cortical plates are lost as a result of apical periodontitis lesions or periapical surgery, periapical wounds will still most probably heal by scar tissue formation (25,26). Using a bone graft material offers a benefits of their properties, which are osteo-conduction and osteo-induction that stimulate osteoprogenitor cells to differentiate into osteoblast and also serves as a scaffold to osteoblast migration, eliminating the dead space, then begin the new bone formation, and provide better stabilities of tooth .

"Platelet Concentrate Technique "was developed in 1980s from Matras. The products contain high concentration of platelet signaling proteins which promote both tissue repair and wound closure. The Choukroun's platelet-rich fibrin (PRF) (France, 2001) is an autologous leukocyte- and platelet rich fibrin biomaterial that activate the platelet and fibrin polymerization, able to release of growth factors during ⩾ 7 days.(30) As a healing material, the use of PRF as cover membranes stimulate the gingival connective tissue on its whole surface with growth factors and has a key matrix proteins for cell migration(19), stimulate osteoblast activity and PDL cell growth and retard epithelial cell proliferation, neutralizing the infectious phenomena (27) . The fibrin matrix itself shows mechanical adhesive properties and biologic functions like fibrin glues: it maintains the flap in a high and stable position, enhances angiogenesis, and reduces necrosis and shrinkage of the flap (29)

Conclusion:

Apicoectomy technique is a surgical root approach used to preserve the tooth after the non-surgical approach has failed to produce favorable outcomes. The communication with the patient about treatment plan, risks and the complication involved is the most important part of the surgery.

It has not been clearly demonstrated that the these biomaterials are capable of inducing the undifferentiated mesenchymal cells to differentiate into oseoblasts, PDL cells and cementoblasts after periapical surgery. Regenerative material is an option for the surgeon, which may have an additional effect to aid in the apical defect healing.

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壁報論文比賽作品欣賞 醫院組 第一名

Osteoinductive Effects of Calcitriol on Mesenchymal Stem Cells Derived from Human Alveolar Periosteum

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Abstract:

The present study characterized alveolar periosteum–derived mesenchymal stem cells (P-MSCs) and examined the hypothesis that 1,25-(OH)2D3 (calcitriol) exerts osteoinductive effects on P-MSCs. The mRNA expression of alkaline phosphatase (ALP), bone sialoprotein (BSP), core-binding factor alpha-1 (CBFA1), collagen-1 (Col-1), osteocalcin (OCN), and vitamin D3 receptor (VDR) at various calcitriol concentrations were assessed through real-time polymerase chain reaction at 1 and 2 weeks of culture. Vitamin C functioned as a positive control (Vit. C-p). Cellular differentiation and ALP activity were analyzed, and $P < 0.05$ assessed using the Student t test was considered significant. Vit. C-p increased ALP and CBFA1 mRNA expression at both 1 and 2 weeks and increased BSP and Col-1 mRNA expression only at the first week. A concentration of 10−8 M calcitriol enhanced ALP, CBFA1, Col-1, and OCN mRNA expression at both weeks; however, it upregulated only the BSP mRNA expression at the first week. Furthermore, 10−7 M calcitriol significantly increased mRNA expressions of all compounds at both weeks, except that of CBFA1 at the first week.10−8 M calcitriol, and Vit. C-p significantly enhanced the ALP activity at the second and third weeks. At 10−8 M and 10−7 M, calcitriols did not significantly affect ALP activity. The results reveal that 10−9, 10−8, and 10−7 M calcitriol induced osteoinduction in alveolar P-MSCs by increasing the ALP, CBFA1, Col-1, and OCN mRNA expression. A calcitriol concentration of 10−7 M revealed a higher mRNA expression than did Vit. C-p on VDR and OCN mRNA expression at both weeks and on Col-1 mRNA at the second week alone. However, the osteoinductive mechanisms of calcitriol must be examined further.

Methods:

Tissue preparation:

Palatal or buccal periosteal tissues were harvested from patients during a routine periodontal surgery at the periodontics department.The periosteal tissues were harvested and stored in Dulbecco's phosphate buffered saline (DPBS; Gibco, Carlsbad, CA, USA) with 300 U/mL of penicillin and 300 mg/mL of streptomycin and transferred to a laboratory within 4 hours, where the tissues were manually minced using scalpels. The obtained fragments were placed on 35-mm culture plates (Coring) containing 1.5 mL of growth medium1 [α−modified Eagle's medium (HyClone), 10% fetal bovine serum (FBS, Invitrogen), 300 U/mL of penicillin, and 300 μg/mL of streptomycin] and were incubated at 37°C under 5% CO2.

Flow Cytometry

In this experiment, 1 × 106 cells were harvested through 0.25% trypsin digestion and were collected through centrifugation. Cell pellets were washed three times using 1× DPBS, following which 1× premineralization buffer was added. Thereafter, surface marker antibodies against CD19 (FITC, BD), CD34 (FITC, BD), CD44 (PE, BD), CD45 (FITC, BD), CD73 (PE, BD), CD90 (APC, BD), STRO-1 (Alex, BioLegend), and HLA-DR (FITC, BD) were added to the cells and incubated for 30 minutes at 4°C in the dark. The cells were washed two times using 1× DPBS, fixed using 2% formaldehyde, and analyzed using a FACSVerseTM flow cytometer (BD Biosciences) that measured 10,000–20,000 cells per sample.

Cell Attachment and Viability During Osteogenic, Adipogenic, and Chondrogenic Differentiation

P-MSC samples of five healthy participants were independently induced for differentiation into osteogenic, adipogenic, and chondrogenic lineages. Cells from passages 3–5 were cultured on 6-well plates having specific differentiation media containing differentiation-inducing reagents.

Effects of Calcitriol on Osteogenesis

Passages 3–5 of P-MSCs were categorized into 6 groups according to the culture media: control group [α-MEM (HyClone), 5% FBS (Invitrogen), 10 mM of β-glycerophosphate (Sigma), and 10^{-7} M dexamethasone (Sigma)], Vit. C-p group (control with 100 μM Vit. C-p), 10^{-10} M calcitriol (Nang Kuang Pharmaceutical Co., Ltd) group (control with 10^{-10} M calcitriol), 10^{-9} M calcitriol group (control with 10^{-9} M calcitriol), 10^{-8} M calcitriol group (control with 10^{-8} M calcitriol), and 10^{-7} M calcitriol group (control with 10^{-7} M calcitriol).

Reverse Transcription and Quantitative Real-Time Polymerase Chain Reaction

After 7 days of osteoblast differentiation, the Trizol reagent was used for isolating total RNA, 1.0 μg of which was reverse transcribed using avian myeloblastosis virus reverse transcriptase (Roche).

First-strand complementary DNA (cDNA) was synthesized, and quantitative polymerase chain reaction (qPCR) was performed using 5 ng/μL of cDNA. Quantitative real-time (qRT)-PCR was conducted using primers for ALP, BSP, CBFA1, Col-1, OCN, and VDR. To avoid DNA contamination by signals, forward and reverse sequences of each primer were designed on distinct exons; qPCR was performed using the SYBR Green PCR Master Mix and TaqMan Master Mix (Applied Biosystems) according to manufacturer instructions. Furthermore, the reactions were performed using the ViiA7 Real-Time PCR system (Applied Biosystems) with the TaqMan Master Mix at 50°C for 2 min, followed by 95°C for 10 min, and then 40 cycles each at 95°C for 15 s and 60°C for 60 s. The SYBR use was followed by PCR at 95°C for 10 min and then 40 cycles each

at 95°C for 15 s, 60°C for 60 s, and 60°C for 15 min. The Ct values for ALP, BSP, CBFA1, Col-1, VDR, and OCN messenger RNAs (mRNAs) were normalized to the value of the housekeeping gene GAPDH mRNA.

Effects of Vit. C-p and Varying Calcitriol Concentrations on Osteogenesis

To confirm the differentiation of human PDCs into a P-MSC-related osteoblast phenotype at the molecular level, we monitored the expression of human ALP, BSP, CBFA1, Col-1, OCN, and VDR mRNAs at the first and second weeks through qRT-PCR by using human-specific primers. Results are presented as the fold change relative to the control group results, which was set to a value of 1.

Results:

Cell Isolation, Morphology and Osteogenic, Chondrogenic, and Adipogenic Differentiation(Fig. 1)

Flow Cytometric Surface Marker Expression Analysis for PDCs(Fig 2)

Alkaline Phosphatase mRNA Expression at the First and Second Weeks

ALP mRNA, a known marker for detecting early osteogenic cell differentiation, acts as an ectoenzyme in the degradation of inorganic pyrophosphate for releasing phosphate for mineralization [24]. Compared with the negative control group, the fold changes of ALP mRNA expression of the first and second week cultures were 3.68 ± 2.24 and 5.12 ± 3.34 for the Vit. C-p group, 0.93 ± 0.14 and 0.95 ± 0.21 for the 10−10 M calcitriol group, 1.59 ± 0.41 and 1.93 ± 0.61 for the 10−9 M calcitriol group, 4.50 ± 1.69 and 4.82 ± 2.44 for the 10−8 M calcitriol group, and 1.49 ± 0.37 and 4.88 ± 1.61 for the 10−7 M calcitriol group, respectively (Fig. 3A). The 10−9, 10−8, and 10−7 M calcitriol and Vit. C-p groups revealed significantly different ALP mRNA expression at both weeks ($P < 0.05$; Fig. 3A). Data pooled and analyzed at 2 weeks revealed a similar developing pattern.

The 10−9, 10−8, 10−7 M calcitriol groups revealed significant changes in ALP mRNA expression fold changes compared with the 10−10 M calcitriol group at the end of both weeks ($P < 0.05$). The Vit. C-p and 10−7 and −8 M calcitriol groups revealed a similar ALP mRNA expression at both weeks; however, the 10−7 M and 10−8 M calcitriol groups revealed a significant variation at the first week (Fig. 3A).

Bone Sialoprotein mRNA Expression at the First and Second Week

The fold changes of BSP mRNA expression between the first and second weeks generally revealed a nonsignificant change for all tested groups. However, the fold changes of BSP mRNA expression mainly occurred at the first week, which were 2.34 ± 0.59, 1.52 ± 0.46, 1.91 ± 0.74, 2.48 ± 0.95, and 2.25 ± 1.00 for Vit. C-p and 10−10 M, 10−9 M, 10−8 M, and 10−7 M calcitriol groups . At the second week, only the 10−7 M calcitriol group revealed a significantly higher BSP

mRNA expression than did the control group ($P < 0.05$, Fig. 3B). Nonsignificant differences were observed between the Vit. C-p and calcitriol groups.

Core-Binding Factor Alpha-1 mRNA Expression at the First and Second Weeks

The fold changes of CBFA1 mRNA expression between the first and second weeks were nonsignificant for most tested groups, except the 10−7 M calcitriol subgroups ($P = 0.009$,). Vit. C-p and 10−8 M calcitriol significantly upregulated the CBFA1 mRNA expression in cells at both weeks compared with the expression in controls; contrastingly, 10−7 M calcitriol upregulated the CBFA1 mRNA expression only at the second week. Differences among the three subgroups were nonsignificant (Fig. 3C).

Collagen-1 mRNA Expression at the First and Second Weeks

The 10−10 and 10−9 M calcitriol groups revealed slight significance; therefore, combining their first and second week data was not feasible. Compared with the control groups, Vit. C-p and 10−9, 10−8, and 10−7 M calcitriol at the first week and 10−10, 10−9, 10−8, and 10−7 M calcitriol at the second week significantly increased the Col-1 mRNA expression (Fig. 3D).

Osteocalcin mRNA Expression at The first and Second Weeks

OCN mRNA expressions did not significantly differ between the first and second weeks for the Vit. C-p and 10−10, 10−8, and 10−7 M calcitriol groups ; Vit. C-p did not affect OCN mRNA expression at both weeks. However, the 10−8 and 10−7 M calcitriol groups revealed a 2-fold increase in the OCN mRNA expression at both weeks than did the control and Vit. C-p groups (Fig. 3E).

Vitamin D Receptor mRNA Expression at the First and Second Weeks

All tested groups presented nonsignificant VDR mRNA expression changes between the first and second weeks ($P > 0.05$). Only the 10−7 M calcitriol group revealed a significant VDR mRNA expression, which was 2.4 times higher than that of other groups, including the Vit. C-p group at both weeks (Fig. 3F).

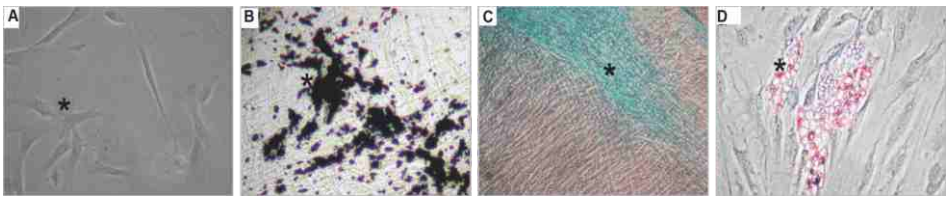

Figure 1: Differentiation study. Mesenchymal stem cells (MSCs) were spindle-shaped with irregular processes and firmly attached to the culture plate after 1–3 days of primary culture (Figure 1A, asterisk). Under in vitro culture conditions, MSCs were subpassaged and differentiated into osteoblasts (Figure 1B, asterisk, black, von Kossa staining), chondrocytes (Figure 1C, asterisk, blue, Alcian blue staining), and adipocytes (Figure 1D, asterisk, pink, Oil Red O staining).

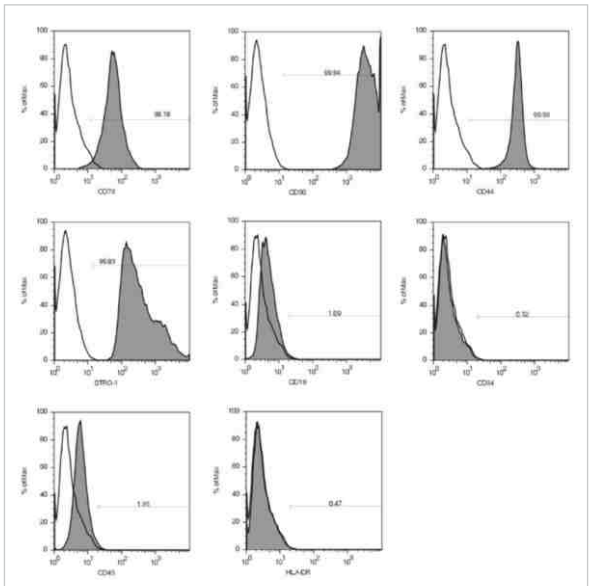

Figure 2 : Surface marker expression of MSCs through flow cytometry. The surface markers expressed by MSCs mainly included CD73 (98.18%), CD90 (99.94%), STRO-1 (99.83%), and CD44 (99.93) but not CD45 (1.35%), CD34 (0.52%), CD19 (1.09%), and HLA-DR (0.47%).

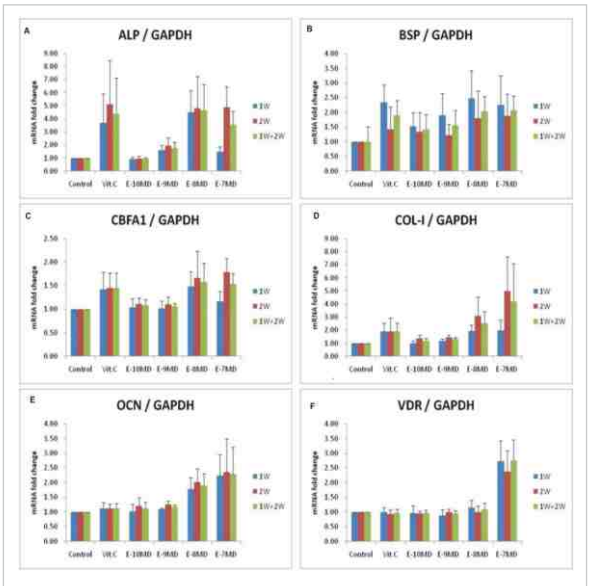

Figure 3 : mRNA expressions on osteoblast differentiation for 1, 2 and 1+2 weeks. (A)ALP expression (B) BSP (C) CBFA1 (D) COL-I (E) OCN (F)VDR.

Conclusions:

In summary, human P-MSCs can be induced to proliferate and differentiate into an osteogenic lineage. P-MSCs treated with Vit. C-p and 10−9, 10−8, and 10−7 M calcitriol promoted the osteogenic differentiation on ALP, BSP, CBFA1, and Col-1 mRNA expression as well as the ALP activity. By contrast, 10−8 and 10−7 M calcitriol significantly enhanced osteogenic OCN mRNA expression than did Vit. C-p. The 10−7 M calcitriol group revealed an upregulated VDR mRNA expression. Further investigation is required on the significance of osteoinductive mechanism between Vit. C-p and calcitriol.

壁報論文比賽作品欣賞 醫院組 第二名

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Relating Root Surface Area to Periodontal Attachment by Micro-Computed Tomography in Human Premolars

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Background:

Clinical attachment loss (CAL) and radiographic bone loss are the important parameters to indicate the severity of periodontitis and the results of related periodontal treatment. However, probing attachment level offers the reference of CAL in one-dimensional measurement without taking root shape and root length into account, and tends to underestimate the real periodontal attachment loss.

A new- generation micro-computed tomography (micro-CT) scan using micro-focal spot X-ray sources and high resolution detectors, allow for projections rotated through multiple viewing directions to produce three-dimensional reconstructed images of samples. The aims of this study was applying micro-CT to measure the root surface area (RSA) ratio of periodontal attachment from the levels of cemenoenamel junction (CEJ) to apex in millimeters 1 to 10 and evaluate the various RSA between two subsequent levels on extracted premolars.

Material and methods:

Extracted 34 maxillary and 36 mandibular intact human premolars were collected and surveyed by a micro-CT (Skyscan 1076, Bruker, Billerica, MA, USA). DataViewer, CTVol and CTVox software were used to analyze the structure of the sample. The RSA amount and percentage at 1 to 10mm periodontal attachment levels (PAL) from CEJ to apex the of maxillary and mandibular premolars were calculated and analyzed. On the other hand, 15%, 30% and 50% radiographic bone loss (RBL) were also related to the percentages of RSA and assessed.

The collected data were statistically analyzed after calibrating every individual tooth to avoid tooth size and root morphology bias. Significant differences between the samples were investigated by using the repeated measures analysis of variance (RMAV), independent t test, and paired t test.

Results:

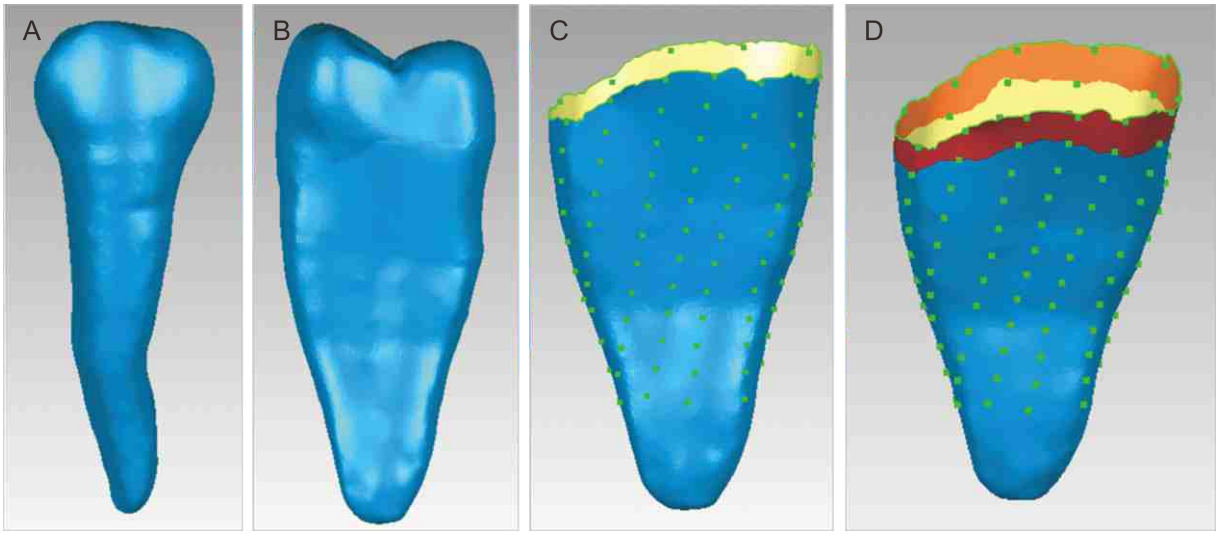

Figure 1 (A)-(D): The views and evaluated levels of PAL & RSA of mandibular premolar. A view of the buccal surface (A) and mesial surface (B) of the micro-CT scanned whole the premolar. (C) Mesial view of the measured 1–10 mm levels corono-apically. (D) Surveyed RSA at 1mm PAL.

Table 1. Lost RSA amount and percentages at the evaluated PALs corono-apically

RSA at various PALs	Maxillary premolars (n=31) Average ± SE	95% confidence 99% confidence	Mandibular premolars (n=36) Average ± SE	95% confidence 99% confidence	Maxilla vs. Mandible P < 0.05
RSA mm² at 100% PAL Root length	226.16 ± 33.37 mm²		202.24 ± 26.22 mm²		
Lost RSA mm² & % at 1st mm PAL	26.01 ± 2.71 mm² 11.6 ± 1.2%	11.16~12.06 11.01~12.22	23.45 ± 2.24 mm² 11.7 ± 1.34%	11.25~12.16 11.09~12.31	0.784
Lost RSA mm² & % at 2nd mm PAL	49.45± 5.34 mm² 22.59 ± 3.54%	21.21~22.96 20.90~23.27	43.74 ± 3.30 mm² 21.46 ± 2.23%	21.08~22.59 20.82~22.84	0.656
Lost RSA mm² & % at 3rd mm PAL	73.74 ± 7.34 mm² 32.68 ± 4.12%	31.73~34.17 31.31~34.59	63.00 ± 9.45 mm² 31.28 ± 3.19%	30.54~32.42 30.22~32.74	0.053
Lost RSA mm² & % at 4th mm PAL	95.67 ±8.95 mm² 42.45 ± 4.69%	41.21~44.32 40.67~44.86	82.05 ± 5.90 mm² 40.57 ± 4.02%	39.68~42.11 39.27~42.52	0.055
Lost RSA mm² & % at 5th mm PAL	116.39 ± 10.88 mm² 51.66 ± 5.25%	50.25~53.75 49.64~54.36	100.26 ± 9.05 mm² 49.44 ± 4.85%	48.53~51.22 48.07~51.68	0.051
Lost RSA mm² & % at 6th mm PAL	136.29 ± 12.56 mm² 60.31 ± 5.68%	58.96~62.76 58.31~63.42	117.00 ± 10.08 mm² 57.83 ± 5.57%	56.64~59.80 56.10~60.34	0.032
Lost RSA mm² & % at 7th mm PAL	154.31 ± 16.81 mm² 68.44 ± 5.96%	66.67~70.83 65.95~71.55	133.59 ± 11.59 mm² 66.09 ± 6.10%	64.68~68.26 64.07~68.87	0.093
Lost RSA mm² & % at 8th mm PAL	171.96 ± 18.75 mm² 75.96 ± 5.97%	74.43~78.73 73.69~79.47	149.29 ± 13.84 mm² 7.77 ± 6.7 %	72.28~76.19 71.61~76.85	0.104
Lost RSA mm² & % at 9th mm PAL	188.53 ± 21.51 mm² 82.82 ± 5.71%	81.73~86.09 80.96~86.84	163.62 ± 16.22 mm² 80.48 ± 6.74%	79.34~83.19 78.68~83.85	0.069
Lost RSA mm² & % at 10th mm PAL	201.16 ± 23.83 mm² 89.00 ± 4.93%	87.46~91.37 86.79~92.05	177.25 ± 20.28 mm² 86.66 ± 6.58%	85.99~89.81 85.33~90.47	0.265

Table 2. Lost RSA amount percentages and root length at the evaluated RBLs corono-apically

RBL %	Maxillary premolars (n=34) Average ± SD	vs. 15, 30, 50% RSA	Mandibular premolars (n=36) Average ± SE	vs. 15, 30, 50% RSA	Maxilla vs. Mandible P< 0.05
RSA mm² at 0% RBL RL	226.76 ± 33.04 mm² 12.56 ± 1.04 mm		202.41 ± 25.49 mm² 13.30 ± 1.56 mm		
Lost RSA amount, percentage & RL at 15% RBL	47.23 ± 6.52 mm² 20.98 ± 2.47% 1.88 ± 0.16 mm	<0.001 H1	43.92 ± 5.69 mm² 21.76 ± 1.85% 2.0 ± 0.23 mm	<0.001 H1	0.148
Lost RSA amount, percentage & RL at 30% RBL	89.09 ± 12.44 mm² 39.47 ± 3.59% 3.77 ± 0.31 mm	<0.001 H1	82.12 ± 10.40 mm² 40.65 ± 2.87% 3.99 ± 0.47 mm	<0.001 H1	0.141
Lost RSA amount, percentage % & RL at 50% RBL	139.65 ± 19.84 mm² 61.76 ± 4.49% 6.28 ± 0.52 mm	<0.001 H1	127.91 ± 15.89 mm² 63.28 ± 3.52% 6.65 ± 0.78 mm	<0.001 H1	0.127

Repeated measures analysis of variance (RMAV) revealed if the lost amount and percentages of RSA at surveyed PALs are in 95% and 99% confidence.

Independent t test for maxilla vs. mandible: *: $p < 0.05$, **: $p < 0.01$, ***: $p < 0.001$

PAL: Periodontal attachment level measured from CEJ to root apex

RSA: Root surface area with periodontal attachment determined by a 3-D image.

One-sample t test for the corresponding PBL at assessed RSAs: H0 ($p \geqslant 0.01$) or H1 ($p < 0.01$)

RBL: Radiographic bone loss measured from CEJ to apex

Discussions:

Generally, maxillary premolar lost about 10% RSA every mm at coronal 5 mm, 9% at 6th to 7th mm, 7.6– 8% at 8th to 9th mm and 7% at 10th mm levels. Mandibular premolar lost around 10% RSA every mm at coronal 4 mm, 9% at 5th to 7th mm and 8–6% at 8th to 10th mm levels. Longer and more taper mandibular premolar roots support the findings that mandibular premolars possess longer root length and less RSA. In addition, once alveolar bone level retrogress 1mm apically, premolars essentially lost 10% RSA bone attachment at coronal levels 4–5 mm. And, around 9% RSA from 6th to 7th mm of maxillary premolar roots and from levels 5th to 7th mm of mandibular premolar roots. 10–9% RSA discrepancies exist between radiographic bone level and clinical attachment level from 2nd–7th mm corono-apically was speculated.

Referring to the American Academy of Periodontology (AAP) guidelines for determining severity of periodontitis, the guidelines define mild periodontitis may present up to 15% of root length or ⩾2mm & ⩽3mm radiographic bone loss. However, the results of present RSA study demonstrate that 1.88–2 mm instead of ⩽3mm radiographic bone loss concurrent with the position at 15% of root length, and it is >18% RSA in place of 15% RSA that correspond to the level of 15% root length. Besides, when taking about 1mm connective tissues attachment into account (about 10% RSA), only about 1mm clinical attachment loss rather than 1–2 mm CAL in mild periodontitis. Diverse root length, size, morphology and taper might partially elucidate the inconsistence between this RSA study and AAP guidelines.

Conclusions:

Premolars could loss 10% RSA attachment corresponding to 1mm clinical attachment loss from mild to severe periodontitis. According to radiographic bone loss and clinical attachment loss without taking RSA into account might underestimate the periodontitis severity.

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壁報論文比賽作品欣賞 醫院組 第三名

Dentigerous Cyst Assoicated with Impacted Mesiodens include Pulp Necrosis of Adjacent Teeth: A case report

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Abstract

Dentigerous cysts are developmental odontogenic cysts derived from the reduced enamel epithelium of the tooth forming organ. Most of dentigerous cysts are combined with third molars of mandible and rarely associated with anterior maxillary supernumerary teeth. The supernumerary teeth located between maxillary central incisors are called mesiodens. This case report presents a dentigerous cyst arising from impacted mesiodens and the treatment procedure.

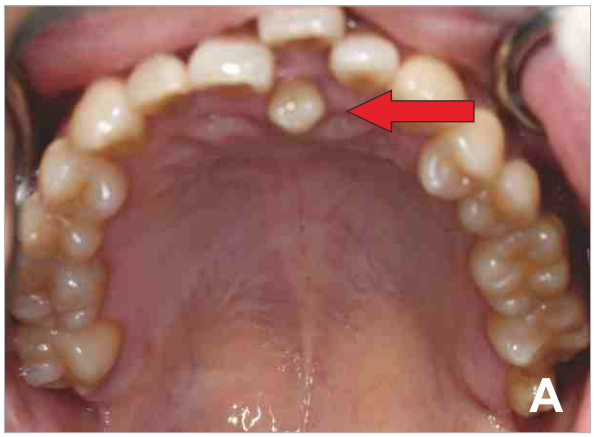
Introduction

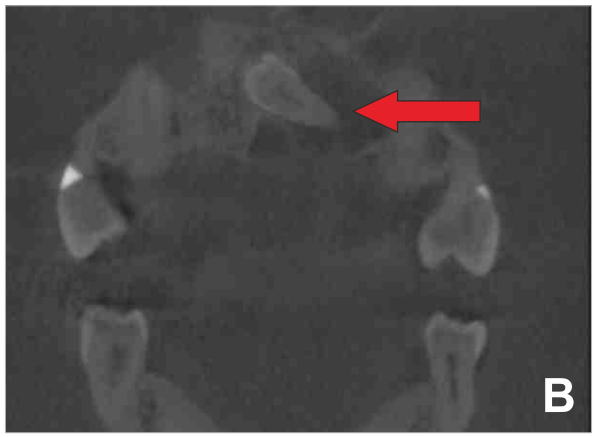
Mesiodens Mesiodens is the supernumerary tooth located between maxillary central incisors[1], usually a small tooth with a cone or peg shaped crown and a short root. Dentigerous cysts associated supernumerary teeth are rare and estimated to constitute 5-6% of all dentigerous cysts. The vast majority, about 90%, are associated with mesiodens[2]. Enucleation is the standard treatment for a dentigerous cyst along with extraction of the associated supernumerary teeth.

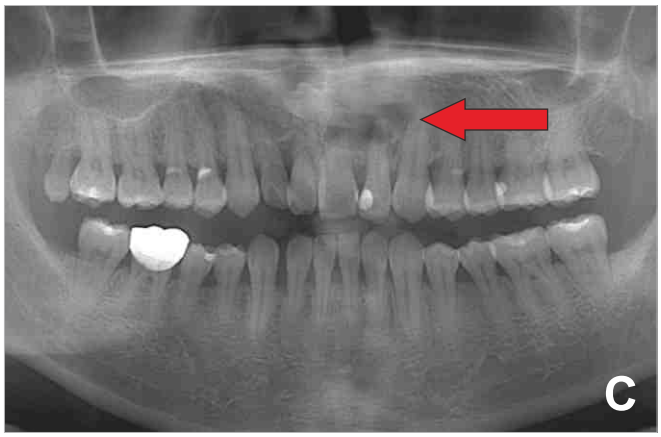
Clinical case

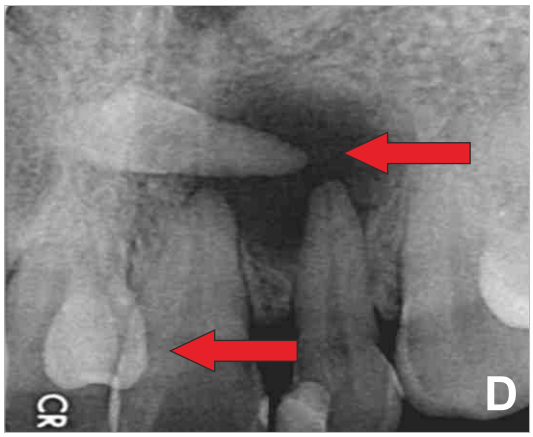
A 38-year-old male presented with a chief complaint of a painful swelling on left side of anterior palate. On intraoral examination, an erupted mesiodens with a conical morphology was noted on palatal side of right upper central incisor (Figure A). In addition, a soft, fluctuant painful swelling was palpable on left side of anterior palate. Percussion of upper left lateral incisor (22) was positive and its vitality test was negative. What is more, the radiological examination revealed two mesiodens, one was erupted and located on palatal side of right upper central incisor, and other was impacted. Computerized Tomography (CT) revealed an impacted horizontal mesiodens with a short root apical to the 21 and 22, combined with a well-defined radiolucent lesion in the anterior region of the maxilla (Figure B-D). A tentative diagnosis of an infected dentigerous cyst associated with an impacted mesiodens was made. The tooth of 22 affected by the lesion and include pulp necrosis was endodontically treated (Figure E), and then, refer the patient to oral-maxillofacial surgeon.

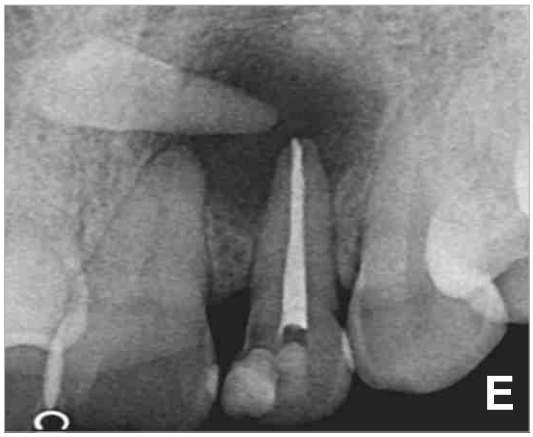
With the patient under general anesthesia, extract the mesidens on palatal side of upper right central incisor (Figure F). A cyst enucleation (with unerupted mesiodens) and the subsequent apicoectomy of upper left lateral incisor were carried out (Figure F-H). Regular post-operative follow-ups revealed a favourable clinical and radiological outcome.

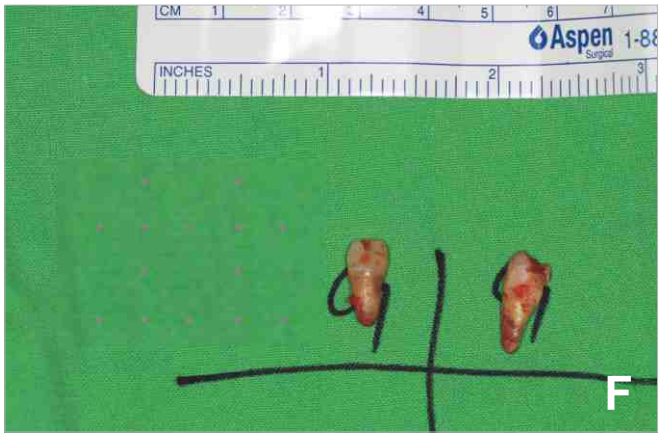


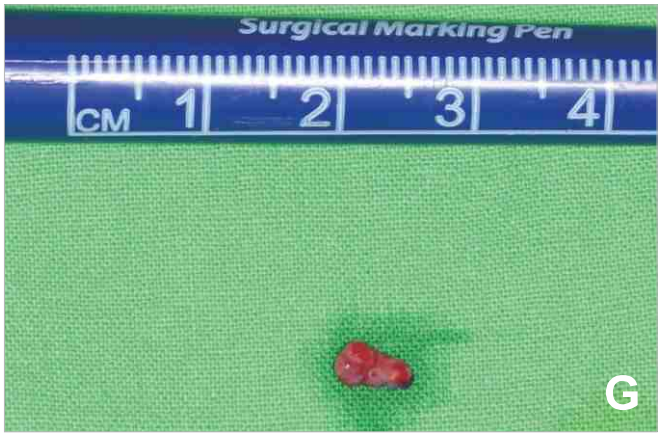


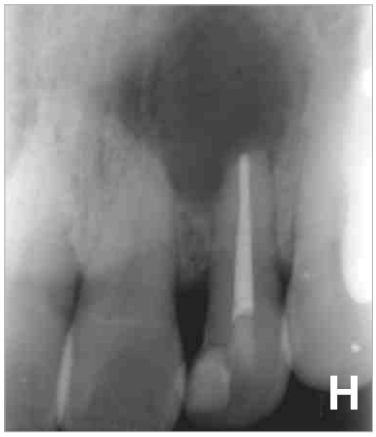












Discussion

Dentigerous cysts are the second most common odontogenic cysts of the jaws after periapical or radicular cysts, while a dentigerous cyst associated with a supernumerary tooth is a rare entity. A review of the literature since 1988 disclosed 16 reported cases of dentigerous cysts associated with premaxillay supernumerary teeth[3]. The panoramic and periapical radiographs reveal the location of the cyst and enable us to carry out a presumptive diagnosis. The maxillary CT, however, portrays the dimension of the lesion and allows us to assess the bone cortical affection as well as that of the neighbouring teeth. Enucleation is the standard treatment for a dentigerous cyst along with extraction of the associated supernumerary tooth. For a large cyst, Scolozzi et al recommended enucleation followed by an immediate bone grafting procedure[4].

The final diagnosis is made according to the histological analysis of the lesion. Accurate diagnosis and proper treatment planning could lead an ideal clinical and radiological outcome.

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顯微根尖手術臨床操作步驟（下）

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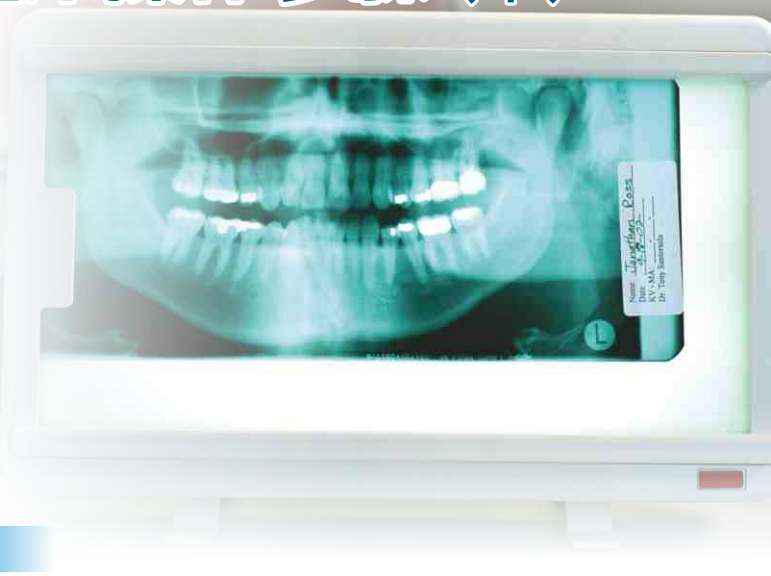


顯微根尖手術的手術步驟

(一) 麻醉與止血

良好的局部麻醉效果，既能減少患者痛苦，也可以減少術中出血，又能提高手術的效率。可選用amide類的lidocanine 內含1:50000腎上腺素的麻藥做局部浸潤麻醉Local infiltration anesthesia，在靠近根尖處進針，於黏膜下推注少量藥液，稍停頓後再繼續進針斜刺入骨膜下，緩慢推注麻醉藥物使其滲透並聚於根尖周圍。浸潤麻醉效果較差的區域，可行神經阻斷麻醉nerve block anesthesia。

(二) 瓣膜設計和切口Flap Design and Incision

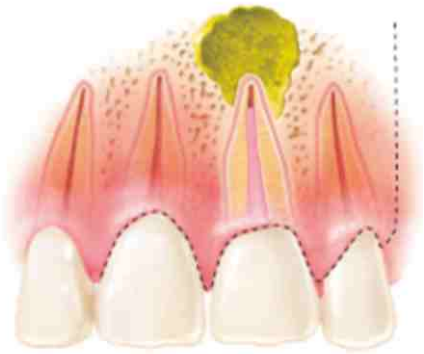
皮瓣的設計必須考慮各種解剖特徵，例如繫帶附著、角化牙齦的寬度、dental papilla的高度和寬度、齒槽骨隆起和牙冠邊緣等。有以下主要類型的翻瓣設計：

A.Full mucoperiosteal flaps

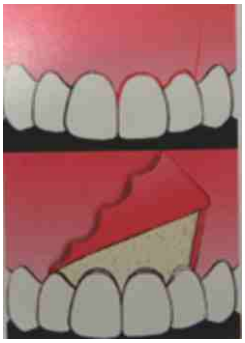
皮瓣的設計包括水平切口和垂直切口。水平切口從牙齦溝通過牙周韌帶到齒槽骨嵴，並通過頰舌側dental papilla的中間區域。以intrasulcular incision將牙齦組織連同dental papilla切開，從齒槽骨上分離。手術時，應盡量保護attached gingiva和free gingiva組織，沿著齒頸部緊貼根面進行切割。垂直切口從free gingiva margin開始，通常靠近dental gingiva的近中或遠中點，與牙齒長軸平行，一直切到mucogingival junction。最常見的intrasulcular full thickness flap是三角形瓣和矩形瓣。

(a)Triangular flaps三角形瓣：

由一個intrasulcular horizontal incision和一個vertical releasing incision組成的瓣稱三角形瓣。該瓣的優點是組織瓣的血供破壞較小，有利於傷口的復位縫合和組織癒合，缺點是單一的垂直切口限制了手術的視野。三角形瓣多用於後牙。



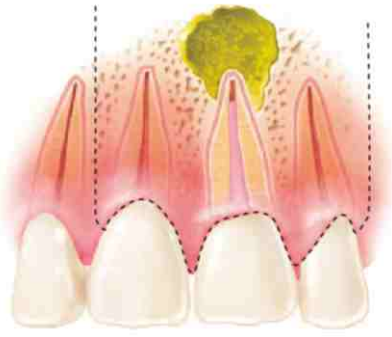
Intrasulcular incision with one vertical releasing



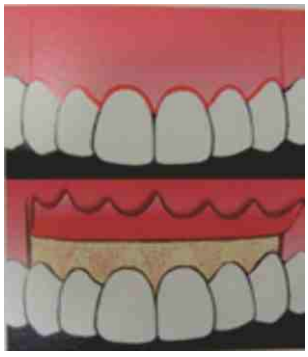
Triangular flap

(b)Rectangular (two vertical releasing incision)矩形瓣：

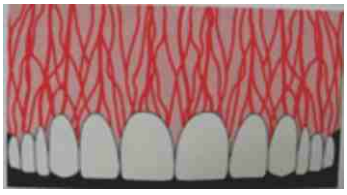
由一個intrasulcular horizontal incision和兩個vertical releasing incision組成的瓣稱為矩形瓣。該瓣最大的優點是手術視野較好，沒有疤痕，適用於上下頷前牙，多根牙和較長的牙根，如上頷犬齒。當設計矩形瓣時，瓣上下的寬度應一致。缺點是難縫合，因而不建議用於後牙。



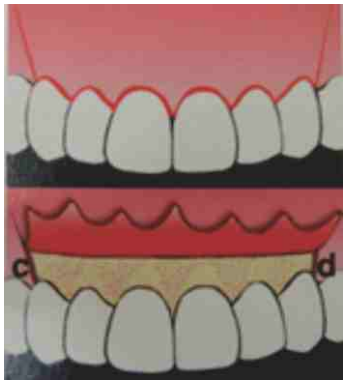
Intrasulcular incision with two vertical releasing incision incisions



Rectangular flap



牙齦微血管為垂直走向



c,d處的牙齦，因為微血管供應被切斷，可能造成牙齦壞死

(a)Rectangular (two vertical releasing incision)矩形瓣：

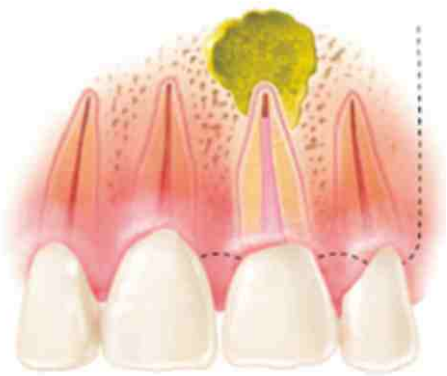
由一個intrasulcular horizontal incision和兩個vertical releasing incision組成的瓣稱為矩形瓣。該瓣最大的優點是手術視野較好，沒有疤痕，適用於上下頷前牙，多根牙和較長的牙根，如上頷犬齒。當設計矩形瓣時，瓣上下的寬度應一致。缺點是難縫合，因而不建議用於後牙。

(b)Horizontal (no vertical releasing incision) flap

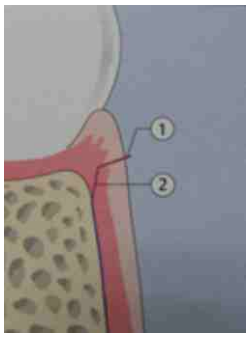
只有水平切口沒有垂直切口的翻瓣設計，又稱為envelopment flap，因為沒有垂直切線，難以達到根尖露出，根尖手術無法施行，目前少用這種設計。

(c)Papilla-base flap

為了防止papilla萎縮，造成美觀上的困擾，可以使用papilla-base flap的設計，水平切線在靠近papilla處，保留papilla，第一刀垂直牙齦表面，深入1.5mm，第二刀轉向齒槽骨嵴，直接切開骨膜，小心翻瓣，避免破壞齒槽骨嵴，縫合時小心復位，可以避免papilla萎縮，也可以減少疤痕組織的形成



Papillary-based incision with one vertical releasing

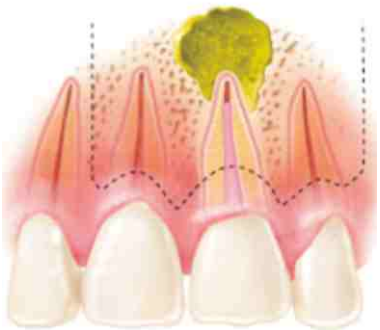


刀垂直牙齦表面，深度1.5mm，
第二刀轉向齒槽骨，直接切開骨膜

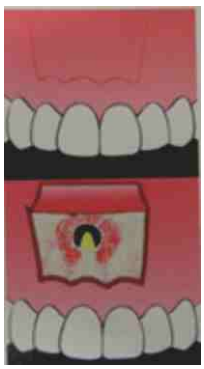
B.Limited mucoperiosteal flaps

(a) Submarginal scalloped rectangular扇形瓣

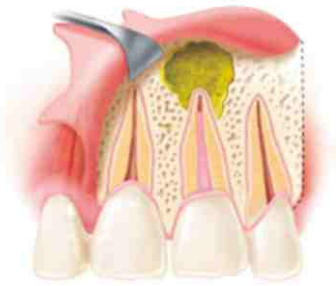
又稱Ochsenbein-Luebke flap，水平切口位於頰側attached gingiva，距free gingiva和gingiva sulcus bottom處3~5㎜，依照gingiva line的型態切成扇貝形scallop form。垂直切口位於兩牙根隆起之間的凹陷區內，起始於水平切口的兩端，切至角化牙齦上。優點是不破壞free gingiva和attached gingiva，不會造成牙齦萎縮，固定假牙邊緣不會外露，不影響固定假牙的美觀性。但缺點是會切斷垂直走向的微血管和膠原纖維，造成術中出血較多，可能皮瓣收縮，皮瓣不易復位，容易形成疤痕組織。對於attached gingiva較短、牙根較短或根尖周圍病變較大的患牙，禁用該瓣設計。



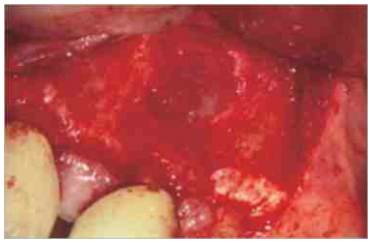
Submarginal (Ochsenbein-Luebke) flap



Submarginal (Ochsenbein-Luebke) flap



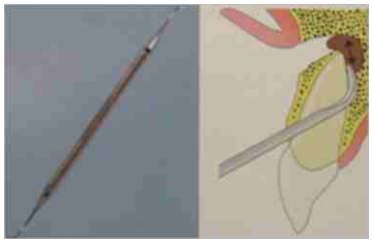
Reflection of the triangular flap to expose the root-end area



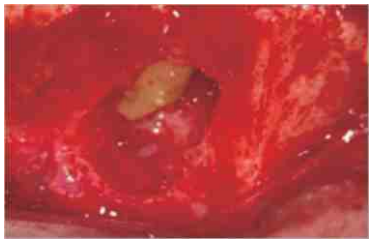
翻瓣後，露出根尖病灶

(五) 刮除根尖周病變組織 Periradicular curettage

根尖區病變組織暴露後，需用currete去除根尖區域的所有病變組織、異物、牙根殘片。刮除病變組織前，要在根尖區域再次注射含有血管收縮劑的局麻藥物，以減少術中出血和減輕患者痛苦。根尖顎側與齒槽骨壁之間的發炎軟組織可以用Jacquette #34 / 35 curette刮除，當發炎組織或囊腫小心從骨腔剝離後，立即置入10%的福馬林(甲醛)溶液中，送病理科做化驗。刮除病變組織時，有時可能傷及重要的神經、血管、上頷竇或鼻底等解剖結構，因此須特別小心。



Jacqutte #34 / 35 curette



將根尖發炎組織取出

根尖發炎組織送病理切片

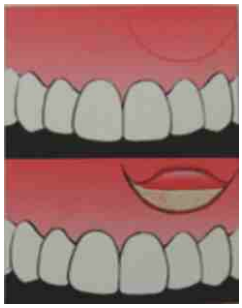
(六) 根尖切除Root resection(Apicectomy)

刮除根尖周圍病變組織後，此時牙根尖就明顯的暴露在齒槽骨腔中，在顯微鏡下仔細檢查根面和牙根走向，找出引起根尖周圍病變的可能因素，如missing canal、over-filling、broken instrument、root fracture，研究指出主要未清潔乾淨的根管解剖位置是位於根尖3mm，因此建議以手術方式切除根尖3mm，如此可以去除約90%的remification和lateral canal，並且使切斷平面上有最少量的dentinal tubule的開口，根尖微滲漏較小，減少細菌由根管再侵入根尖周圍的機會，提高治療成功率，另個原因是切除3mm後的切面，才有足夠強度的管壁厚度可以承受超音波機頭的震盪力量，減少超音波機頭造成根尖裂痕而導致失敗的可能性。早期傳統所使用micro-handpiece與鑽針的根尖手術，通常將根尖斷面制備成與牙體長軸成45O 的斜面，有可能導致根尖微滲漏和根尖舌側的側支根管遺漏，已不再適用於根尖手術。

在顯微鏡高放大倍率下(×16~×25)檢查，可使用methylene blue甲基藍染色根尖切面，可以確定牙周韌帶的位置與型狀，牙根橫切面外緣是否完整，用以判斷根尖切除是否理想。使用SybronEndo micro explorer CX-1檢查牙根表面有無裂痕，牙根橫切面有無未經治療的根管開口或是isthmuses。

(b) Submarginal curved (semilunar)半月形瓣

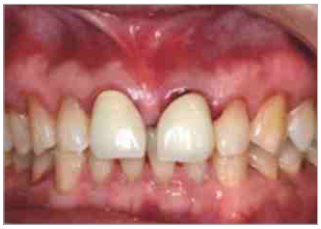
半月形瓣由單一的弧形切口構成，切口從unattached gingiva (mucosa) 開始，彎向冠方的attached gingiva，再回到unattached gingiva呈半月形。齦瓣的邊緣應延長至attached gingiva，不可距free gingiva margin太近。這種瓣的缺點是微血管血流通路不佳、易留下斑痕，臨床上已較少使用。



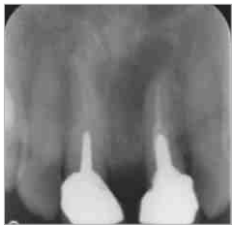
Semilunar flap

(三)翻瓣Flap reflection

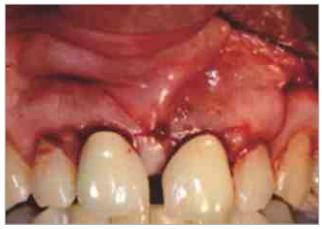
使用perio elavator骨膜分離器翻開flap時，為了不損傷上皮和牙齦血管，要先由vertical incision垂直切口處開始翻瓣，由根尖部向前向上coronal side翻開，應盡可能避免對瓣的擠壓或撕裂，保持瓣膜完整。如果直接由papilla翻開，常常造成齒槽骨受損導致牙齦萎縮。



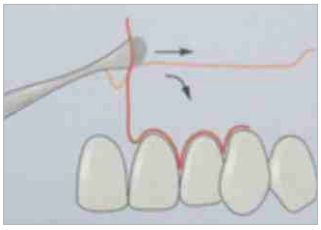
術前口內照



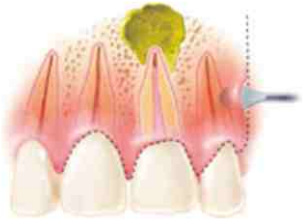
術前X光片檢查
#21根尖發炎



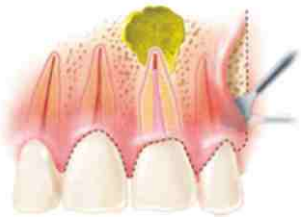
Papilla-base Triangular flap



The soft-tissue flap is mobilized from the vertical releasing incision



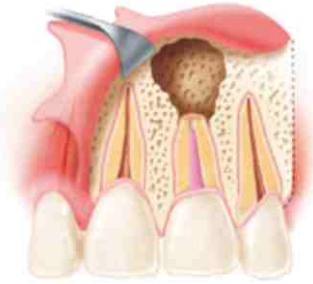
Elevator placed in the vertical incision for the first step in undermining flap reflection



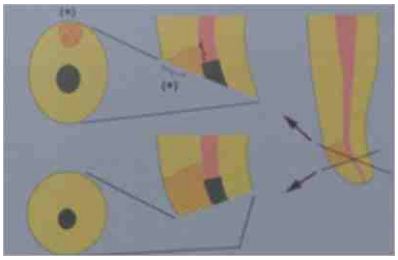
Continuation of reflection of full-thickness flap

(四)去骨osteotomy

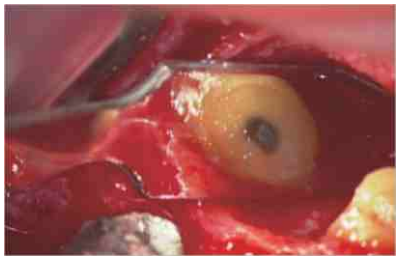
翻開flap之後，用retractor拉開，如果皮質骨板已被病變組織穿通，刮除肉芽組織或囊腫後，根尖會直接顯露於骨腔。若皮質骨完整沒有破孔，則應確定根尖所在部位，可以根據牙根的解剖外型、術前X光片確定根尖的位置，使用牙科探針檢查根尖病灶的位置，找出最薄弱皮質骨區域，再用高速手機和carbide round bur去除病灶上方的皮質骨，讓病灶完全暴露出來，傳統根尖手術去骨的範圍一般約在10㎜，而在顯微鏡及顯微器械的幫助下，只需要約3~5㎜大小的骨腔，便可得到清楚的視野和足夠的操作範圍，從而減少骨組織的損傷，可以避免損傷重要的解剖結構，縮短傷口癒合的時間；去骨的方向應盡量往根尖的方向，避免往牙冠的方向，以減少bony dehiscence的機會，導致perio-endo combined lesion產生，可能預後不佳。此時顯微鏡放大倍率在10~16倍，容易看到整個手術視野和區分骨組織與牙根。



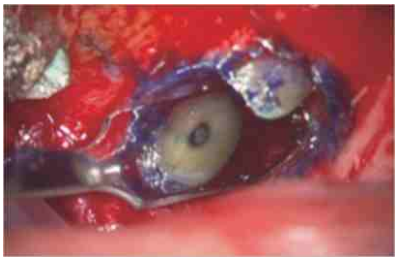
垂直牙根尖長軸切除3mm



在90度切面上Dentinal tubules有最少的暴露量，減少根管內細菌進入根尖周圍組織



切除根尖3mm後，以顯微口鏡觀察切面



以甲基藍染色，顯示牙周韌帶範圍、牙齦外緣與根管位置。

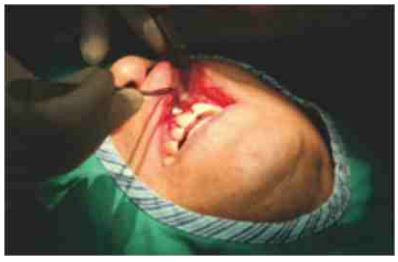
甲基藍染色觀察切面是否完整，判斷未治療與不緻密的根管，觀察牙根尖是否有裂痕或isthmus

(七) 止血Hemostasis

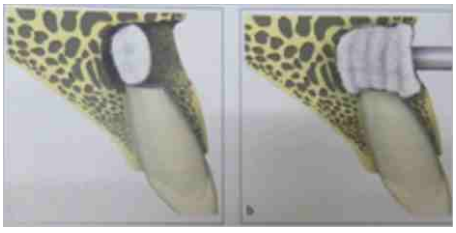
齒槽骨內窩洞止血的目的是要維持良好的手術視野，避免逆充填窩洞被血液浸潤，才能完成良好緻密逆充填治療；完成止血工作後，留下一塊止血棉球墊在骨內窩洞壁上，是為了防止手術中骨內血管再破裂造成流血，影響手術視野與窩洞乾燥，另外也有防止逆充填材料掉入骨內窩洞壁上，造成殘留逆充填材料無法完全清除

無菌乾燥棉球

浸泡1mg/cc epinephine



置入齒槽骨內窩洞止血

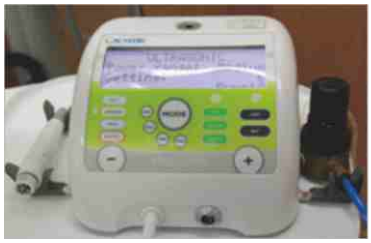


將第一塊止血棉球放入骨內窩洞的底端，持續放入止血棉球直到骨內窩洞被填滿，加壓4分鐘止血

將所有止血棉球移除留下底部第一塊止血棉球，直到逆充填完成，傷口窩洞沖洗之後才移除

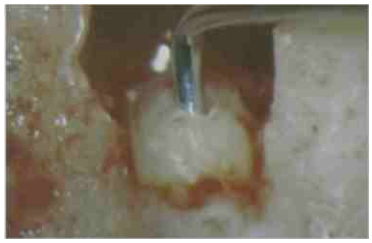
(八) 根尖逆充填窩洞備置Retrograde cavity preparation

切斷根尖3mm之後，可以看見根管內的馬來膠，此時需要再移除3mm的馬來膠以做為根尖逆充填的空間，Dr. Carr在1990年代引進根尖超音波技術，自此根尖超音波器械成為根尖逆充填窩洞技術的主流，超音波工具使用石英壓電原理產生每秒鐘28000-40000週期，傳導到超音波tip產生單一平面single plane的震動，可以對於牙本質造成細微磨耗，對於馬來膠產生熱熔效果，同時需要持續的沖水冷卻超音波tip，以達到最好的效果，以超音波器械配合適當角度的鑽針可以達到最理想的逆充填窩洞置備，使用顯微鏡與micro mirrow可以在最小的範圍內操作以上步驟，在顯微鏡低倍率下(×4~×6)將超音波tip放入根尖，保持超音波tip與牙根長軸一致，超音波器械振幅強度調整到最低或次低，若震動太大可能會造成牙根齒質變薄甚至造成裂痕而導致失敗，啟動後，應該做短距離的前後輕掃動作和短距離的上下動作，並且將isthmuses適當的擴大清潔，可精確預備到3㎜，創造可以容納逆充填材料的空腔，此時要小心超音波工具不可以震動太大，若震動太大可能會造成牙根齒質變薄甚至造成裂痕而導致失敗，超音波tip不能壓得太緊，防止降低其效率。根尖逆充填窩洞備置完成後，用無菌生理食鹽水徹底沖洗，用microplugger壓緊根尖冠方的馬來膠，然後在高倍率下(×16~×25)下，使用顯微口鏡檢查根管壁的清理效果，避免殘留任何牙膠或碎屑在根管壁上。以往所使用的micro-handpiece與鑽針已不再適用。

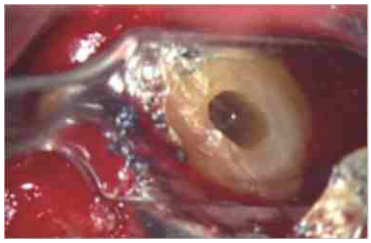


超音波器械振幅強度調整到最低或次低。

前牙常用的KiS 1 tip，3mm長，直徑0.24mm，角度80度。

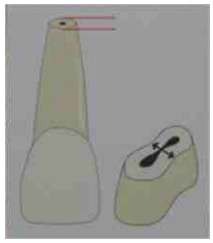


使用micro plugger將管壁上的馬來膠往牙冠部擠壓，也將底部熱熔化的馬來膠緊壓緻密



去除3mm馬來膠之後，檢視窩洞備製

顯微鏡檢查並拍照



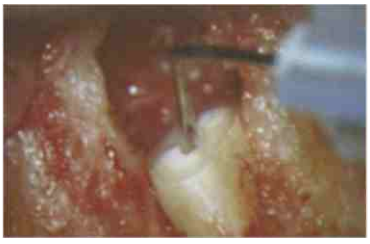
對於lenticular形狀根管，要小心不可去除過多齒質，造成管壁脆弱，可能造成牙根裂痕

(九) 根尖逆充填窩洞乾燥Retrograde cavity drying

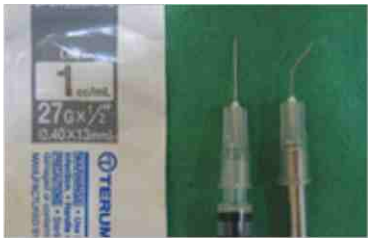
根尖逆充填前，需要將逆充填窩洞保持乾燥，以免MTA受到潮濕破壞水粉比例導致密合度不佳，封填品質不良，病菌微生物仍然可以進出根管，導致手術失敗。乾燥逆充填窩洞的最好方法是直接將氣體吹進逆充填窩洞內，治療椅上的三合一噴頭不夠集中無法有效乾燥逆充填窩

洞，甚至可能造成氣腫emphythema等後遺症，應該使用Stropko irrigator搭配使用drier syringe，它的噴氣出口非常精細，可以直接放入retrograde cavity吹乾，替代方式可以用1c.c.空針針頭，套在治療椅的三合一噴頭上，要確實卡緊防止噴氣時針頭脫落；另外可以用消毒乾燥的紙針放入逆充填窩洞中，吸乾多餘的水份。

Sybron Endo Stropko irrigator

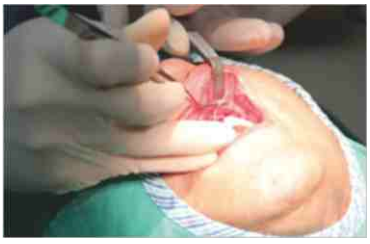


Drier syringe tip 放入cavity



使用1c.c.空針針頭，套在三合一噴頭上，可以作為替代方式

無菌消毒紙針



以紙針乾燥牙根管內逆充填窩洞

(十) 根尖逆充填Retrograde filling

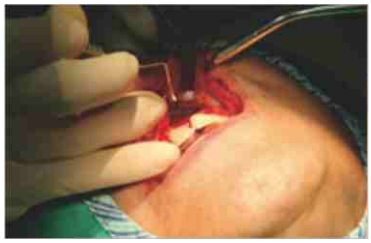
根尖逆充填後，需要在根管系統與根尖周圍組織之間建立一個嚴密的屏障，來封閉所有暴露於根尖周圍組織的根管系統。MTA是根尖逆充填的首選材料，過去常用的根尖逆充填材料有銀汞合金、氧化鋅和玻璃離子等，但這些材料根尖封閉性能不佳，遠期效果較差。三氧化聚合物(mineral trioxide aggregate,MTA)是一種新型的逆充填材料，又被稱為”生物水泥”。以無菌蒸餾水將MTA調成顆粒狀聚合物，使用MTA block & carrier或MTA messing gun將MTA放入逆充填窩洞內。一旦MTA放入窩洞內，用microplugger輕輕加壓，防止將MTA擠出窩洞。然後用以小濕棉球輕輕清理根切面，去除多餘的MTA。放置MTA後，勿沖洗齒槽骨窩洞，以防MTA流失。逆充填結束後，使用Micro explorer CX-1檢視MTA封填材料與根管管壁是否密合。最後一定不要忘記移除墊在骨腔底部的小棉球或其他止血材料，以防止傷口癒合不良，可能造成醫療糾紛。

MTA水粉比 1:3

MTA水粉比 1:3

使用MTA block成形

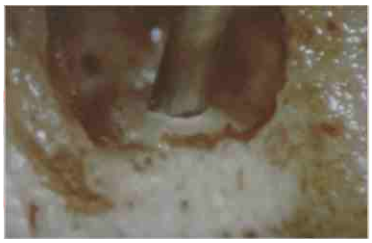
使用Sybron Endo 974-0020取出MTA



放入根尖逆充填窩洞

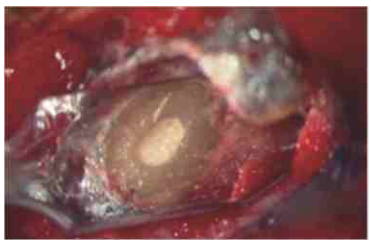
尚未使用部份，以濕紗保持濕潤

也可以使用MTA messing gun來裝置MTA



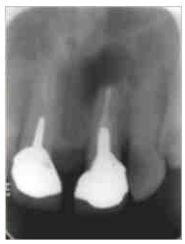
MAP SYSTEM裝入MTA後選擇適當大小的tip size可以直接放入逆充填窩洞中

使用顯微鏡輔助，置入MTA



MTA逆充填根尖窩洞

Checking for marginal integrity with a CX-1 explorer



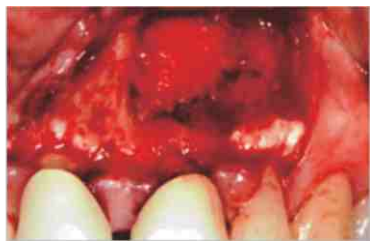
X光片檢查逆充填是否完整

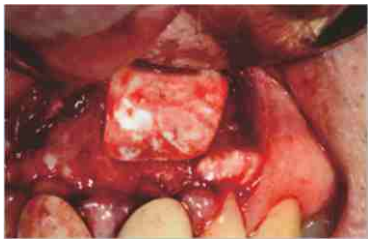
(十一) Bone replacement materials and membrane

可以選擇性的放入補骨材料與再生膜，對於through and through bone defect頰側與顎側齒槽骨都被發炎組織所破壞穿孔，可以先在顎側墊一塊Colla Cote collagen sponge作為基底，再放入補骨材料，一般而言，越靠近根尖的bone defect，可以使用allograft或xenograft配合非骨釘固定可吸收再生膜，如果是靠近牙冠部的bone defect，或是perio-endo combined lesion and cervical bone dehiscence就建議使用自體骨autograft或同種異體骨allografts配合骨釘固定不可吸收再生膜。

ALLOMARIX含骨生成蛋白

攪拌均勻後置入齒槽骨窩洞



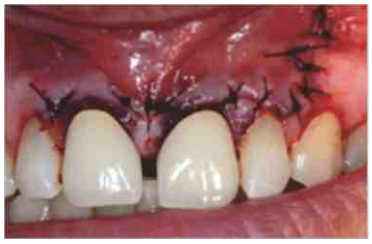


吸收性再生膜覆蓋

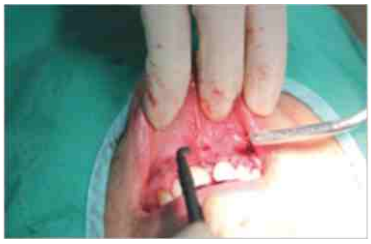
(十二) 翻瓣的復位與縫合Flap replacement and suturing

用生理食鹽水沖洗術區，用組織鉗將瓣復位，注意動作輕柔並盡可能將瓣復位至原處。用濕紗布在唇頰側由根方滑向冠方輕輕擠壓2~3分鐘，去除瓣膜下血液和其他液體，減少瓣膜與皮質骨組織之間血凝塊形成，使瓣與骨面緊密貼合，有利切口縫合。在手術過程中，皮瓣必須保持濕潤，以防止皮瓣因乾燥而萎縮，皮瓣保持濕潤在術後縫合時，可以以無拉力tension-free的狀況下，將皮瓣重新貼合原本的位置，在顯微鏡下進行縫合，能更精確的看清瓣膜的切緣，有助於更精確的復位。

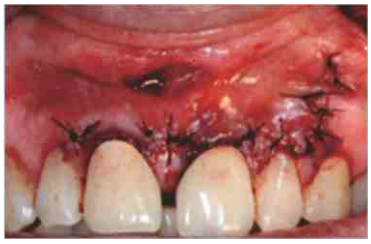
常用的縫合材料包括合成纖維(尼龍、聚酯纖維等)羊腸線catgut和絲線等。常用的縫合技術有四種：interrupted suture、sling suture、continuous suture和mattress suture。相較於continuous suture，使用interrupted suture可以使皮瓣對齒槽骨有較好的貼合，使用3/8或1/2 circle reverse cutting edge的縫針穿過皮瓣時會有最小的傷口，配合使用6 / 0或7 / 0尼龍線縫合皮瓣，在顯微鏡下操作可以將皮瓣密貼在原始的切口，可以加速傷口癒合，防止傷口裂開，避免疤痕產生。角化牙齦部份可選擇使用絲線或尼龍線，絲線可能易有牙菌斑附著或帶入傷口，尼龍線可能易有黏膜刺激感；非角化牙齦部份可考慮使用可吸收線，減少拆線時的困難度。



術後傷口縫合



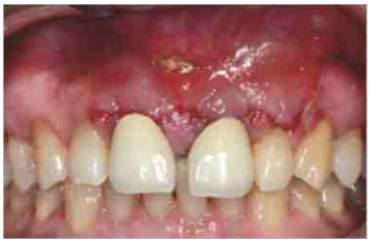
選擇性施作唇繫帶切除



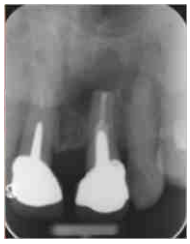
(十三) 術後照護

縫合完成後，用生理食鹽水紗布輕壓術區3~5分鐘，可以縮小血凝塊的厚度並有利於止血，防止血腫發生。也可使用冰袋在頰部或下頷輕壓術區20分鐘以收縮血管、減少腫脹和促進血液凝固。術後應告知患者術後反應以及家庭護理的方法。囑患者縫線處暫不要刷牙，術後第二天用0.12% chlorohexidine輕輕漱口。術後24小時，適合加壓冰敷傷口，可以降低傷口流血，促進凝血成形，避免傷口腫脹，而且降低疼痛感。在顯微手術過程中，軟硬組織損傷較小，術後疼痛一般較輕。常用的止痛藥為：1、非鴉片類止痛藥，如acetaminophen有止痛效果，但無抗發炎作用，對腸胃無刺激性。2、非類固醇抗發炎止痛藥NSAID，如ibuprofen，止痛效果

來自抑制周邊前列腺素prostaglandin的合成，但會對腸胃有刺激性，對於有胃十二指腸潰瘍的病人，懷孕第三期的孕婦應該避免使用，建議餐中服用或配合胃藥服用，可以減少腸胃道不適反應。3、鴉片類止痛藥，如嗎啡morphine，對於深度疼痛的止痛效果明顯，對於輕中度疼痛的止痛效果等同上述二類止痛藥，合併使用acetaminophen(1000mg)和ibuprofen(600mg)的止痛效果如同鴉片類止痛藥，而沒有其副作用。如去骨較多、血凝塊較大、上頷竇穿通等情況，應在手術後服用抗生素。



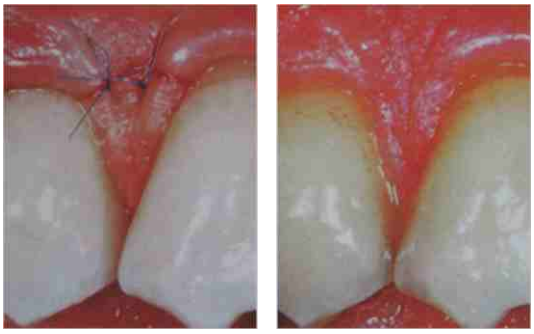
術後一周拆線



術後X光片檢查

(十四) 回診

一般術後5~7天拆線。術後六個月應複查一次，並於術後十二個月至二十四個月再進行複查。複查包括臨床表現和X光片檢查兩方面。如果患牙無臨床症狀和不適，X光片顯示骨缺損開始修復和牙周膜形成，可視為成功；如果患牙出現咬合痛、牙鬆動、廔管或X光片顯示骨缺損範圍持續擴大，則視為失敗；如果患牙未出現臨床症狀，X光片的骨缺損較治療前無明顯變化，則可再繼續觀察一段時間。



Papilla base flap with 6-0 nylon sutures
使用6/0尼龍線，傷口癒合後，幾乎看不出切線與疤痕

新式方塊型膠原蛋白敷料(collagen matrix cube)於游離牙齦移植術(FGG)之應用~病例報告

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前言

植牙美學已是現今牙科治療的顯學,而其中粉紅色美學(pink esthetics)是較難上手的部分,尤其軟組織手術的高技術敏感性常常讓醫師裹足不前,於是較為容易執行的自體移植游離牙齦移植術(FGG)往往是醫師在做牙齦移植時的首選,而顎部是最常採用的捐贈區,但此捐贈區的傷口處理卻又是令醫師與病人頭痛的問題,本文主要針對一新式方塊型膠原蛋白敷料(collagen matrix cube)於FGG顎部捐贈區傷口之應用做一病例報告。

FGG捐贈區傷口常見的後遺症以及一般處理方式

1.術中大量出血:此區有豐富的血管,在切取游離牙齦移植體的同時就會產生大量的出血,而在取下牙齦移植體之後通常需要立即加壓止血並覆蓋止血棉或子彈型膠原蛋白(collagen plug)再以縫線固定。

2.術後易受刺激而再次大量出血:在傷口癒合過程若患者不小心刺激傷口導致深層的小血管破裂可能引發再次大量出血甚至血噴,血液汩汩流出不止常常使得病人驚慌失措,此時病人本身可做的就是以溼紗布加壓止血並立即就醫,由醫師找出止血點方能止血;傳統可於術前製作手術止血壓板(surgical stent)讓病人術後配戴來減少此一狀況發生。

3.術後癒合不佳:若取游離牙齦移植體時切割過深或是剝離骨膜導致捐贈區底下骨質露出將導致傷口癒合不良,由於角化牙齦細胞增生不足可能使得此處牙肉塌陷。

新式方塊型膠原蛋白敷料(collagen matrix cube)應用於FGG顎部捐贈區傷口的優點

1.膠原蛋白止血能力較止血棉強,因為止血棉是吉利丁(已降解的膠原蛋白),生物相容性不佳,較不具疏水性,而且對酵素的抵抗能力差。

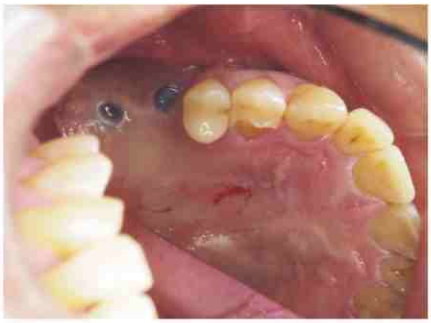
2.方塊型膠原蛋白敷料不須剪裁即可立即貼合於傷口,若是使用子彈型膠原蛋白(collagen plug)還需要剪裁或是削薄。

3.方塊型膠原蛋白敷料取得成本較市面上一般子彈型膠原蛋白(collagen plug)低。

4.不須製作手術止血壓板,膠原蛋白促進軟組織癒合能力佳,可加快表皮癒合並減輕術後不適。

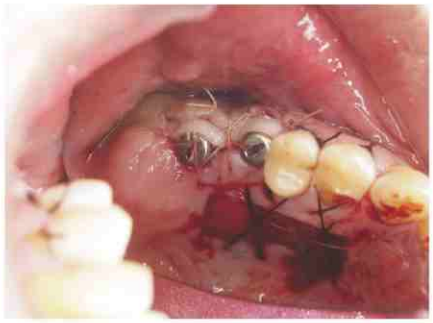
病例報告

FGG應用於植牙區角化牙齦不足之soft tissue augmentation

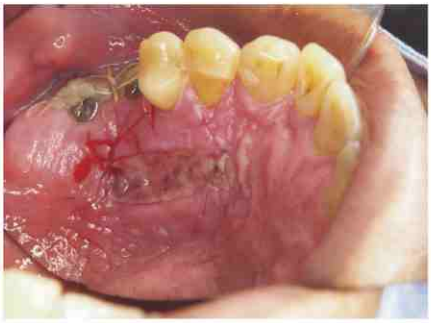


(圖一) 術前可見植牙區角化牙齦不足

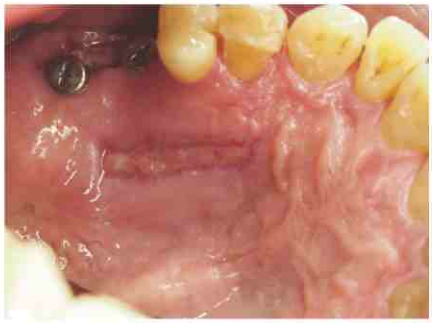
(圖二) 新式方塊型膠原蛋白敷料(collagen matrix cube)



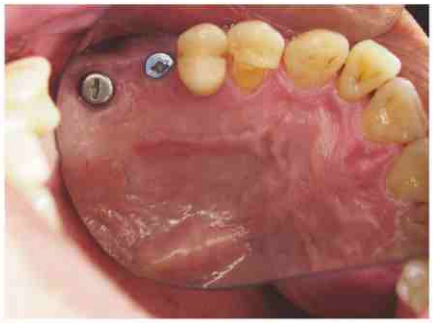
(圖三) 術中將collagen matrix cube以縫線固定於顎部捐贈區



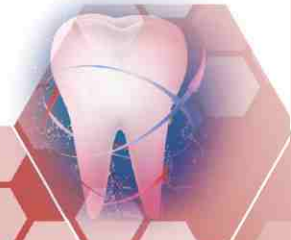
(圖四) 術後一周拆線可見表皮已開始癒合



(圖五) 術後兩周可見癒合迅速



(圖六) 術後一個月可見捐贈區傷口癒合完全



結論

FGG是軟組織擴進術中最常被採用的術式,而此術式技術敏感性較低更是進行牙齦移植時的入門,其顎部捐贈區傷口的處理傳統上皆以手術止血壓板來做傷口立即加壓止血與病人術後傷口照護,但是若能以縫線固定膠原蛋白敷料於顎部捐贈區傷口,不僅可以幫助止血,更能避免傷口直接暴露並促進傷口癒合,此舉不但能省去製作手術止血壓板的麻煩,更能有效減少後遺症發生並減緩病人傷口不適,而新式方塊型膠原蛋白敷料(collagen matrix cube)使用方便且取得成本低廉,不失為進行此一手術時可取代手術止血壓板之另一選擇。