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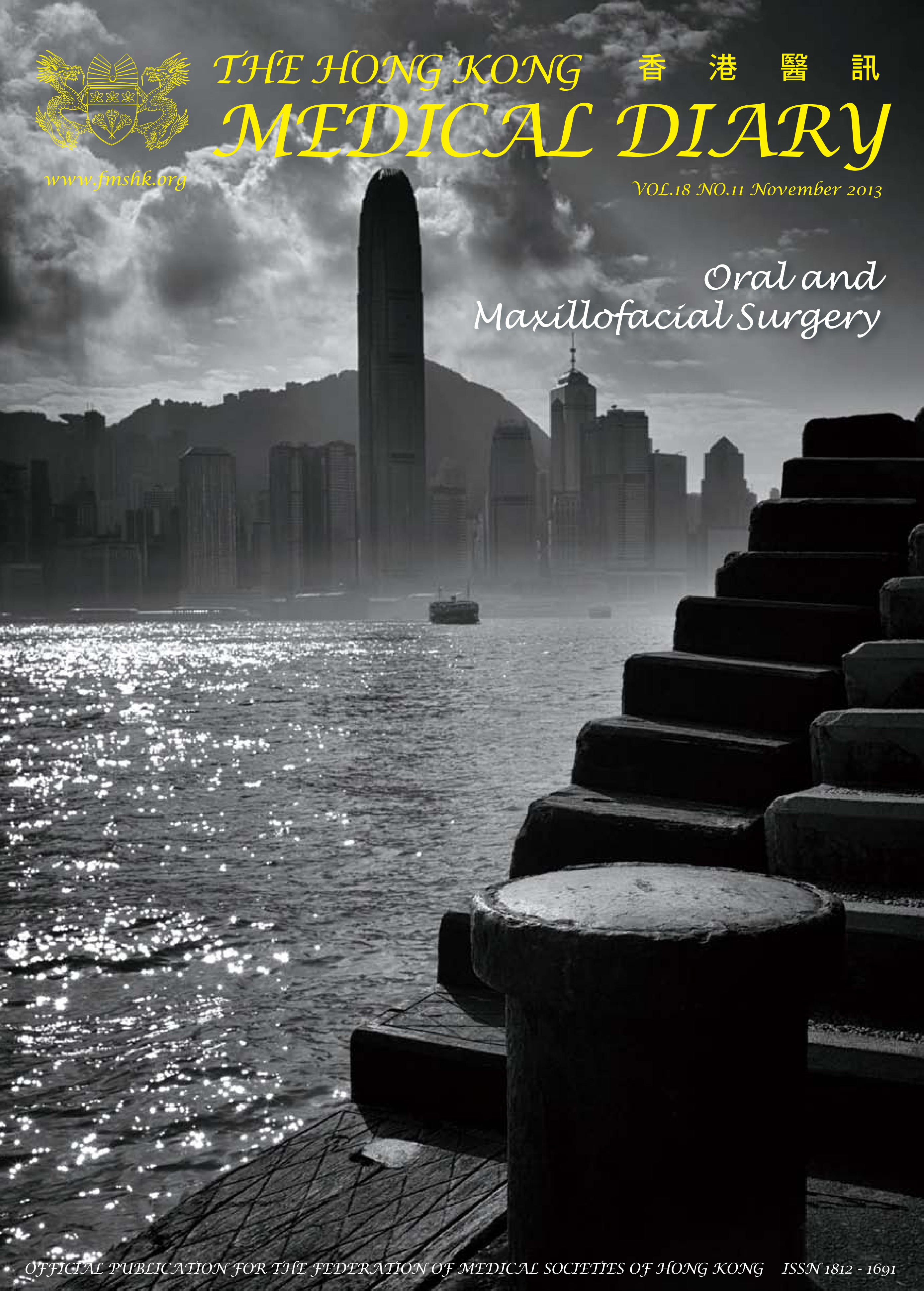
Oral and Maxillofacial Surgery



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Editorial

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Editor

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The face could be considered as a special organ and probably is the most complex one of the human body. Not only does it contain the "five senses" that we interact with our surroundings, it is also essential for social interactions. Individual faces are unique and represent one's identity.

However, when there is trauma to the head and maxillofacial region, our face is dispensable anatomically. Our facial skeletons could collapse and be displaced relatively easily. This cushion effect helps to decrease the impact to our cranial vault, which harbours one other important organ of our body, our brain. However, the trauma to the facial skeletons could have severe impacts on the patient's "five senses" and the well-being as an individual.

In this issue, we shall discuss a few topics that are commonly seen in patients with maxillofacial trauma.

As the dentition is closely related to the facial skeleton, it is not uncommon to see associated malocclusion in those patients with facial trauma. Restoration of the traumatised dentition is always a challenge to clinicians. When we are treating patients with maxillofacial trauma, rehabilitation of functions and restoration of anatomy are equally imperative in the treatment planning.

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Mandibular Condylar Fracture – A Review of Management and Case Reports

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This article has been selected by the Editorial Board of the Hong Kong Medical Diary for participants in the CME programme of the Medical Council of Hong Kong (MCHK) to complete the following self-assessment questions in order to be awarded 1 CME credit under the programme upon returning the completed answer sheet to the Federation Secretariat on or before 30 November 2013.

Introduction

The condyles of the mandible are the weakest parts of the mandible, which by itself basically is a solid piece of bone. Condylar fractures commonly occur when there is trauma to the lower jaw. The "Guardsman Fracture" typically describes such trauma. The syncope of the long standing solider leads to a fall and impact at the chin which results in a unilateral or bilateral condylar fractures as well as the symphysis fracture. (Fig. 1)

Fig. 1 Guardsman Fracture

Condylar fractures can be classified according to the anatomical location of the fracture and the degree of dislocation of the condylar head.

Classifications according to Lindahl (1977)[1]

Fracture level
1. Intracapsular fracture
2. Conylar neck fractue
3. Subcondylar fracture

According to its relationship with the mandible, the condylar fragment is then described and classified as displaced or non-displaced; and according to its relationship with the fossa as dislocated or non-dislocated. Unilateral or bilateral condylar fractures could occur.

Depending on the degree of injury, displacement of fractured fragments; and dislocation of the condylar head, the patient may present with pain, a limited mouth opening, a deviated lower jaw and malocclusion with an open bite. Much more serious complications include fracture of the tympanic plate, mandibular fossa of temporal bone fracture with or without dislocation of the condylar head into the middle cranial fossa. Any disturbance in growth of the developing jaw or even ankylosis of the temporomandibular joint must be considered in the treatment of fractured condyles in a growing patient.[2,3]

The aims of treatment are to restore the occlusion and the function of the temporomandibluar joints.

Condylar fractures are treated through surgical open reduction with internal rigid fixation or non-surgical functional therapy through closed reduction with intermaxillary fixation. With advances in osseous synthesis techniques and materials, and the emergence of titanium micro-screws and plates, open reduction and internal rigid fixation is getting more and more common and predictable with less disturbance to joint function. In closed reduction, the joint function is restored by allowing active mobilisation of the joint after a short period of intermaxillary fixation. The condyle is allowed to remodel. Elastic traction might be necessary to control any occlusal disharmony. There are advantages and disadvantages with both these techniques.

The general consensus is to treat young growing patients with condylar fractures non-surgically. (Fig. 2, Fig. 3) However, controversies exist in choosing which technique is the best for a particular patient.[4]

Fig. 2 Fracture right condyle in a young child

Fig. 3 Remodelled right condyle after closed reduction

Ellis et al[5] compared the outcomes of one hundred forty-six patients, 81 were treated by closed and 65 by open methods. The patients who were treated by closed methods had significantly shorter posterior facial and ramus heights on the side of injury, and more tilting of the occlusal and bigonial planes towards the fractured side than the patients whose fractures were treated by open methods. It is likely that loss of posterior facial height on the side of fracture in these patients is an adaptation that helps reestablish a new temporomandibular joint.

In another study Ellis[6] reported that complications such as intraoperative bleeding and postoperative infection, facial nerve paralysis, functional disorder of the auriculotemporal nerve, and condyle growth disorder significantly increased when open reduction was conducted to treat condylar head and neck fractures, and that closed reduction was a more advantageous method.

In another study by Santler et al[7], 150 patients were followed up, with a mean follow-up time of 2.5 years. No significant differences in mobility, joint problems, occlusion, muscle pain or nerve disorders were observed when the surgical and non-surgically treated patients were compared. However, surgically treated patients showed significantly more weather sensitivity and pain on maximum mouth opening. They concluded that open surgery is only indicated in patients with severely dislocated condylar process fractures.

Nussbaum et al[8] compared if open or closed treatment of condylar fractures produces the best result but the results were inconclusive. Haug and Assael[9] also reported no statistically significant differences in occlusion status and mandibular movement restriction between open and closed reductions. However, Jeter et al[10] reported that closed reductions could cause mouth opening disorder, mandibular set back and joint pain. Tu and Tenhulzen[11] reported that open reduction and fixation prevented disuse atrophy of the masticatory muscles, achieving early mouth opening and significantly decreased post-operative complications.

Case Report

Case 1

A 36 years old French man sustained trauma to his chin after a sudden collapse from syncope attack at home. The patient was seen four days after injury and was stabilised in the A&E Department. The patient had open bite malocclusion and step deformity in the mandible. There were also coronal fractures of the upper incisors. (Fig. 4)

Fig. 4 Open bite malocclusion

The CT scan confirmed the patient's left unilateral condylar fracture and right parasymphyseal fracture. The condylar fracture was at the subcondylar level and the condyle was displaced and incompletely dislocated medially. (Fig. 5)

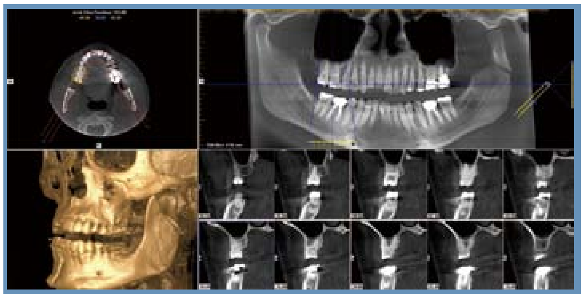

Fig. 5 CT scan showed dislocated left subcondylar fracture

As the condyle was displaced medially and partially dislocated, a surgical open approach was recommended for the patient. As the level of the fracture is at the subcondylar region, an intraoral access to the fracture was used for open reduction and internal fixation.

The operation started with restoring the occlusion using intermaxillary fixation. The parasymphyseal fracture was accessed via a vestibular incision with protection of the mentle nerves. The fracture was reduced and fixed with two titanium mini-plates. (Fig. 6) Fixation of the parasymphyseal fracture created a solid platform for the manipulation of the subcondylar fracture which had a poorer access intraorally. The condylar fragment was then approached via a lateral buccal incision. The condylar fragment was reduced anatomically and fixed with a mini-titanium plate and four screws. (Fig. 7) The occlusion was checked with release of intermaxillary fixation. This was found to be satisfactory. (Fig. 8, Fig.9)

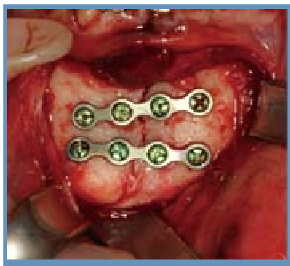

Fig. 6 Fixation of parasymphyseal fracture

Fig. 7 Fixation of subcondylar fracture

Fig. 8 Post operative CT

Fig. 9 Post operative dental occlusion

Postoperative recovery of the patient was uneventful. The mouth opening and jaw movement were satisfactory with no abnormal crepitus or clicks of the temporomandibular joints. His general dentist then restored the traumatised dentition. (Fig. 10)

Fig. 10 Restoration of dental function

Case 2

A 27 years old air stewardess was admitted after a bicycle accident. She was diagnosed to have right condylar fracture and mandibular fracture. She was treated non-surgically with intermaxillary fixation in another hospital. The chief complaint of the patient on presentation was severe pain and the bite discrepancy.

On examination, the patient was in intermaxillary fixation with slightly off occlusion. Soft tissue lacerations were found both at the chin and lips. A CT scan confirmed right condylar neck fracture and a fractured left parasymphysis with minor displacement. The right condyle was completely dislocated and displaced antero-medially. The right ramus height was shortened. (Fig. 11) The upper left cental and lateral incisors were avulsed.

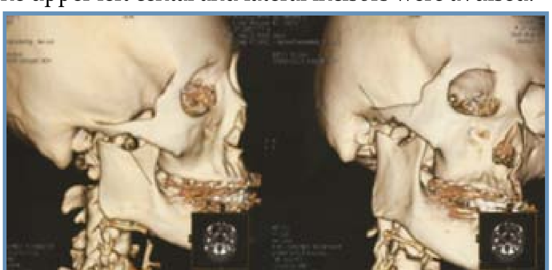

Fig. 11 Dislocated right condyle and shortened right ramus

A surgical approach was planned to correct the ramus height and malocclusion.

The left symphyseal fracture was reduced and fixed with two titanium mini-plates. This formed a rigid platform for correction of the ramus height. Good occlusion was achieved with temporary intermaxillary fixation.

The right condylar fracture was approached using the Al-Kayat and Paul Bramley modified preauricular approach. The condyle was uncovered with minimal stripping of soft tissue attachment. The condylar fracture was reduced anatomically to restore the ramus height and fixed with a titanium micro-plate and screws. (Fig. 12, Fig. 13, Fig. 14, Fig. 15)

Fig. 12 Modified Preauricular approach

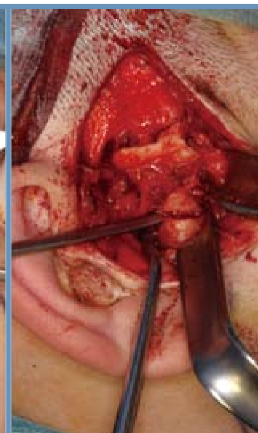

Fig. 13 Dislocation reduced

Fig. 14 Fracture reduced anatomically

Fig. 15 Fixation with micro-plate

The patient was put in intermaxillary fixation for two weeks. The occlusion and mouth opening were satisfactory after release of intermaxillary fixation. (Fig. 16)

Fig. 16 occlusion after release of IMF

The fractured teeth and avulsed teeth were restored with dental implants and full ceramic crowns. (Fig. 17)

The postoperative recovery was satisfactory. The range of movement and mouth opening 3 months after surgery were satisfactory. The mouth opening was 35mm with no crepitus, deviations or clicking of the temporomandibular joints.

Discussion

Surgical treatment of condylar fractures had been quite controversial, especially before the development of rigid internal fixation with micro-plates and screws. Both the surgical approach and non-surgical approach have their advantages and disadvantages. Open reduction and internal fixation aim to restore the anatomy and then the function. However, it could carry potential risks of facial nerve injury, avascular necrosis of the condylar stump with resorption and open bite deformity. The non-surgical approach is much less invasive and depends on the functional remodelling of the condylar stump with active mobilisation. However, with a severely dislocated fracture, it would be difficult to restore the shortened ramus height. Closed reduction is usually advocated for the growing patients, the malocclusion could usually be compensated with a functional appliance. Ankylosis of the joint is a severe complication and is seen more frequently in the child patient.

The two cases presented were managed surgically with satisfactory outcomes. The first case discussed was a condylar neck fracture, which was accessible with an intraoral approach. The fracture could be reduced and rigidly fixed with relative ease. The morbidity and risks were less compared to external approach. The fixation could further be enhanced with the use of 3D stereo-model and endoscopic assistance. A mock surgery that could be performed on the model and the titanium plate pre-bended before the surgery will greatly shorten the operating time.

In case two, the non-surgical approach was not adequate for the management as the condyle fragment was completely dislocated antero-medially and the occlusion achieved was unstable. To lengthen the shortened ramus, functional rehabilitation will need to take place early with active mobilisation, raising the posterior bite and elastic traction. The success of this approach requires a stable mandibular platform and good compliance from the patient, both of which were lacking in this case. The modified pre-auricular approach offered good access and visibility to the temporomandibular joint and the fracture dislocated condyle was isolated and reduced anatomically without too much soft tissue stripping and manipulation. Fixation could be achieved purely with titanium screws but micro plating is usually easier to achieve and preferably with two screws for each bone end. To conclude, there are absolute and relative indications for a surgical approach in condylar fracture management.[12] A case-by-case assessment is mandatory for success and to minimise post operative morbidity.

References

1. Lars Lindahl, Condylar Fractures of the Mandible. Classification and relation to age, occlusion, and concomitant injuries of teeth and teeth supporting structures, and frctures of the mandibular body. International Journal of Oral Surgery, Vol.6; Issue 1, February 1977, pg. 12-21
2. Rowe N.L., Ankylosis of the Temporomandibular Joint. Journal of the Royal College of Surgeons of Edingburg 1982, 27, 167 and 209
3. Gilhums-Mol, Fractures of the mandibular condyle in growth period. Thesis 1969; Oslo University
4. Rowe N.L., Fracture of the Jaws in Children. Journal of Oral Surgery 1969; 27, 497
5. Ellis et al, Facial Asymmetry after closed and open treatment of Fracture Mandibular Condylar Process. Journal of Oral Maxillofac Surg 2000; 58:719-728
6. Ellis et al, Surgical Complications with open treatment of Mandibular Condylar Process Fracture. Journal of Oral Maxillofac Surg 2000; 58:950-958
7. Santler et al, Fractures of the Condylar Process. Surgical versus Non-surgical treatment. Joural of Oral Maxillofac Surg 1999; 57:392-397
8. Nussbaum et al, Closed versus Open Reduction of Mandibular Condylar Fractures in Adult: A Meta-Analysis. Journal of Oral Maxillofac Surg 2008; 66:1087-1092
9. Hang and Assael, Outcomes of open versus closed treatment of mandibular subcondylar fractures. Journal of Oral Maxillofac Surg 2001;59:370-375
10. Jeter et al, Intraoral Open Reduction with Rigid Internal Fixation of Mandibular Subcondylar Fractues. Journal of Oral Maxillofac Surg 1988;46:1113-1116
11. Tu & Tenhulzen, Compression Osteosynthesis of Mandibular Fractures: a retrospective study. Journal of Oral Maxillofac Surg 1985; 43:585-589
12. Zide MF and Kent JN: Indications for open reductions of mandibular condyle fractures. J Oral Maxillofac Surg 41:89-98, 1983.

MCHK CME Programme Self-assessment Questions

Please read the article entitled "Mandibular Condylar Fracture – A Review of Management and Case Reports" by Dr. Philip KM LEE and complete the following self-assessment questions. Participants in the MCHK CME Programme will be awarded CME credit under the Programme for returning completed answer sheets via fax (2865 0345) or by mail to the Federation Secretariat on or before 30 November 2013. Answers to questions will be provided in the next issue of The Hong Kong Medical Diary.

Questions 1-10: Please answer T (true) or F (false)

1. Fractured Condyles are commonly associated with trauma to the chin with or without mandibular symphyseal fractures.
2. There are controversies in the treatment of young growing patients with condylar fractues. The general consensus is to treat the fracture with open reduction and internal fixation.
3. Ankylosis of the Temporomandibular Joint is one of the most severe complications in inadequately treated condylar fractures.
4. Conservative closed reduction of fractured condyles involves intermaxillary fixation for a period of 10 weeks.
5. Early mobilisation after a short period of intermaxillary fixation is the key to success in closed reduction of fractured condyles management.
6. Resorption and avascular necrosis of the fractured condylar stump are due to too much stripping of soft tissue attachments in surgical open reduction and fixation.
7. Functional appliance and elastic traction are used in open reduction and fixation of fractured condyles.
8. Intraoperative bleeding and postoperative infection, facial nerve paralysis, functional disorder of the auriculotemporal nerve, and condyle growth disorder are complications of surgical treatment of fractured condyles of the mandible.
9. A stable occlusal platform is the keystone of success in the treatment of fractured condyles whether by a surgical or non-surgical approach.
10. Management of fractured mandibular condyles should be customised for individual patients but the absolute indication for non-surgical approach includes dislocated condylar stump into the middle cranial fossa.

ANSWER SHEET FOR NOVEMBER 2013

Please return the completed answer sheet to the Federation Secretariat on or before 30 November 2013 for documentation. 1 CME point will be awarded for answering the MCHK CME programme (for non-specialists) self-assessment questions.

Mandibular Condylar Fracture – A Review of Management and Case Reports

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Answers to October 2013 Issue

A Brief Update on Oral Antidiabetic Medications

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Controversies and Advances of Orbital Fractures and Reconstruction

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Introduction

Orbital fractures areis common among patients who have sustained craniomaxillofacial injuries, with a prevalence of around 20% of those who have facial fractures[1]. It is believed that facial bone fractures may act as a shock absorber during direct trauma which reduces the energy towards the central nervous system. However, orbital fractures may result in ophthalmic complications. Orbital apex fractures may cause traumatic optic neuropathy. "Blow-out fractures", the orbital floor fractures, may result in diplopia and enophthalmos. Medial or lateral wall fractures may cause limitation in eye movements from the entrapment of extraocular muscles. Retrobulbar haemorrhage from the fractured orbital bones may also compress the optic nerve and cause blindness. Apart from the functional morbidities, cosmetics can be significantly compromised when the eye is displaced as a consequence of enophthalmos or hypoglobus. These considerations pose great challenges in the surgical treatment of orbital fractures.

Controversies exist in the management of orbital fractures and protocols vary from different surgeons or centres. There are different opinions on the indications of surgical treatment or conservative management, the surgical approach that carries the least morbidity, and the best material for orbital floor repair. The uprising practice of evidence-based medicine is trying to answer these clinical questions and helps clinicians in their decision making. Recent advances in imaging and image-guided navigational surgery have also improved the surgical predictability and thus the outcome with reduced risks and morbidities. These issues will be discussed in this update of orbital fractures.

Controversy 1: Indications of surgical treatment in orbital fractures

It has been a topic of debates on the indications of operation especially when a pure orbital fracture occurs. Functional and cosmetic outcomes in the long term are the two major considerations. Wrong decision in treating the orbital fracture surgically or not will either put the patient into an unnecessary surgery or leave secondary or even permanent disabilities and/or deformities. Orbital fractures may trap extraocular muscles and cause diplopia. They occur most frequently on the inferior rectus muscle because the orbital floor is the thinnest and may fracture easily when a direct force acts onto the eyeball, or in concomitant with a zygomatic complex fracture, which limits an upward gaze of the affected eye. Displacement of the globe posteriorly (enophthalmos) or inferiorly (hypoglobus) may occur in orbital fractures as a consequence of the increase in the orbital volume. The eyes are the key in drawing attention to a person's facial appearance, and as a result any difference between the eye levels or prominence may cause a huge aesthetic defect.

To avoid these complications of the fractures, most surgeons would opt to treat surgically in an early manner when 1. Obvious muscle entrapment as shown on the CT scan; 2. Obvious hypoglobus or enophthalmos; 3. Concomitant zygomatic fractures that will be operated. There lies the decision dilemma in mild to moderate orbital fractures especially when globe displacement is not obvious, or when the affected eye's mobility is only mildly affected. In this case it has been suggested to monitor the condition for 7-14 days with steroids to reduce the effects of inflammation and followed by reassessment of the need of surgical treatment. It has also been recommended to determine the need of surgical treatment by the defect size of the orbital floor of 50% as the threshold. However, most of these suggestions are based on experience and no good piece of evidence is available in the literature. Recently a retrospective study of 48 cases concluded that conservative management in an orbital fracture of a defect within 3cm^2 has a low risk of permanent functional damage if enophthalmos is less than 2mm and without soft tissue or muscle entrapment. It is clear that more research is required to give a definitive answer on the indications of surgical treatment in orbital fractures.

Controversy 2: Surgical approaches to the orbital floor

Access to the orbital floor is necessary for the surgical treatment of blow-out fractures. Three transcutaneous approaches, namely the subciliary approach, subtarsal approach and infraorbital approach, are described for accessing the orbital floor (Figure 1). The subciliary approach offers a minimal scar but the meticulous dissection makes it more technically challenging and also risks damaging the pretarsal orbicularis muscle, which may result in ectropion. The subtarsal approach is believed to preserve the innervation to the orbicularis oris and thus has a lower incidence of ectropion. The infraorbital approach offers the most direct route to the orbital floor but the scar is more obvious. Apart from the transcutaneous approaches, transconjunctival approaches with or without lateral canthotomy also offer sufficient access and is favoured by many oral and maxillofacial surgeons due to the fact that the scar is minimal or even absent and with relatively few complications. The choice of the surgical approach may be considered by factors like the age of the patient, preexisting laceration or access to the fracture site, but mostly based on the surgeon's preference. Bahr et al. compared the transcutaneous approaches in 130 orbital floor fractures and concluded that the subciliary approach carried the highest rate of scleral show and ectropion, while the infraorbital approach had the highest rate of noticeable scars. They also concluded that the subtarsal approach carried the fewest complications and thus was the best approach when compared to the other two[3]. A recent meta-analysis compared the complications of subciliary, subtarsal and transconjunctival approaches, and concluded that the ectropion rate of subciliary, subtarsal and transconjunctival approaches were 14%, 3.8% and 1.5%, respectively. There was also a higher risk of lid oedema of 3.6% in the subciliary approach. The subtarsal approach had a 3.4% rate of hypertrophic scar. The transconjunctival approach carried a 0.7% chance of entropion. The overall complication rates of subciliary, subtarsal and transconjunctival approaches were 19.1%, 9.7% and 2.1% respectively and therefore they concluded that the transconjunctival approach was suitable for isolated orbital floor fractures[4].

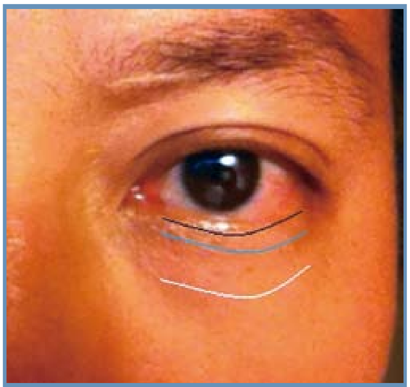

Figure 1. Transcutaneous approaches to the orbital floor. Black line: subciliary approach; Blue line: subtarsal approach; White line: infraorbital approach.

Controversy 3: Materials for orbital floor repair

When orbital fractures occur the orbital volume and shape may change. The orbital floor is the weakest and thus the most common site of fractures and usually causes a "blow-out fracture" which increases the orbital volume. Many options of repairing the orbital floor are available and they can be categorised into autografts, allografts, or alloplasts. Suggestions of the characteristics of an ideal material for orbital floor repair were made and should be: 1. Safe to use; 2. Strong in strength to withstand deformation; 3. Easy to mould to the preferred shape; 4. Radio-opaque but with minimal artifacts on radiological evaluation; 5. Cost-effective[5]. Autografts, including bone (from hip or calvarium), cartilage (from nasal septum or ear) or temporalis fascia, have been suggested to be good materials for orbital floor repair, which are the most biocompatible and have sufficient strength. However, they are usually difficult to shape to the ideal anatomical form, and with various certain extents of donor site morbidities depending on which grafting material is used. Irradiated cadaveric cartilage or fascia lata have been suggested as possible allogeneic sources for orbital floor repair. Studies have shown that these materials were safe to use with similar properties with the autografts, and without any risks of donor site morbidities. Yet these allogeneic materials are expensive and may not be easily available in every country. Alloplastic materials are very popular as the option to repair the orbital floor. Titanium mesh plates and PDS plates are widely used. They are biocompatible and can provide sufficient strength, and reasonably mouldable to restore the original orbital anatomy (Figure 2). Preformed titanium mesh plates are developed from cadaveric studies with large sample sizes, which may aid the placement and shorten the surgical time with a high precision in restoring the appropriate volume of the orbit (Figure 3). Recently, a systematic review on the biomaterials of orbital floor fractures concluded that all graft materials were successful to variable degrees, with all reported to have improvement in their reported outcome measures. The authors further suggested a guideline of the material choice based on the defect size of the orbital floor fractures[6]. However, as most of the included studies in the systematic review were retrospective and none was any randomised clinical trial, the truth of what is the best to use and when to use in orbital floor fractures repair may still be in the mist.

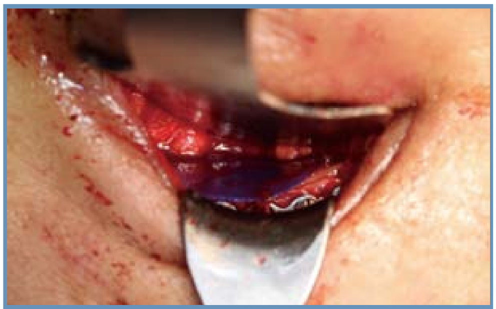

Figure 2. A PDS plate placed to repair the fractured orbital floor through a transconjunctival approach.

Figure 3. Titanium mesh plates for orbital floor repair

Advances in imaging and image-guided navigational systems

Three-dimensional imaging is crucial for the detection and treatment of orbital fractures. Medical computed tomography (CT) was the standard imaging in detecting the site of fractures, entrapment of extraocular muscles, presence of retrobulbar haemorrhage or the change of orbital volume (Figures 4a and 4b). Cone-beam CT is a big advancement in three-dimensional imaging in the craniomaxillofacial area. Compared to the conventional medical CT, CBCT has a comparable image quality and resolution that can show the fractures of the thin bones of the orbital walls[7]. The CBCT machine is much cheaper and occupies less space than a medical CT machine. The pulsed x-ray beam in CBCT also reduces the total scan time and thus the patient's overall radiation dosage[8], which is important especially in paediatric patients with blow-out fractures. These advantages have drastically increased the popularity of CBCT as an imaging tool in the management of orbital fractures.

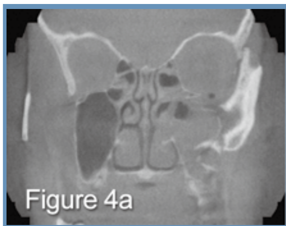

Figure 4a. Pre-operative CT image showing fractured zygomatic complex and orbital floor resulting in an increase of orbital volume.

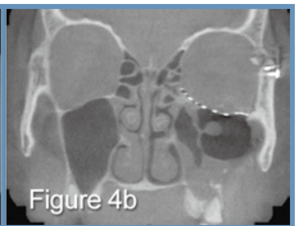

Figure 4b. Post-operative CT image of the same patient showing the orbital volume is restored after open reduction and internal fixation of the fractured zygoma and orbital floor repair with a titanium mesh plate.

Another technological advancement is the improvement in the accuracy in image-guided navigational surgery, which improves the surgical safety and outcome of orbital fracture management and reconstruction. Orbital reconstruction is challenging to many surgeons to restore the orbital volume while avoiding damage to the optic nerve at the apex. Dissection and implantation of materials to repair the orbital floor are procedures with known risks of causing blindness. Classical anatomical studies concluded that the mean distance of the orbital apex from the infra-orbital rim should be around 40mm. However, when an orbital floor fracture occurs together with a zygomatic complex fracture, the reference point of this measurement of safety may be lost. To achieve a stable orbital floor reconstruction and to restore the orbital volume, a posterior support is required for any kind of repair material. With improvement in the accuracy of the surgical navigation to be within 1mm of error, searching for the posterior support without risking the optic nerve becomes more predictable[9]. Moreover, by mirroring the non-fractured side to the fractured side, the surgeons may also use the navigation pointer to confirm the original anatomy of the orbital floor after repair is restored (Figures 5a and 5b). Studies have proved the overall outcome and safety are greatly improved with the help of the surgical navigational systems, especially in cases of deep and extensive orbital wall fractures[10,11].

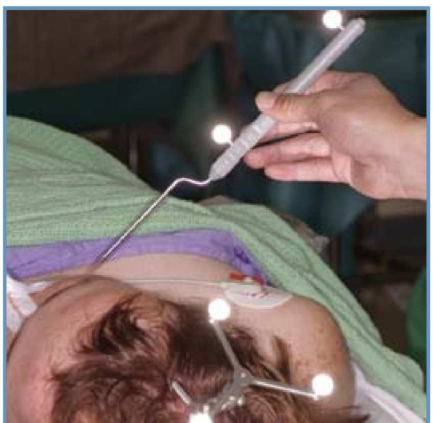

Figure 5a. Calibration of the navigation pointer at the start of the surgery.

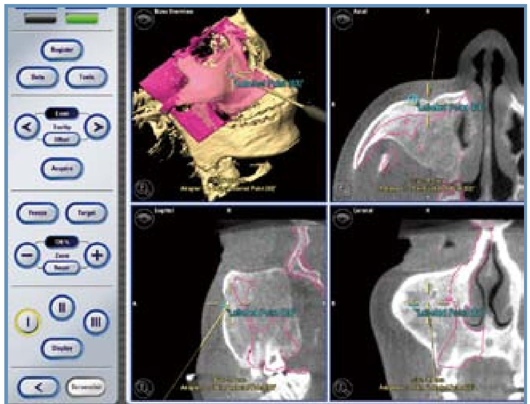

Figure 5b. Mirror images of the unfractured side to the fractured side can help to confirm the orbital floor or zygomatic complex fracture reduction is achieved

Conclusion

Controversies exist in the management of orbital fractures. Evidence-based practice has cleared some of the uncertainties but it will be a long continual process for clinicians and researchers to discover the best possible ways to achieve the most favourable outcome for the condition. Recently advances in technology have greatly improved the safety and outcome in orbital fracture management. With these technologies becoming more popular and financially affordable, oral and maxillofacial surgeons are looking forward to utilise these advances to benefit more patients with orbital fractures.

References

1. Scherer M, Sullivan WG, Smith DJ Jr, Phillips LG, Robson MC. An analysis of 1,423 facial fractures in 788 patients at an urban trauma center. J Trauma. 1989 Mar;29(3):388-90.
2. Kunz C, Sigron GR, Jaquiery C. Functional outcome after non-surgical management of orbital fractures-the bias of decision-making according to size of defect: critical review of 48 patients. Br J Oral Maxillofac Surg. 2013 Sep;51(6):486-92
3. Bähr W, Bagambisa FB, Schlegel G, Schilli W. Comparison of transcutaneous incisions used for exposure of the infraorbital rim and orbital floor: a retrospective study. Plast Reconstr Surg. 1992 Oct;90(4):585-91.
4. Ridgway EB, Chen C, Colakoglu S, Gautam S, Lee BT. The incidence of lower eyelid malposition after facial fracture repair: a retrospective study and meta-analysis comparing subtarsal, subciliary, and transconjunctival incisions. Plast Reconstr Surg. 2009 Nov;124(5):1578-86.
5. Potter JK, Malmquist M, Ellis E 3rd. Biomaterials for reconstruction of the internal orbit. Oral Maxillofac Surg Clin North Am. 2012 Nov;24(4):609-27.
6. Gunarajah DR, Samman N. Biomaterials for repair of orbital floor blowout fractures: a systematic review. J Oral Maxillofac Surg. 2013 Mar;71(3):550-70.
7. Hatcher DC. CT & CBCT imaging: assessment of the orbits. Oral Maxillofac Surg Clin North Am. 2012 Nov;24(4):537-43
8. Angelopoulos C, Scarfe WC, Farman AG. A comparison of maxillofacial CBCT and medical CT. Atlas Oral Maxillofac Surg Clin North Am. 2012 Mar;20(1):1-17.
9. Yu H, Shen G, Wang X, Zhang S. Navigation-guided reduction and orbital floor reconstruction in the treatment of zygomatic-orbital-maxillary complex fractures.J Oral Maxillofac Surg. 2010 Jan;68(1):28-34
10. Bly RA, Chang SH, Cudejkova M, Liu JJ, Moe KS. Computer-guided orbital reconstruction to improve outcomes. JAMA Facial Plast Surg. 2013 Mar 1;15(2):113-20.
11. Cai EZ, Koh YP, Hing EC, Low JR, Shen JY, Wong HC, Sundar G, Lim TC. Computer-assisted navigational surgery improves outcomes in orbital reconstructive surgery. J Craniofac Surg. 2012 Sep;23(5):1567-73.

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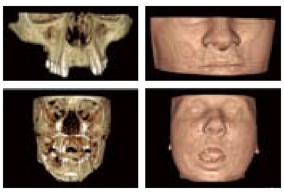

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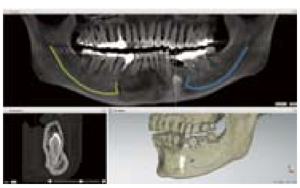

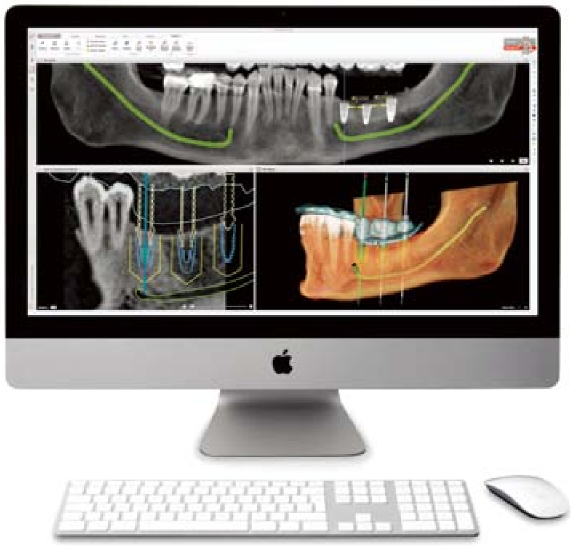

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Zygomaticomaxillary Complex Fractures – The Sunken Tripod of the Face

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Introduction

Zygomaticomaxillary complex (ZMC) fractures are common facial fractures resulting from assaults, traffic accidents, falling accidents and sports injuries. These injuries are found more common in males and most often at the age between 20 and 41 years old. Alcohol consumption could explain around 35% of all cases[1]. Since the zygomatic buttress is one of the most prominent frameworks of the human face, the incidence of fractures involving the ZMC is high. It comprised of around 34% of all facial fractures in one recent study in Italy[2], however the overall incidence worldwide had not previously been reported. It was estimated that the incidence of zygomatic fractures when compared to mandibular fractures was around 1:3 and when comparing zygomatic fractures to maxillary fractures it was around 2:1. It was also estimated that roughly around 25% of all ZMC fractures were associated with other fractures[3].

Report of two cases

The following is an illustration of two cases in a local maxillofacial surgical centre, which required surgical treatment.

The First case was a 30-year-old male who had been assaulted around six months ago. He presented with minimal swelling and ecchymosis when we first saw him (fig 1). He was diagnosed with a right sided tripod fracture over the ZMC immediately after the trauma at the emergency department of a local government hospital, however it was suggested that surgery might not be a must at that time. His main complaints were a depression over the right sub-orbital region and a mild numbness over the right infra-orbital area including the skin over the malar prominence and the lateral side the right nasal bridge. Sinus symptoms and trimus were not noted at that time. There was neither displacement of the globe nor any functional or motility loss to his right eye. His concern was purely cosmetic without any functional impairment. There were also facial scars already treated with laser previously.

Cone-Beam Computerised Tomography (CBCT) was taken and revealed a classical tripod fracture over the right ZMC (fig 2). There was an in-fracture of the right anterior maxillary wall, depressed ZMC with mild inferior rotation resulting in a mild step deformity over the inferior orbital rim and a depressed facial contour. The fracture was involved into the right infra-orbital foramen explaining the numbness over the relating region. The zygomatic arch was not displaced significantly so there was no hindrances towards the coronoid process in turn any trimus. The fracture lines had healed up because it was already six months ago since we first saw him. Explanation was given regarding the difficulties and the risks of fracturing it again although not totally impossible. Finally a decision was made to correct the deformity with the MEDPOR® non-resorbable implant (Stryker).


Fig 1. Clinical photos showing depression over right infra-orbital region.

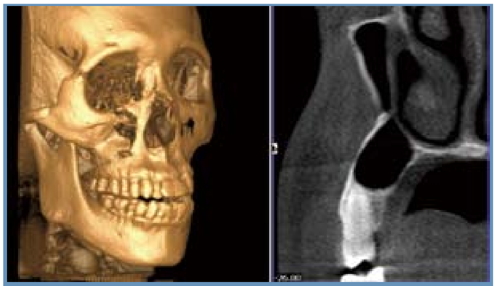
Fig 2. CBCT revealed right displaced and rotated ZMC fracture

A 3-dimensional (3D) model of the patient's skull was printed using an in-office 3D printer by utilising the patient's DICOM data from the CBCT. A specific MEDPOR® was chosen which suited to the right infra-orbital region with a spare space for the infra-orbital nerve. By utilising the 3D model, an acrylic template was made so that the MEDPOR® could be trimmed into a size that fitted to the defect during the surgery. Operation was done under general anaesthesia and the implant was fixed with titanium mini screws. The patient was satisfied post-operatively and regained a normal facial /infra-orbital profile (fig 3, 4). The numbness recovered a short while after the surgery although this was not directly related to the surgery.

Fig 3. Post-operative showing balanced and symmetrical facial profile

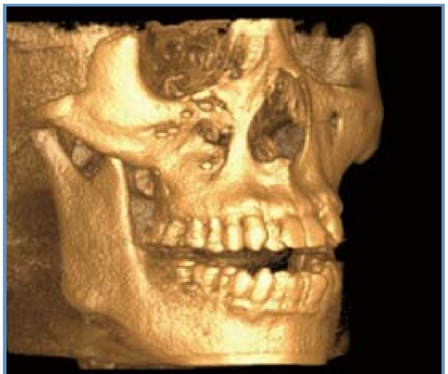

Fig 4. Post-op CBCT showing fixation screws with radiolucent MEDPOR

Another case was a similar ZMC fracture on the left side. The patient was a 35-year-old male who got injured during contact sports. He was admitted on the same day of the injury and CBCT scan was done for assessment (fig 5) of his fracture immediately after ruling out other problems of the rest of the body. His chief complaints were similar to the previous patient. However his mouth opening measurement was only around 18mm. There was, fortunately, no eye involvement, but a mild numbness over his left infra-orbital region. His diagnosis was left ZMC tripod fracture with minimal displacement of his fronto-zygomatic process and zygomaticomaxillary process. However a significant inward displacement of the mid portion of the zygomatic arch was noted (fig 6). This explained the trimus for there was hindrance over the left coronoid process and the oedema over the attached temporalis myofascial layer and its tendon. There were also comminuted fragments over the left posterior lateral side of the maxilla. A 3D model was printed in the same manner for a detailed understanding of the ZMC displacement and for better patient communications. The decision was made for open reduction and internal fixation after discussion regarding to the pros and cons and possible risks and benefits. Operation was done under general anaesthesia. An intra-oral approach was used with good enough exposure up to the zygomatic buttress and arch area. Reduction was done adequately with Rowe's dis-impaction forceps and 2.0 titanium mini plates and fixation screws were placed to stabilise the segment. Small fragments at the back of the lateral maxillary sinus wall were removed and the edges smoothened. Around 45mm of Mouth opening was achieved on table after the operation. Healing was satisfactory post-operatively and he could regain his usual mouth opening after the swelling had subsided. Unfortunately his numbness did not recover fully as we havehad expected. Figure 7 shows his post-operation CBCT.

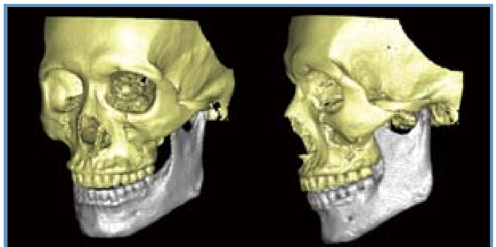

Fig 5. Left ZMC fracture with minimal displacement but comminuted posterior maxillary wall

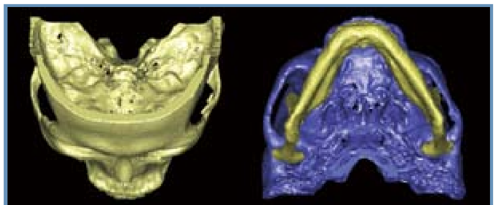

Fig 6. In-fracture of left zygomatic arch, hindering the movement of left coronoid

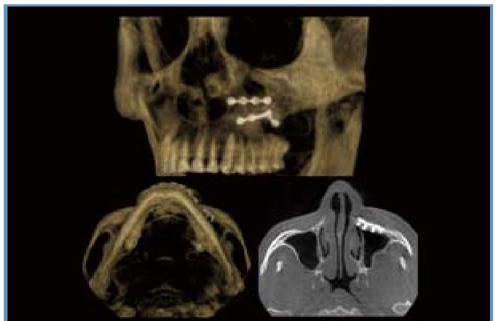

Fig 7. Post-op CBCT showing zygomatic arch was adequately reduced without interfering the coronoid process movement

Discussion

There are many different classifications reported to categorise different types of ZMC fractures. The most commonly quoted one was by Zingg et al[4]. This system encompasses all types of ZMC fractures. Type A involves only one site of the ZMC. It was sub-classified as type A1, the arch; A2, the lateral orbital rim; and A3, the inferior orbital rim. Type B involves all four suture lines of the ZMC (tripod fracture) and lastly Type C involves comminuted ZMC fractures. The author personally also likes the classification by Knight and North[5] which indicates the displacement of the ZMC by its anatomical nature from group I to VI: Group I, no displacement; Group II inward displacement of the malar; Group III, un-rotated body fracture; Group IV, medially rotated body fracture; Group V, laterally rotated body fracture and finally Group VI, complex fracture (presence of additional fracture lines across

the main fragments). Only a combination of these two systems can describe in full details of a ZMC fracture.
It was reported that only around 34% of all ZMC fractures required surgical intervention6 while others reported that approximately 77% to 94% needed surgical interventions[5]. There is, however, no consensus as to who and when surgeries are required and they will mostly depend on the practice of each centre and the patients' acceptance. According to Knight and North[5], Group II and Group V needed only closed reductions without fixation and those in Group III, IV and VI needed open reduction and adequate fixation. The main indication of surgical intervention is functional impairment and most importantly is the eye. Muscle entrapment may lead to inadequate movement of the eye, thus with visual impairment such as diplopia. Others include pressure over the optic nerve by haematoma, while entrapment of nerves and injury to the orbital apex could lead to serious consequences as it is very close to the internal carotid artery and cavernous sinus. Trimus caused by in-fracture of the zygomatic arch needs to be addressed because if untreated, it may heal up fused with the coronoid process resulting in jaw ankylosis.

Cosmetic correction is another reason for surgical intervention of ZMC fractures although it is not an absolute indication. The ZMC is one of the most important frameworks supporting the face. The malar prominence consists of four major pillars or buttresses namely, A. frontozygomatico, B. zygomaticotemporal, C. zygomaticomaxillary and D. zygomaticosphenoid (fig 8). A typical ZMC fracture almost always involves three or more of these buttresses. Delayed or inadequate correction may lead to depression of the malar prominence, depression over the zygomatic arch area and enophthalmos. Despite seemingly adequate reduction and fixation, several authors have also noted a relative high rate of asymmetry after surgery up to around 13%[4, 7]. These may probably be due to inadequate reduction masked by soft tissues due to its lack of accessibility or post-operative displacement attributed by inadequate fixation and/or muscle and scar contracture. If the fracture involves a blow out of the orbital floor, it will result in an increase of the volume of the orbit and thus with subsequence problems. This situation is addressed by another colleague in the next article of the same issue and will not be discussed here.

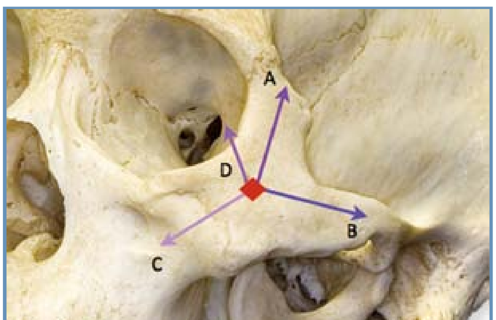

Fig 8. Zygomaticomaxillary buttresses

Diagnoses of ZMC fractures are mostly clinical. A full history should be taken and any underlying medical condition should be understood. Most of the time a ZMC fracture is not an emergency and clinicians should take time for stabilising the vital signs and rule out other problems before hand. Spiral Computerised Tomography (CT) or CBCT is a gold standard for diagnosis and classification of a ZMC fracture, although one may still want to have some plain X-rays, such as the Waters, Caldwell and sub-mental views. CT allows physicians to evaluate the globe, nerve and extra-ocular muscle involvement besides looking at the fracture itself. It also helps to rule out other facial fractures, skull fractures and intro-cranial injuries. Documentation of any paraesthesia by the clinician who first saw the patient is crucial because it was reported that up to around 70% to 90% of neurosensory deficits could be permanent[8].

Open reduction and rigid fixation is the gold standard for patients who are indicated for surgical intervention. The most commonly used surgical approaches are the intra-oral and Gillies approaches. If the inferior orbital rim needs to be exposed more for reduction and fixation, a sub-conjuctival or lower eyelid approaches such as a subciliary, subtarsal or infra-orbital incision would be indicated. Theoretically the incision should be intra-oral whenever possible to avoid scars on the face. Ellis and Kittidumherng[7] concluded that all approaches involving the internal orbit imposed risks of complications and should be avoided whenever possible. For example ectropion(12%) and permanent sclera show(28%) might happen after the subciliary approach while sclera show happened in around 3% of transconjuctival approaches[9]. A subtarsal approach should not be used unless there iswas already skin laceration over that region. It could cause poor cosmetic derangement over the lower eyelid with prolonged oedema, which is difficult to be corrected[10]. The scar over a Gillies incision could be hidden quite well within the hairline so it might be a good choice in some situations. The trend in the current literatures always suggest clinicians to have less soft tissue disruption and thus less scaring and less complications. One can make good use of appropriate instruments for good reduction and fixation, such as Carroll-Girard screws and a bone hook. The long arm of the Rowe's dis-impaction forceps helps a lot to reduce arch fractures adequately. A right angled hand piece and screwdriver may spare a lot of skin incision during fixation. Another recent treatment development is the endoscopic approach. This approach allows surgeons to visualise the fractures directly without exposing them with large incisions by a sub-labial approach and access to the orbital floor with a trans-antral approach. Reduction and fixation could be done easily with the help of the endoscope[11].

Fixation was suggested to be at least two or three points with rigid or semi rigid fixation screws and plates. The Frontozygomatico suture, if displaced, is a good place to fix because it is one of the most important pillars of the facial skeleton. Due to the hardness and thickness of the bone and without important structures around, it always results in a good and adequate fixation without many complications. However a lateral eyebrow incision or an upper blepharoplasty incision may be needed in addition. A recent study by Kim et al[12] suggested that one point fixation at the buttress provided sufficient stability of the ZMC if there was no comminuted fractures over the orbital rim. A one point fixation concept helps to reduce a lot of unnecessary incisions and exposure and as long as the fracture is adequately reduced, results would be satisfactory. Sometimes the post-operative deformity could be attributed to the strong muscle pull by the masseteric sling. Although most of the time the teeth and occlusion are not involved in ZMC fractures, it is always good to advise the patients to have a soft diet for around two weeks to avoid excessive muscle pull. An injection of botulinum toxin has been advocated by Davidson et al[13] to paralyse the masseter muscle and allow proper healing of a repaired ZMC fracture and was proven to be effective.

Conclusion

ZMC fractures are common facial fractures, which are usually easy to deal with. With accurate diagnosis by CT scans, a great proportion of patients could regain their symmetrical facial contours and functions. The technology of 3D printing helps a great leap for better understanding of the nature of individual fracture patterns and better surgery by fabrication of templates and pre-bent fixation plates beforehand. However if the fracture involves the disturbance of the orbital content, sometimes it may be difficult to have full recovery. Hopefully in the future, there could be better navigation devices and minimally invasive tools to help clinicians to do easier, quicker and better surgeries for the patients.

References

1. Bogusiak K, Arkuszewski P. Characteristics and epidemiology of zygomaticomaxillary complex fractures. J Craniofac Surg. 2010;21(4): 1018-1023
2. Aroangio P et al. Maxillofacial fractures in the province of Latina, Lazio, Italy: Review of 400 injuries and 83 cases. J Craniofac Surg. 2013. article in press
3. Ellis E III et al. An analysis of 2067 cases of zygomatico-orbital fracture. J Oral Maxillofac Surg. 1985;43(6): 417-428
4. Zingg M et al. Classification and treatment of zygomatic fractures: a review of 1025 cases. J Oral Maxillofac Surg. 1992;50(8): 778-790
5. Knight JS, North JF. The classification of malar fractures: an analysis of displacement as a guid to treatment. Br J Plast Surg. 1961;13: 325-339
6. Sargent LA, Fernandez JG. Incidence and management of zygomatic fractures at a Level I trauma Center. Annals Plast Surg. 2012;68(5): 472-476
7. Ellis E III, Kittidumkerng W. Analysis of treatment for isolated zygomatico-maxillary complex fractures. J Oral Maxillofac Surg. 1996;54(4): 386-401
8. Ceallaigh PO et al. Diagnosis and management of common maxillofacial injuries in the emergency department. Part 4: Orbital floor and mid face fractures. Emerg Med J. 2007;24: 292-293
9. Appling WD et al. Transconjuctival approach vs subciliary skin-muscle flap approach for orbital fracture repair. Arch Otolaryngol Head Nexk Surg. 1993;119(9): 1000-1007
10. String B, Sykes J. Zygoma complex fracture. Facial Plast Surg. 1998;14(1): 105-115
11. Mueller R. Endoscopic treatment of facial fractures. Facial Plast Surg. 2008;24(1): 78-91
12. Kim JH et al. The effectiveness of 1-Point fixation for zygomaticomaxillary complex fracture. Arch Otolaryngol Head Neck Surg. 2012;138(9): 828-832
13. Davidson J et al. Zygomatic fractures: comparison of methods of internal fixation. Plast Reconstr Surg. 1990;86(1): 25-32

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Overview of Dentoalveolar Fractures

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Dentoalveolar injuries are those injuries involving the teeth, the alveolar portion of the maxilla and mandible, and the adjacent soft tissues.[1]

A 12-year literature review showed a high prevalence of traumatic dental injuries in the primary and permanent teeth throughout the world. One third of all preschool children have suffered a traumatic dental injury involving the primary dentition, one fourth of all school children and almost one third of adults have suffered a trauma to the permanent dentition.[2]

In the paediatric population, a bimodal trend in the peak incidence in traumatic injuries was observed in 1-4 years of age and the eighth year of life.[9] This may be due to developing motor coordination in the early years of life and increased in participations in sports and play activities respectively. Falls is the most common cause and the predominant location is at home, followed by the school. Higher incidence of periodontal tissue injury is observed and concussion is the most common type of injuries.[4,10] This is suggested to be because of higher elasticity and resilience of the supporting bones in children.

Sports, falls, violence and traffic accidents are common aetiologies in adolescents and the adult population with variable rankings between countries.[3,5,11-13] The most common types of injury are uncomplicated crown fractures and subluxations.[3,5,8]

In general, males are at higher risks of experiencing injuries than females[3-5,9], considering their high interests in recreational activities and sports. Yet, there was a study that revealed no statistically significance between the genders. 6 This may be due to the reason that more girls are interested in leisure recreational activities.

The anterior teeth are mostly involved in both the primary and permanent dentitions, especially the maxillary central incisor.[2,4-5,8,10] An increased overjet is a known predisposing factor to traumatic dental injuries.[7]

History Taking and Clinical Examination

It is necessary to obtain a thorough history on the patient's medical problems and details of the traumatic incident, including the time, location and nature of injury, loss of consciousness and presence of malocclusion, for the establishment of a correct diagnosis and optimal treatment planning.

Examination should be comprehensive and systematic. An avulsed tooth, loose tooth fragments and a dislodged dental prosthesis should raise the suspicion of aspiration and ingestion. Vital signs and any wheezing sound on breathing should be observed. Chest or abdominal radiographs should be arranged if indicated.

Location of any extra-oral laceration, abrasion, contusion and facial swelling and any neurosensory deficit should be recorded. The facial bones should be palpated for any bony step or displacement and tenderness because they can indicate an underlying hidden facial bone fractures. The temporomandibular joint should be assessed for any pain or sound on function and range of movement.

Next, location of any intra-oral soft tissue laceration, abrasion and haematoma should be inspected. Any sublingual haematoma at the floor of the mouth indicates a fracture of the anterior mandible. The occlusion should be examined with manipulation for any presence of open bite, displacement and mobility. The teeth should be examined for involvement of enamel, dentine and pulp, displacement, mobility or bleeding. A percussion test and vitality pulp test may provide further information on the involvement of the periodontal or pulp tissue and underlying fractures.

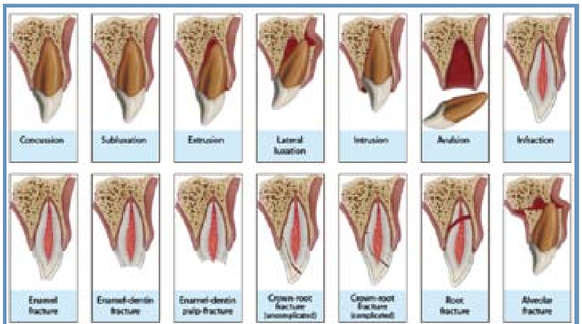
Radiographic Examination

Radiographs are essentials to provide additional information in trauma cases. However, there is a lack of consensus in regard to the methods of radiography in dentoalveolar trauma.[14] Different radiographs should be ordered on individual clinical basis. Orthopantomogram is simple and easily accessible. It gives an overall picture on the dentition and jaw bones in low radiation dosage. It is useful in diagnosis of mandibular or condylar fractures. However, the anterior part of the maxilla and mandible are not clearly seen due to the superimposition with the cervical vertebrae. Intra-oral radiographs (periapical or occlusal view) give details on crown and root fractures, tooth displacements and stages of apical development. It can also be used with a low radiation dose to evaluate for any embedded foreign objects inside the oral soft tissues. Conventional computer tomography (CT) is useful in the assessment of maxillofacial fractures as it gives details of the injury in three-dimensional views. Cone-beam computed tomography has a high diagnostic accuracy in a lower radiation dosage when compared to conventional CT. It is useful in maxillofacial and dental injuries.

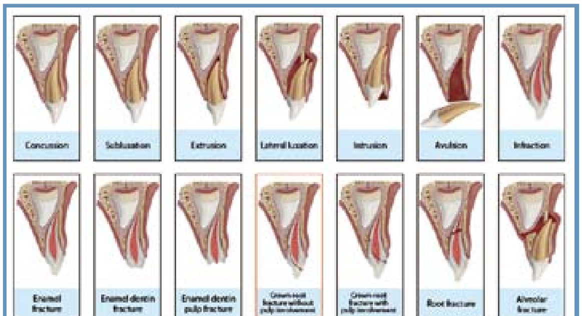
Classification of Dentoalveolar Injuries

Classification adopted by World Health Organiszation and modified by Andreasen is commonly used. It categorised traumatic injuries into involvement of dental tissue and pulp, periodontal tissue, supporting bone, and gingival or oral mucosa.[15]

Types of Dentoalveolar Injury
Dental Tissue and Pulp Enamel infraction Enamel fracture Enamel-dentine fracture Complicated crown fracture Uncomplicated crown-root fracture Complicated crown-root fracture Root fracture
Periodontal Tissue Concussion Subluxation Extrusive luxation Lateral luxation Intrusive luxation Avulsion
Supporting bone Comminution of the mandibular or maxillary alveolar socket Fracture of the mandibular or maxillary alveolar socket wall Fracture of the mandibular or maxillary alveolar process Fracture of mandible or maxilla
Gingivae and oral mucosa Laceration Contusion Abrasion



Types of Dentoalveolar Injury for Permanent Teeth. (Adapted from Dental Trauma Guide, www.dentaltraumaguide.org)



Types of Dentoalveolar Injury for Primary Teeth. (Adapted from Dental Trauma Guide, www.dentaltraumaguide.org)

Diagnosis and Treatment for the Permanent Dentition

The International Association of Dental Traumatology (IADT) has developed a consensus statement after a review of the dental literature and group discussions. The guideline was first published in 2001 and was updated, describing the management of traumatic dental injuries.[16-19] A brief summary of the diagnosis and treatment would be discussed as follows:

Injury to the Dental Tissue and Pulp

Crown and crown-root fractures can be classified as complicated or uncomplicated, with and without pulpal involvement respectively. Uncomplicated crown fractures include enamel infraction, enamel fracture and enamel-dentine fracture. The treatment options will depend on the extent and location of the fracture, pulpal involvement and stage of root development.

Enamel infraction

It is an incomplete fracture (crack) of the enamel without the loss of tooth substance. Presence of a crack line is visible with transillumination. No immediate treatment is usually necessary.

Enamel fracture

It is a crown fracture involving the enamel only, with the loss of tooth substance. Smoothening of the rough edge or restoration with composite resin should be performed depending on the extent and location of the crown fracture.

Enamel-dentine fracture

It is a crown fracture involving the enamel and dentine only, without exposure of the pulp. The pulp test is usually positive. Restoration with suitable restorative materials is necessary to prevent bacterial penetration through the dentinal tubules, which may lead to pulpal inflammation.

Complicated crown fracture

It is a crown fracture involving the enamel, and dentine with exposure of the pulp. Bleeding from the pulp horn or pulp chamber is visible. The pulp test is usually positive. In a fractured tooth with a closed apex, root canal treatment is usually the treatment of choice with subsequent restoration or crown fabrication. In a fractured tooth with an open apex, pulp vitality should be preserved by pulp capping and pulpotomy to allow further root development. Calcium hydroxide and mineral trioxide aggregate are suitable materials for such procedures.

Uncomplicated crown-root fracture

It is a fracture involving the enamel, dentine and cementum, without exposure of the pulp. A fracture line extends below the gingival margin and mobile crown fragments are observed. The tooth is tender to the percussion test. Loose fragments should be removed and the extension of the fracture line should be assessed. Extraction is necessary for any deep crown-root fractured tooth. Restoration with glass ionomer or composite resin should be performed with crown lengthening or orthodontic extrusion if necessary.

Complicated crown-root fracture

It is a fracture involving the enamel, dentine and cementum, with exposure of the pulp. A fracture line extends below the gingival margin and mobile crown fragments are observed. The tooth is tender to the percussion test. Loose fragments should be removed and the extension of the fracture line should be assessed.

Extraction is inevitable in any vertically fractured tooth. In fractured teeth with open apices, pulp vitality should be preserve whenever possible by pulp capping or a partial pulpotomy. In a fracture tooth with a closed apex, root canal treatment is the treatment of choice. Crown lengthening or orthodontic extrusion may be necessary.

Root fracture
It is a fracture involving the dentine, pulp and cementum. Mobile coronal segments and bleeding from the gingival sulcus may be observed. The pulp test is usually negative. The tooth may be tender to the percussion test. Repositioning of the coronal segment, if displaced, should be done and stabilised with flexible splint for 4 weeks. The pulpal status should be monitored and root canal treatment up to the fracture line is indicated if pulp necrosis develops.

Injury to Periodontal Tissue

There are a total of 7 types of injury, classified according to the extent of mobility and displacement of the injured teeth. Avulsion is the most severe type of injury. Treatment options depend on the mobility and displacement of the injured teeth and the stages of root development.

Concussion
It is an injury to the tooth supporting tissue, without increased mobility or displacement. The tooth is tender to percussion. No immediate treatment is necessary.

Subluxation
It is an injury to the tooth supporting tissue, resulting in increased mobility but without displacement of the tooth. The tooth is tender to the touch or percussion. Bleeding from the gingival sulcus is visible. The pulp test may be negative due to transient pulpal damage. Usually no treatment is necessary. A 2-weeks' flexible splint for stabilisation may be indicated in cases of excessive mobility.

Extrusive luxation
It is an injury with partial displacement of the tooth out of the socket in an occlusal direction. The tooth looks longer, with excessive mobility. It is tender to percussion. The alveolar socket bone is usually intact. The pulp test is usually negative. Increased periodontal ligament space is noted on radiographs. The tooth should be repositioned with gentle force. Stablisation of the injured tooth with a flexible splint should be applied for 2 weeks. The pulpal status should be monitored for any possibility of pulpal necrosis.

Lateral luxation
It is an injury with displacement of the tooth from the socket in a labial or palatal/lingual direction. It is usually associated with comminution or fractures of the labial or palatal/lingual alveolar socket bone. The tooth is displaced and non-mobile. It usually gives a high metallic sound on percussion. Widening in the periodontal ligament space is noted on radiographs, better with the occlusal view. The tooth should be repositioned with gentle force or forceps. Stabilisation of the injured tooth with a flexible splint should be applied for 4 weeks due to the associated bone fracture. The pulpal status should be monitored for any possibility of pulpal necrosis.

Intrusive luxation
It is an injury with displacement of the tooth into the alveolar socket. It is usually associated with comminution or fractures of the alveolar socket. The tooth is displaced and non-mobile. It gives a high metallic sound on percussion. Lack of a periodontal ligament space is noted on radiographs. Spontaneous eruption should be allowed in cases of injured teeth with open apices. In cases of injured teeth with closed apices, surgical repositioning should be performed with application of flexible splints for 4-8 weeks. As revascularisation of the pulp is unlikely in a closed apex and therefore root canal treatment should be performed 3-4 weeks post-trauma to avoid any related root resorption.

Avulsion
It is an injury with complete displacement of the tooth out of the socket. The socket is empty and filled with blood clot. Radiographs should be taken to confirm any possible intrusion and root fractures. Replantation is the treatment of choice, but is not indicated if the involved tooth is with severe caries or periodontal disease and in patients with severe medical conditions. The choice of treatment depends on the maturity of the root, the condition of periodontal ligament cells, in which it is related to the storage medium and the extra-oral dry time. All periodontal ligament cells are non-viable after a dry time of 60 minutes or more.

For immediate replantation, the tooth should be picked up by holding the crown. The root should be washed under cold running water for a maximum of 10 seconds. The tooth is replanted into the socket and bite on a handkerchief to hold it in position. If replantation is not possible, the avulsed tooth should be stored preferably in a special storage medium (Hank's balanced storage medium) if accessible or in cold milk, saliva or saline. Emergency dental treatment should be sought immediately.

In cases of immediate replantation or within 60 minutes, a flexible splint should be applied for 2 weeks. Root canal treatment should be performed 7-10 days after replantation in an avulsed tooth with a closed apex and pulpal necrosis in an avulsed tooth with an open apex.

In cases of delayed replantation (extra-oral dry time longer than 60 minutes), ankylosis or root resorption should be expected and the tooth will be lost eventually. The treatment goal is to restore aesthetics, function and to maintain the alveolar bone contour. The avulsed tooth should be splinted for 4 weeks. Root canal treatment should be started 7-10 days in avulsed tooth with closed or open apices.

Alveolar fracture

It is a fracture of the alveolar process, may or may not involve the alveolar socket. Multiple teeth will move as one unit on manipulation. There will be presence of occlusal interference. The teeth are tender to percussion. A vertical fracture line may be seen on radiographs. The displaced segment should be manually repositioned or using forceps. The segment should be stabilised with a flexible splint for 4 weeks. In cases if the segment is grossly displaced or cannot be freely reduced, open reduction may be indicated. The displaced segment can then be stabilised with monocortical plates or wires.

Special Considerations in the Primary Dentition

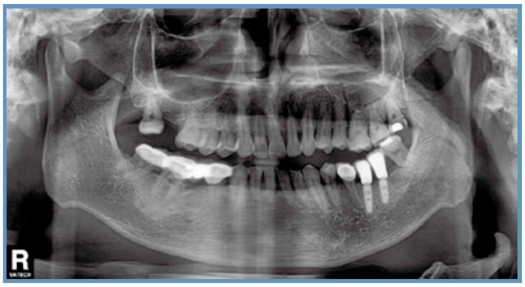
Root apices of primary teeth are closely related to the developing permanent teeth. As such, one of the treatment goals is to avoid the damage to permanent tooth buds, which may lead to malformations and disturbances in development and eruption. Displacement injuries are more common in children. In cases of root fractures, the mobile coronal fragment should be removed and the apical fragment should be left to be resorbed. It is not recommended to replant avulsed primary teeth in most instances. Splinting is only used for alveolar bone fractures or possibly intra-alveolar root fractures.

Case report

A 61-year-old gentleman was referred to us by our Accident and Emergency Department colleagues for assessment and management of jaw injuries. He was a victim of a motorbike traffic accident happened in the Mainland. He fell from the motorbike and landed on the left side of his face and body. It had been one week after the accident when he was first presented to us. He complained of inferior displacement of his upper left posterior teeth with malocclusion.

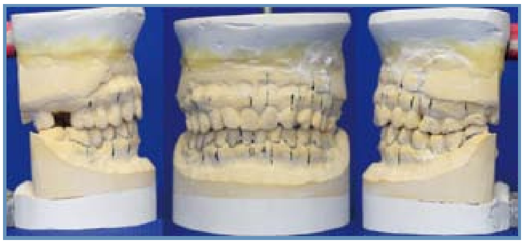
On clinical examination, he presented with bruising over the left peri-orbital region. There was no obvious bony displacement over the orbital rim, zygomatic arch and inferior border of the mandible. No limited mouth-opening or pain over the temporomandibular joint was observed. Intra-orally, there was bruising over the left posterior maxillary sulcus. A left posterior maxillary dentoalveolar segment was inferiorly displaced, causing an open bite at the anterior and right posterior segments. The fractured segment could not be manually reduced to its original position.

Orthopantomogram was taken and showed a vertical fracture line between the upper left second premolar and first molar.



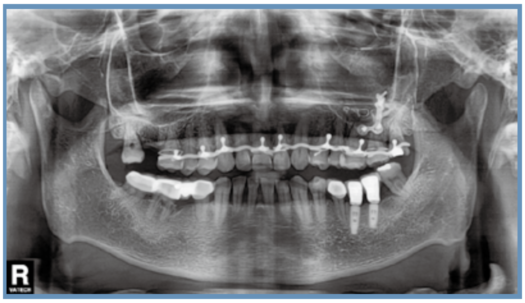
A set of upper and lower dental impressions was taken for occlusal analysis and model surgery.

Model surgery was performed and pre-injury occlusion could be restored.



Open reduction and internal fixation for the displaced left posterior maxillary dentoalveolar fracture was performed under general anaesthesia. Left posterior vestibular incision was made. Fractures of the anterior wall of the maxillary sinus and the left posterior maxillary dentoalveolar block were well exposed. The malunited displaced segment was osteomised, mobilised and reduced. Pre-injury occlusion was restored with the aid of an occlusal wafer. The fractured segment was stabilised by a 2.0mm miniplate and arch bar. The fragments of the anterior wall of the maxillary sinus were stabilised by stainless steel wires. The wound was debrided and closed by Vicryl 4/0.

The patient presented with mild pain and left facial swelling early post-operatively, which gradually subsided. Post-operative orthopantomogram was taken and showed the fracture site was well stabilised.



The wound healed well without any late complication. Function was fully restored. Occlusion was stable and maintained at his pre-injury position. He was scheduled for regular reviews at our Specialty clinic.

Conclusion

Dentoalveolar trauma is common and it can be associated with maxillo-mandibular fractures. A correct diagnosis is mandatory and appropriate treatment should be provided for favourable outcomes.

A questionnaire survey in 2012 showed insufficient knowledge on emergency management of dental trauma among primary and secondary school teachers in Hong Kong. Mass media campaigns or projects should be launched to increase public awareness especially of parents and teachers on the emergency treatment of dental injuries.

References

1. Robert A. Dale. Dentoalveolar trauma. Emergency Medicine Clinics of North America 2000; 18: 521-538.
2. Ulf Glendor. Epidemiology of traumatic dental injuries – a 12 year review of the literature. Dental Traumatology 2008; 24: 603-611.
3. Gassner R, Tuli T, Hächl O, Rudisch A, Ulmer H. Cranio-maxillofacial trauma: a 10 year review of 9543 cases with 21067 injuries. Journal of Cranio-Maxillofacial Surgery 2003; 31: 51-61.
4. Sung Chul Choi, Jae Hong Park, Ahran Pae, Jong Ryul Kim. Retrospective study on traumatic dental injuries in preschool children at Kyung Hee Dental Hospital, Seoul, South Korea. Dental Traumatology 2010; 26: 70-75.
5. Gong Y, Xue L, Wang N, Wu C. Emergency dental injuries presented at the Beijing Stomatological Hospital in China. Dental Traumatology 2011; 27: 203-207.
6. Traebert J, Peres MA, Blank V et al. Prevalence of traumatic dental injury and associated factors among 12-year-old school children in Florianópolis, Brazil. Dental Traumatology 2003; 19: 15-18.
7. Ulf Glendor. Aetiology and risk factors related to traumatic dental injuries – a review of the literature. Dental Traumatology 2009; 25: 19-31.
8. Eva Lauridsen, Nuno Vibe Hermann, Thomas Alexander Gerds et al. Pattern of traumatic dental injuries in the permanent dentition among children, adolescents, and adults. Dental Traumatology 2012; 28: 358-363.
9. Gassner R, Tuli T, Hächl O, Moreira R, Ulmer H. Craniomaxillofacial trauma in children: a review of 3,385 cases with 6,060 injuries in 10 years. Journal of Oral and Maxillofacial Surgery 2004; 62: 399-407.
10. Yin Man Chan, Sheila Williams, Lesley E. Davidson, Bernadette K. Drummond. Orofacial and dental trauma of young children in Dunedin, New Zealand. Dental Traumatology 2011; 27: 199-202.
11. Hecova H, Tzigkounakis V, Merglova V, Netolicky J. A retrospective study of 889 injured permanent teeth. Dental Tramatology 2010; 26: 466-475.
12. Flavio Brunner, Gabriel Krastl, Andreas Filippi. Dental trauma in adults in Switzerland. Dental Traumatology 2009; 25: 181-184.
13. Tham RC, Cassell E, Calache H. Traumatic orodental injuries and the development of an orodental injury surveillance system: a pilot study in Victoria, Australia. Dental Traumatology 2009; 25: 103-109.
14. Leif Kullman, Mona Al Sane. Guidelines for dental radiography immediately after a dento-alveolar trauma, a systematic literature review. Dental Traumatology 2012; 28: 193-199.
15. Andreasen JO. Textbook and color atlas of traumatic injuries to the teeth.
16. Dental Trauma Guide. www.dentaltraumaguide.org
17. Anthony J. DiAngelis, Jens O. Andreasen, Kurt A. Ebeleseder, David J. Kenny et al. International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: 1. Fractures and luxations of permanent teeth. Dental Tramatology 2012; 28: 2-12.
18. Lars Andersson, Jens O. Andreasen, Peter Day, Geoffrey Heithersay et al. International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: 2. Avulsion of permanent teeth. Dental Traumatology 2012; 28: 88-96.
19. Barbro Malmgren, Jens O. Andreasen, Marie Therese Flores, Agneta Robertson et al. International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: 3. Injuries in the primary dentition. Dental Traumatology 2012; 28: 174-182.
20. Cecilia Young, KY Wong, LK Cheung. Emergency management of dental trauma: knowledge of Hong Kong primary and secondary school teachers. Hong Kong Medical Journal 2012; 18: 362-370.

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About 3D Printing

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Fig 1.Cover story of Economist

Introduction

Recently, 3D printing is a subject in the focus of media attention. There are many cover stories, news reports, TV programmes, and conferences on 3D printing across the world. Authorities say that 3D printing will bring the third industrial revolution (Fig 1). As a global trend, designers, engineers, architects, scientists, healthcare professionals and hobbyists are learning and exploring the power of 3D printing (Fig 2a to 2d). 3D printers are available from the professional grade for industries to a desktop size for hobbyists (Fig 3a to 3b).

Fig 2a. 3D printed bicycle; Fig 2b. 3D printed lamp by MGX; Fig 2c. Food printer; Fig 2d. Family figures by 3D printing; Fig 2e. 3D printed fashion and shoes

Fig 3a. Industrial grade 3D printer; Fig 3b. Desktop 3D printer by MakerBot

What is 3D printing? What can we do with 3D printing?

Although 3D printing sounds like a new technology, it first appeared almost 30 years ago. In 1984, Charles Hull conducted experiments on how ultraviolet light could be used to solidify liquid photopolymers. Hull soon realised his experiments could build a 3D object of any shape from scratch and he named this process "Stereolithography". On March 11, 1986 Hull obtained a US patent for his apparatus for producing 3D objects using Stereolithography (SLA). In 1988, Hull and his co-workers successfully launched the first commercial 3D printer and also created the STL* file format for 3D printing.

*STL (STereoLithography) is a file format native to the stereolithography CAD software created by 3D Systems. STL is also known as Standard Tessellation Language. This file format is widely used for rapid prototyping and computer-aided manufacturing.

At about the same time in America, another 3D printing pioneer, Scott Crump, invented a material extrusion process called fused deposition modelling (FDM). When these 3D printing processes were first employed, they were mainly used for rapid prototyping.

Nowadays, both Stereolithography (SLA) and Fused Deposition Modelling (FDM) are known as additive manufacturing** processes. Additive manufacturing is defined as the process of joining materials to fabricate objects from 3D data, usually layer upon layer, as opposed to subtractive manufacturing methods. In recent years, additive manufacturing has expanded its applications from rapid prototyping to include rapid tooling, metal casting, and rapid manufacturing.

Since the introduction of SLA and FDM, additive manufacturing (AM) evolves continuously and it is adopted by various industries such as the sectors for consumer products and for motor vehicles. The medical and dental sector has been ranked the third largest user of 3D printing globally over the past decade. Medical and dental applications include anatomical and surgical models, custom-made implants and prosthetics, personalised surgical guides, templates, and instruments.

Today, there are many processes and materials available for additive manufacturing. According to the ASTM*-approved systems, Additive Manufacturing processes can be categorised as:

1. Material extrusion,
2. Material jetting,
3. Binder jetting,
4. Sheet lamination,
5. Vat photo-polymerisation,

6. Powder bed fusion, and
7. Directed energy deposition.

*ASTM is the American Society for Testing and Materials

Stereolithography (vat photo-polymerisation), Fused Deposition Manufacturing (material extrusion), PolyJet and PolyJet Matrix Technology (material jetting), and 3D printing (binder jetting) are the most popular processes used by the dental industry.

In this article, the author will present the various dental applications employing the additive manufacturing process.

Anatomical and surgical models

Anatomical models produced by additive manufacturing are made for a specific patient based on data from a medical imaging study. These models are replicas of a patient's anatomical structures useful for planning complex surgical procedures.

3D models for planning bone reconstructive surgery are used by surgical specialists in oral and maxillofacial surgery, neurosurgery, plastic & reconstructive surgery and orthopaedic surgery. The commonest indications for these models include bending metal reconstruction plates for fixation, creating custom implants, and designing distraction devices, etc. Documented benefits of these anatomical models include:

1) Optimised treatment plan,
2) Reduced surgical time, and
3) Improved surgical outcome.

Advanced imaging techniques such as multi-slice computed tomography and cone beam computed tomography are essential for diagnosis and treatment planning when treating patients for dental implants, orthognathic surgery, tumour resection, and jaw reconstruction. By employing some medical software such as Mimics™ (Materialise Interactive Medical Image Control System), we can convert the DICOM-3 format of the imaging files to the STL format for 3D printing.

Image processing of the DICOM3.0 image data involves the following steps:

1. Image segmentation*
2. Output to STL format

* **Image segmentation** is the process of partitioning a digital image into multiple segments.. When applied to a stack of images, typical in medical imaging, the resulting contours after image segmentation can be used to create 3D reconstructions with the help of interpolation algorithms.

After image processing, it is ready to print the 3D model. The models can be created by different 3D printing methods using different materials. In general, we can make plastic models or plaster models. Plastic models made by stereolithography and PolyJet have the thinnest layers of 0.025 mm and 0.016 mm respectively. Plaster models made by binder jetting can reach 0.102 mm to 0.089 mm thin. To achieve a better illustrative function, plastic models can be made of multiple materials with different colours and consistencies (Fig 4a and 4b). Similarly, plaster models can be produced in multiple colours. In general, plastic models are more durable than plaster models; however, plastic materials are also more expensive.

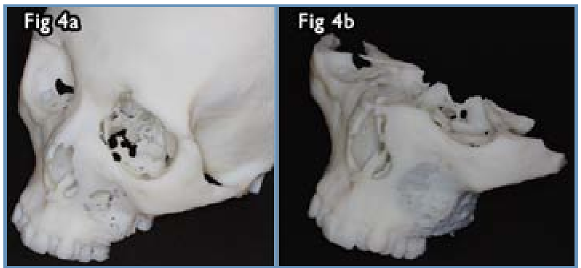

Fig 4a. Myxoma left maxilla - single material model;
Fig 4b. Myxoma left maxilla-multimaterial model

Surgical guides and templates

In addition to anatomical and surgical models, we can also print surgical guides and templates. The surgical guides and templates are custom devices to assist clinicians to transfer the computer-based surgical plan to the surgical patient during operation.

The surgical guides and templates can be fabricated by the following methods:

1. A 3D jaw model is printed and a surgical guide is designed on the model and fabricated in the laboratory
2. The surgical guide is designed in the computer, the virtual guide is verified and then produced by 3D printing

Since the surgical guides and templates are inserted to the patient temporarily, medical grade biocompatible and non-cytotoxic materials are recommended.

Stereolithography is commonly used to manufacture surgical guides and templates (Fig 5a and 5b). The SLA guides and templates are sensitive to UV light and moisture; therefore, these devices should be kept in a special container to avoid direct exposure to the environment until being used.

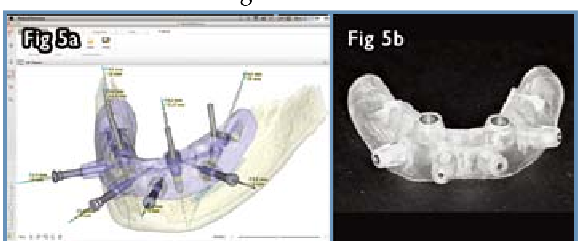

Fig 5a. Computer planning for guided implant surgery;
Fig 5b. SLA template for guided implant surgery

Surgical tools

By simulating and rehearsing for the surgical procedures prior to surgery and using customised surgical guides, templates, and instruments, the surgeon and the surgical team can offer better treatment to their patients. They can do so by 1) studying and understanding the unique anatomy of individual patients, 2) improving or perfecting the surgical plan, and 3) designing and producing specific tools or instruments for surgery, 4) increasing efficiency and safety during operation with better knowledge before surgery. Common applications of this technology include reconstruction of the facial skeleton for cases of edentulism, trauma and tumours.

With additive manufacturing, clinicians can design a tool using CAD software, produce a rapid prototype for testing, and finally manufacture the actual tool to work (Fig 6a and 6b). Without additive manufacturing, the workflow of making a new surgical tool may take weeks or months to complete. In addition, the cost of producing just one copy of the new tool by the traditional method is far too expensive and not cost-effective.

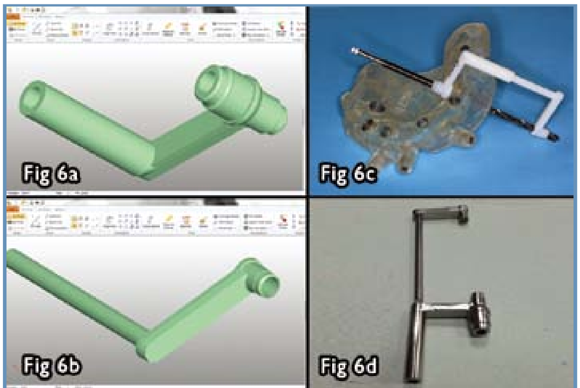

Fig 6a. CAD file of the female part of Zygoma drill guide;
Fig 6b. CAD file of the male part of Zygoma drill guide;
Fig 6c. 3D printed Zygoma drill guide(assembled) in testing;
Fig 6d. Zygoma drill guide produced by CNC Milling

Prostheses – from jawbone to limbs

Often, 3D printing is employed to produce models, surgical guides, and templates. It is possible to print personalised prostheses to replace missing body parts. There are universities and companies able to print implantable artificial mandibles and functional prosthetic lower limbs to rehabilitate amputees.

Bio-printing

Another significant development of additive manufacturing is to print cells, tissues and organs. Bio-printers are available in some universities and companies (Fig 7). Already these institutes have successfully printed cartilages, skin, blood vessels, cardiac tissue, liver tissue, ears and kidneys (Fig 8a and 8b). Although these bio-printed tissues are living and functioning, the techniques to implant these tissues and/or organs into human beings is still under development.

In the coming future, we may be able to see 3D printed vital teeth and jawbones for oral reconstruction.

Discussion

Conventional digital manufacturing processes are based on the subtractive technique to produce products from base materials by cutting or milling. In contrast, 3D printing builds the desired products layer-by-layer through addition of materials.

In the dental industry, companies have been using 3D printing for the fabrication of models, abutments, copings, and crowns. In addition, 3D printing can be used for the fabrication of surgical guides for placing dental implants and for other surgical templates. There are laboratories using 3D printing to make models for clear orthodontic positioners/aligners.

In order to create a 3D models by additive manufacturing, we have to be able to scan, to process, and finally to print.

1) Ability to Scan

In addition to the diagnostic imaging techniques such as CT, MRI and Ultrasound examination, we can employ other scanning methods such as laser scan and stereo-photogrammetry to acquire the images. Already, dentists can use intraoral scanners to obtain information directly from the patient's mouth and then to send digital files immediately to manufacturing centres for crown and bridge production, eliminating the need for making impressions and pouring of stone models. It is also possible to use extra-oral scanning methods and 3D printing processes to produce maxillofacial prostheses for head and neck oncology patients.

2) Ability to process

Once we have the images, we need to process the data using suitable software such as Mimics, 3-matics, Geomagic, etc. Software can perform 3D reconstruction from medical images by segmentation or create CAD files from data generated by intra-oral and extra-oral scanning.

3) Ability to print

When the data files are processed, we need to output the files to the STL format that can be read by the 3D printers. Finally the model can be produced as a 3D object. Based on different application requirements, we can choose the most suitable 3D printing method with the desirable material for manufacturing.

3D printing is changing the way we live. One day, we may be living in a world where we sit on a 3D printed chair, eat 3D printed food, wear 3D printed shoes and clothes, drive 3D printed cars, and live in a 3D printed house. Most importantly, for those who are suffering from congenital or acquired defects, they can receive replacement by 3D printed tissues or organs.

Welcome to a fabricated new world of 3D printing!

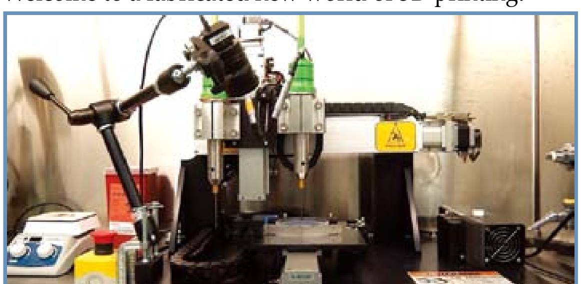

Fig 7. Bio-printer by Organovo

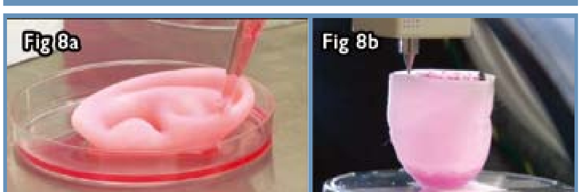

Fig 8a. 3D printed ear; Fig 8b. 3D printed kidney

*** The terms additive manufacturing and 3D printing are used interchangeably in this article.*

THE FEDERATION OF MEDICAL SOCIETIES OF HONG KONG
香　港　醫　學　組　織　聯　會

The Federation Annual Dinner 2013

31st December, 2013 (TUE)

Run Run Shaw Hall
The Hong Kong Academy of Medicine Jockey Club Building

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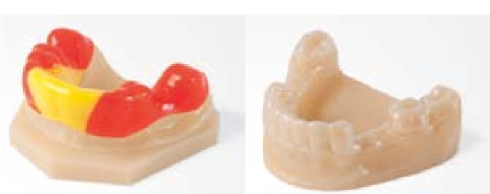


3D Printing in Medical Field

Prof. Ian GIBSON

Associate Professor at National University of Singapore

Additive manufacturing, now more commonly referred to as 3D printing, is in its third decade of commercial technological development. Since its introduction there have been a number of significant changes, including improvements in accuracy and material strength, increases in the range of applications and reductions in the cost of machines and parts. The PolyJet technology from Stratasys employs print heads similar to those used in high-speed inkjet systems, jetting photopolymer layer by layer. The parts can be finely detailed due to the droplet size, allowing for thin layers and walls in any orientation. Different material properties can be achieved using different photopolymers, parts with multiple properties such as two colours or two hardness values can also be printed.

3D Printing for Medical Applications

Almost from the outset, 3D printed models have been used in medical applications. Both 3D printing and computerised tomography (CT) developed alongside 3D representation techniques. While CT data were originally used only for imaging and diagnostic purposes, it soon was commonly used in CAD/CAM systems for model design. Due to the complex, organic nature of the products, 3D printing technology was the most effective means of realising these models. Medical data generated from patients are unique to the individual. Because of the complexity of CT data, the automated and deskilled form of production provided by 3D printing makes it an excellent choice for generating products based on patient data. 3D printing -based fabrication has been used in the following medical applications:

- Surgical and diagnostic aids
- Prosthetics and medical product development
- Manufacturing
- Tissue Engineering

Surgical and Diagnostic Aids: This was probably the first 3D printing medical application. Surgeons perform much of their work in the operating room using both sight and touch. Consequently, models, which can be seen and touched from any angle, are useful because they help surgeons understand complex surgical procedures. Also, models help improve communications among the surgery team members and between the surgeon and the patient. 3D printed models have been known to reduce surgery time in complex cases by allowing the surgeons to both better plan ahead and to better understand the situation during the procedure. (In such cases, sterilised models are brought into the operating room.)

While CT data provide the source for the majority of medical models, MRI data can also be used. For example, cases of complex vascular models based on MRI data have been reported. 3D printed models of soft tissue are useful for certain aspects of visualisation but little can be learned from practising surgery on them.

Models can be multi-coloured to highlight important features, such as tumours, cavities, vascular tracks, etc. And, when these features are buried inside bone or other tissues, an opaque material encased in a transparent material can be used.

Prosthetics and Medical Product Development: Initially, CT-generated data were combined with low resolution 3D printing to create models that looked anatomically correct but were not accurate when compared with the actual patient. As the technologies improved, models have become more precise and it is now possible to use these technologies in the fabrication of close-fitting prosthetic devices. CAD software supports this process by providing fixtures for orientation and tooling guidance when screwing into bone. It is quite common for surgeons to use flexible titanium mesh for bone replacement or for joining pieces of broken bone prior to osteointegration. Models can be used as templates for these meshes, allowing the surgeon's technical staff to bend the mesh into the correct shape prior to surgery, so that minimal rework is required during surgery. Alternatively, 3D printing processes can create parts to be used as casting patterns or reference patterns during machining processes.

Many prosthetics are built using components that come in a range of sizes to fit a standard population distribution. This means that a precise fit is often not possible, resulting in the patient experiencing post-operative difficulties. Greater comfort and performance can be achieved when some of the components are customised. While a socket fixturing for a total hip joint replacement built using a standardised process often returns joint functionality to the patient, incorrect fixturing of the socket commonly causes discomfort, requiring extensive physiotherapy. A customised fixture would reduce the discomfort by making it possible to more precisely match the original or preferred geometry and kinematics.

Images: Medical models can be used to create prosthetic devices, such as implants precisely fabricated to match a cavity. Engineering features can be easily added, making it possible to correctly fix the implant in place.

Manufacturing: 3D printing technology provides the ability to incorporate custom features into mass-produced products. This form of mass-customisation can be applied to consumer products that require anatomical information to perform effectively. The two most well known examples are in-the-ear hearing aids and orthodontic aligners. Both these applications involve taking precise data from an individual and applying this to the design of a manufactured product. Using 3D printing technology may make the production process more expensive but the product will perform more effectively.

Tissue Engineering: The ultimate in medical implants would be the fabrication of replacement body parts. This can be feasibly done using 3D printing technology, with the deposited materials being cells, proteins and other materials that assist in the generation of integrated tissue structures. An indirect process would be to create a scaffold from a biocompatible material that represents the shape of the final tissue construct and then add cells at a later juncture. Such processes generally use bioreactors to incubate the cells prior to implantation. While creating soft tissue structures or load-bearing bone is still not technologically possible, some non-load bearing bone constructs have already been commercially proven.

Stratasys 3D Printers are well suited for producing models to be used as communication aids between surgeons, technical staff and patients. These models can also be used as diagnostic aids, to assist in the planning and development of surgical procedures, and for creating surgical tools and prosthetics.

Radiology Quiz

Radiology Quiz

Dr. Agnes WONG

Department of Radiology, Queen Mary Hospital

History:

A full term newborn presented with blood-stained stool once, which subsided spontaneously after admission. Physical examination was unremarkable.

Questions:

1. What are the radiological findings?
2. What is the diagnosis?

(See P.36 for answers)

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
					1 ★ Joint Surgical Symposium -Ptosis Management ★ HKMA Shatin Doctors Network - New Strategy in the Management of Acute Pain	2 ★ MPS Workshop – Mastering Professional Interactions
3 ★ HKMA Family Sports Day 2013 ★ HKMA Tennis Tournament 2013	4	5 ★ FMSHK Officers' Meeting ★ HKMA Council Meeting	6 ★ HKMA Kowloon City Community Network-Allergic Rhinitis & Asthma: An Update	7 ★ MPS Workshop – Mastering Adverse Outcomes	8 ★ HKMA Shatin Doctors Network-Treatment of Sputum: Old is New	9 ★ HKMA CME–Refresher Course for Health Care Providers 2013/2014 ★ MPS Workshop–Mastering Difficult Interactions with Patients
10 ★ HKMA Tennis Tournament 2013	11	12 ★ MPS Workshop-Mastering Professional Interactions	13 ★ Hong Kong Neurosurgical Society Monthly Academic Meeting–Creutzfeldt Jakob Disease and Neurosurgery ★ HKMA Central, Western & Southern Community Network-Final Session of the Certificate Course on Dermatology 2013-1). Nail Disorders 2). Phototherapy ★ HKMA Shatin Doctors Network-Updates on CHB Management	14 ★ HKMA Structured CME Programme with Hong Kong Sanatorium & Hospital Year 2013–Fillers, PLLA & BTXA for Face Renewal ★ MPS Workshop–Mastering Shared Decision Making ★ FMSHK Executive Committee, Council Meeting, Foundation Meeting and Annual General Meeting	15 ★ Oxfam Trailwalker 2013 ★ HKMA Jiangxi Tour	16 ★ 28th Anniversary of Hong Kong Society of Nuclear Medicine & Scientific Symposium: Advances in Nuclear Medicine ★ Oxfam Trailwalker 2013 ★ HKMA Jiangxi Tour ★ MPS Workshop–Mastering Adverse Outcomes ★ Gastro intestinal dysfunction: integrative management
17 ★ Oxfam Trailwalker 2013 ★ HKMA Jiangxi Tour ★ Bringing Better Health to Our Community 2013 ★ HKMA Tennis Tournament 2013	18 ★ HKMA Jiangxi Tour	19 ★ HKMA Jiangxi Tour	20 ★ HKMA Central, Western & Southern Community Network-Chronic Pain Management in Musculoskeletal Disorder	21 ★ HKMA Golf Tournament 2013 ★ HKMA Hong Kong East Community Network-Current Challenges in Managing T2DM Patients with CVD/CV Risks ★ HKMA Kowloon East Community Network–Fifth Session of the Certificate Course for GPs 2013: Common Skin Problems in General Practice ★ HKMA New Territories West Community Network-Right Treatment, Right Patient and Right Prostate	22 ★ HKMA Yau Tsim Mong Community Network-Advance in Rheumatology ★ Gourmet Subcommittee Wine Dinner	23 ★ HKMA Trailwalker Reunion
24 ★ Islands Hopping Tour in Yan Chau Tong ★ HKMA Tennis Tournament 2013	25	26	27 ★ HKMA Shatin Doctors Network-Update on Diagnosis and Management of Men with Symptomatic BPH	28	29	30 ★ HKMA First-ever Music Fiesta Show

Date / Time			Function	Enquiry / Remarks
1	FRI	8:00 am	**Joint Surgical Symposium -Ptosis Management** Organisers: Department of Surgery & The University of Hong Kong & Hong Kong Sanatorium & Hospital, Chairman: Prof. William I WEI, Speakers: Dr. Walter KING, Dr. Joan WU & Dr. George LI, Venue: Hong Kong Sanatorium & Hospital	Department of Surgery, Hong Kong Sanatorium & Hospital Tel: 2835 8698 1 CME point
		1:00 pm	**HKMA Shatin Doctors Network - New Strategy in the Management of Acute Pain** Organiser: HKMA Shatin Doctors Network, Chairman: Dr. MAK Wing Kin, Speaker: Dr. CHEN Chi Kin, Venue: Jasmine Room, 2/F., Royal Park Hotel, 8 Pak Hok Ting Street, Shatin	Ms. Sandy MAK Tel: 3605 5774 1 CME point
2	SAT	2:30 pm	**MPS Workshop – Mastering Professional Interactions** Organisers: Hong Kong Medical Association & Medical Protection Society, Speaker: Dr. LEE Wai Hung, Danny, Venue: HKMA Central Premises	HKMA CME Dept. Tel: 2527 8452 2.5 CME points
3	SUN	12:30 pm	**HKMA Family Sports Day 2013** Organiser: The Hong Kong Medical Association, Venue: Stanley Ho Sports Centre	Mr. Andie HO Tel: 2527 8285
		8:00 pm	**HKMA Tennis Tournament 2013** Organiser: The Hong Kong Medical Association, Venue: Kowloon Tong Club	Ms. Dorothy KWOK Tel: 2527 8285
5	TUE	8:00 pm	**FMSHK Officers' Meeting** Organiser: The Federation of Medical Societies of Hong Kong, Venue: Gallop, 2/F., Hong Kong Jockey Club Club House, Shan Kwong Road, Happy Valley, Hong Kong	Ms. Nancy CHAN Tel: 2527 8898
		8:00 pm	**HKMA Council Meeting** Organiser: The Hong Kong Medical Association, Chairman: Dr. TSE Hung Hing, Venue: HKMA Head Office (5/F., Duke of Windsor Social Service Building, 15 Hennessy Road, Hong Kong)	Ms. Christine WONG Tel: 2527 8285
6	WED	1:00 pm	**HKMA Kowloon City Community Network-Allergic Rhinitis & Asthma: An Update** Organiser: HKMA Kowloon City Community Network, Chairman: Dr. CHIN Chu Wah, Speaker: Dr. CHAN Hing Sang, Venue: Sportful Garden Restaurant, 2/F, Site 6, Whampoa Garden, Wonderful Worlds of Whampoa, 8 Shung King Street, Hung Hom	Ms. Candice TONG Tel: 2527 8285
7	THU	6:30 pm	**MPS Workshop – Mastering Adverse Outcomes** Organiser: Hong Kong Medical Association Medical Protection Society, Speaker: Dr. HUNG Chi Wan, Emily, Venue: Eaton Hotel	HKMA CME Dept. Tel: 2527 8452 2.5 CME points
8	FRI	1:00 pm	**HKMA Shatin Doctors Network-Treatment of Sputum: Old is New** Organiser: HKMA Shatin Doctors Network, Chairman: Dr. MAK Wing Kin, Speaker: Dr. Edwin POON, Venue: Jasmine Room, 2/F., Royal Park Hotel, 8 Pak Hok Ting Street, Shatin	Ms. Jess LAU Tel: 2507 9969 1 CME point
9	SAT	2:15 pm	**HKMA CME–Refresher Course for Health Care Providers 2013/2014** Organisers: Hong Kong Medical Association, HK College of Family Physicians & HA-Our Lady of Maryknoll Hospital, Speaker: Dr. YUEN Wai Cheung, Venue: Training Room II, 1/F, OPD Block, Our Lady of Maryknoll Hospital, Wong Tai Sin	Ms. Clara TSANG Tel: 2354 2440 2 CME points
		2:30 pm	**MPS Workshop–Mastering Difficult Interactions with Patients** Organiser: Hong Kong Medical Association & Medical Protection Society, Speaker: Dr. CHENG Ngai Shing, Justin, Venue: HKMA Central Premises	HKMA CME Dept. Tel: 2527 8452 2.5 CME points
10	SUN	8:00 pm	**HKMA Tennis Tournament 2013** Organiser: The Hong Kong Medical Association, Venue: Kowloon Tong Club	Ms. Dorothy KWOK Tel: 2527 8285
12	TUE	6:30 pm	**MPS Workshop-Mastering Professional Interactions** Organisers: Hong Kong Medical Association & Medical Protection Society, Speaker: Dr. HAU Kwun Cheung, Venue: HKMA Central Premises	HKMA CME Dept. Tel: 2527 8452 2.5 CME points
13	WED	7:30 am	**Hong Kong Neurosurgical Society Monthly Academic Meeting–Creutzfeldt Jakob Disease and Neurosurgery** Organiser: Hong Kong Neurosurgical Society, Chairman: Dr. TAN Tze Ching, Speaker: Dr. YU Chi Hung, Venue: Seminar Room, Ground Floor, Block A, Queen Elizabeth Hospital	Dr. Gilberto LEUNG Tel: 2255 3368 1.5 CME points
		1:00 pm	**HKMA Central, Western & Southern Community Network-Final Session of the Certificate Course on Dermatology 2013-1). Nail Disorders 2). Phototherapy** Organiser: HKMA Central, Western & Southern Community Network, Speaker: Dr. TANG yuk Ming, William, Venue: HKMA Central Premises	Miss Hana YEUNG Tel: 2527 8285 1 CME point
		1:00 pm	**HKMA Shatin Doctors Network-Updates on CHB Management** Organiser: HKMA Shatin Doctors Network, Chairman: Dr. MAK Wing Kin, Speaker: Dr. YIU Chi Him, Desmond, Venue: Jasmine Room, 2/F., Royal Park Hotel, 8 Pak Hok Ting Street, Shatin	Miss Sibia YEUNG Tel: 2510 6165
14	THU	2:00 pm	**HKMA Structured CME Programme with Hong Kong Sanatorium & Hospital Year 2013–Fillers, PLLA & BTXA for Face Renewal** Organisers: Hong Kong Medical Association Hong Kong Sanatorium & Hospital, Speaker: Dr. KING Wing Keung, Walter, Venue: HKMA Central Premises	HKMA CME Dept. Tel: 2527 8452 1 CME point
		6:30 pm	**MPS Workshop–Mastering Shared Decision Making** Organisers: Hong Kong Medical Association & Medical Protection Society, Speaker: Dr. FUNG Shu Yan, Anthony, Venue: HKMA Central Premises	HKMA CME Dept. Tel: 2527 8452 2.5 CME points
		8:00 pm	**FMSHK Executive Committee, Council Meeting, Foundation Meeting and Annual General Meeting** Organiser: The Federation of Medical Societies of Hong Kong, Venue: Council Chamber, 4/F, Duke of Windsor Social Service Building, 15 Hennessy Road, Wanchai, Hong Kong	Ms. Nancy CHAN Tel: 2527 8898
15	FRI	(16,17)	**Oxfam Trailwalker 2013** Venue: MacLehose Trail	Ms. Dorothy KWOK Tel: 2527 8285
		(16-19)	**HKMA Jiangxi Tour** Organiser: The Hong Kong Medical Association, Venue: Jiangxi	Miss Phoebe WONG Tel: 2527 8285
16	SAT	8:30 am	**28th Anniversary of Hong Kong Society of Nuclear Medicine & Scientific Symposium: Advances in Nuclear Medicine** Organiser: Hong Kong Society of Nuclear Medicine, Chairman: Dr. Chiu Ming LOK, Speakers: Dr. John Buscomb (UK), Prof. Tian Jiahe (China), Dr. Chi Ping WONG (HK) & Dr. Chiu Ming LOK (HK), Venue: Ballroom, Sheraton Hong Kong Hotel & Towers	Dr. Chiu Ming LOK Tel: 2339 7429
		2:30 pm	**MPS Workshop–Mastering Adverse Outcomes** Organisers: Hong Kong Medical Association & Medical Protection Society, Chairman: , Speaker: Dr. LEE Wai Hung, Danny, Venue: HKMA Central Premises	HKMA CME Dept. Tel: 2527 8452 2.5 CME points
		3:00 pm	**Gastro intestinal dysfunction: integrative management** Organiser: Hong Kong Association for Integration of Chinese-Western Medicine, Chairman: Dr. OR Ka Hang, Speakers: Prof. Justin Wu, Prof. Leung Wai Keung & Prof. Bian Zhao Xiang, Venue: Lecture Theatre, 10/F., Yu Chun Keung Memorial Medical Centre, Kwong Wah Hospital	Miss YC YEUNG Tel: 3119 1858 2.5 CME points
17	SUN	2:30 pm	**Bringing Better Health to Our Community 2013** Organisers: The Hong Kong Medical Association, Kowloon Central Cluster of HA, The Hong Kong Baptist Hospital & Kowloon City District Council, Venue: Floor M, Hospital Authority Building, 147B Argyle Street	Ms. Candice TONG Tel: 2527 8285
		8:00 pm	**HKMA Tennis Tournament 2013** Organiser: The Hong Kong Medical Association, Venue: Kowloon Tong Club	Ms. Dorothy KWOK Tel: 2527 8285
20	WED	1:00 pm	**HKMA Central, Western & Southern Community Network-Chronic Pain Management in Musculoskeletal Disorder** Organiser: HKMA Central, Western & Southern Community Network, Chairman: Dr. LAW Yim Kwai, Speaker: Dr. LEE Ka Wing, Gavin, Venue: The Hong Kong Medical Association Central Premises,Dr. Li Shu Pui Professional Education Centre, 2/F., Chinese Club Building, 21-22 Connaught Road Central	Miss Hana YEUNG Tel: 2527 8285 1 CME point
21	THU	11:33 am	**HKMA Golf Tournament 2013** Organiser: The Hong Kong Medical Association, Venue: Old Course, HK Golf Club, Fanling NT	Ms. Dorothy KWOK Tel: 2527 8285

Date / Time		Function	Enquiry / Remarks
21 THU	1:00 pm	**HKMA Hong Kong East Community Network-Current Challenges in Managing T2DM Patients with CVD/CV Risks** Organiser: HKMA Hong Kong East Community Network, Speaker: Dr. IP Tai Pang, Venue: HKMA Head Office	Ms. Candice TONG Tel: 2527 8285
	1:00 pm	**HKMA Kowloon East Community Network–Fifth Session of the Certificate Course for GPs 2013: Common Skin Problems in General Practice** Organiser: HKMA Kowloon East Community Network, Chairman: Dr. David CHAO, Speaker: Dr. LUK Chi Kong, David, Venue: East Ocean Seafood Restaurant, Tseung Kwan O	Ms. Cordy WONG Tel: 3513 3087 1 CME point
	1:00 pm	**HKMA New Territories West Community Network-Right Treatment, Right Patient and Right Prostate** Organiser: HKMA New Territories West Community Network, Chairman: Dr. CHEUNG Kwok Wai, Alvin, Speaker: Dr. FUNG Tat Chow, Berry, Venue: Plentiful Delight Banquet (元朗喜尚嘉喜酒家),1/F., Ho Shun Tai Building,10 Sai Ching Street, Yuen Long	Miss Hana YEUNG Tel: 2527 8285 1 CME point
22 FRI	1:00 pm	**HKMA Yau Tsim Mong Community Network-Advance in Rheumatology** Organiser: HKMA Yau Tsim Mong Community Network, Chairman: Dr. CHUANG Hsiu Min, Speaker: Dr. TSUI Hing Sum, Kenneth, Venue: Pearl Ballroom, Level 2, Eaton, Hong Kong380 Nathan Road	Ms. Candice TONG Tel: 2527 8285 1 CME point
	8:00 pm	**Gourmet Subcommittee Wine Dinner** Organiser: The Hong Kong Medical Association, Venue: HKMA Central Premises	Mr. Benjamin CHAN Tel: 2527 8285
23 SAT	4:00 pm	**HKMA Trailwalker Reunion** Organiser: The Hong Kong Medical Association, Venue: HKMA Central Premises	Ms. Dorothy KWOK Tel: 2527 8285
24 SUN	10:00 am	**Islands Hopping Tour in Yan Chau Tong** Venue: Yan Chau Tong	Ms. Dorothy KWOK Tel: 2527 8285
	8:00 pm	**HKMA Tennis Tournament 2013** Organiser: The Hong Kong Medical Association, Venue: Kowloon Tong Club	Ms. Dorothy KWOK Tel: 2527 8285
27 WED	1:00 pm	**HKMA Shatin Doctors Network-Update on Diagnosis and Management of Men with Symptomatic BPH** Organiser: HKMA Yau Tsim Mong Community Network, Chairman: Dr. CHUANG Hsiu Min, Organiser: HKMA Shatin Doctors Network, Chairman: Dr. MAK Wing Kin, Speaker: Prof. NG Chi Fai, Anthony, Venue: Jasmine Room, 2/F., Royal Park Hotel, 8 Pak Hok Ting Street, Shatin	Miss Sharon LAM Tel: 3189 8787
30 SAT	4:00 pm	**HKMA First-ever Music Fiesta Show** Organiser: The Hong Kong Medical Association, Venue: Backstage, 11F Somptueux Central	Miss Phoebe WONG Tel: 2527 8285

Upcoming Meeting

8-10/11/2013	**International Scientific Congress- Manpower needs in medicine: moving with the times** Organiser: Hong Kong Academy of Medicine, Venue: Academy Building, Enquiry:Secretariat Tel: 2871 8787
5/12/2013	**Integrative Management of Skin Secretions and Seborrhoea** Organiser: Association for Integrative Aesthetic Medicine, Chairmen: Dr. HAU Kwun Cheung, Dr. CHAN Kam Tim, Michael, Speakers: Dr. LOO King Fan, Steven, Dr. TAI Yuk Ping Cheung & Dr. CHAN Kam Tim, Michael, Venue: The Hong Kong Medical Association Central Premises, Dr. Li Shu Pui Professional Education Centre, 2/F, Chinese Club Building, 21-22 Connaught Road Central, Enquiry: Ms. P SUEN Tel: 3575 8600

Federation News

Free Seminar – The Use of Mediation in the Healthcare Sector

On 24 September 2013, a free seminar on the use of mediation in the healthcare sector was held at the Federation's Lecture Hall attended by 21 participants from our member societies. The Federation was privileged to organise this event with the Hong Kong Mediation Council (HKMC) to enhance the public's awareness and to promote the use of mediation in the healthcare sector.

Mr. Vod CHAN, Chairperson of the General Mediation Interest Group(GIG) of HKMC, gave an introduction of HKMC & dispute resolutions; Ms. Christine LAM, an accredited mediator, delivered a talk on the mediation process; Ms. Cindy FONG, Vice-Chairperson of GIG, delivered a talk on the role of mediators; Dr. James CHIU, Vice-Chairman of GIG, delivered a talk on the use of mediation in healthcare disputes; Ms. Melody LEUNG, a listed mediator, demonstrated a role play in 'Dispute about promotion' which lively presented how mediation could be worked out in healthcare working environments.

The participants' attentiveness helped to complete a very successful & interactive seminar. We would like to express our appreciation to the GIG team for co-organising this free educational seminar to our member societies.

Answers to Radiology Quiz

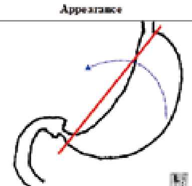
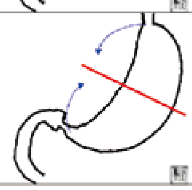
Answers:

1. A stomach bubble with the gastric tube is abnormally located in the right lower thorax. Features are suspicious of herniation of the stomach with volvulus. No abnormally dilated bowel seen. No definite abnormal free intraperitoneal gas noted. Liver and splenic shadows appear in normal position. Otherwise, no focal abnormal consolidation or pleural effusion is evident.

2. Water soluble contrast meal and follow through confirms that the stomach has herniated into the right lower thorax and twisted along the axis of the stomach. Findings are compatible with **congenital diaphragmatic hernia with gastric volvulus (organoaxial type)**.

Discussion:

- Uncommon
  - o May occur in children due to congenital diaphragmatic defects
  - o In adults, rarely occurs before age 50
    - - Most common cause of gastric volvulus in adults are diaphragmatic defects
- Stomach twists on itself
- Classified as one of two types-organoaxial or mesenteroaxial

Type	Appearance	Description	Remarks
Organoaxial		Twist occurs along a line connecting the cardia and the pylorus—the luminal (long) axis of the stomach	· Most common type. · Usually associated with diaphragmatic defects. · Vascular compromise more common.
Mesenteroaxial		Twist occurs around a plane perpendicular to the luminal (long) axis of the stomach from lesser to greater curvature	· Chronic symptoms more common. · Diaphragmatic defects less common.

- Treatment
  - o Surgery in acute gastric volvulus
  - o In patients with chronic gastric volvulus, surgery is performed to prevent complications
    - - Nonoperative mortality rate = as high as 80%
    - - Mortality rate from acute gastric volvulus = 15-20%
    - - Mortality rate from chronic gastric volvulus ranges up to 13%
- Complications
  - o Peritonitis
  - o Perforation
  - o Shock
  - o Death

Dr. Agnes WONG
Department of Radiology, Queen Mary Hospital

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- Iodine helps fetal brain development[3]

WYETH MAMA™

- Provides balanced nutritional support throughout planning, pregnancy and lactation
- High calcium and relatively low fat[+]

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- High purity and free from oceanic contamination[6,7,8]
- Easy to be utilized by the human body[8]

References:

1. Obican SG, Finnell RH, Mills JL, et al. Folic acid in early pregnancy: a public health success story. FASEB J. 2010;24(11):4167-4174. 2. Mulligan ML, Felton SK, Riek AE, et al. Implications of vitamin D deficiency in pregnancy and lactation. Am J Obstet Gynecol. 2010;202 (5):429.e1-9. 3. Murcia M, Rebagliato M, Iniguez C, et al. Effect of iodine supplementation during pregnancy on infant neurodevelopment at 1 year of age. Am J Epidermiol. 2011;173(7):804-814. 4. Koletzko B, Lien E, Agostoni C, et al. The roles of long-chain polyunsaturated fatty acids in pregnancy, lactation and infancy: review of current knowledge and consensus recommendations. J Perinat Med. 2008;36(1):5-14. 5. FAO/WHO. Fats and fatty acids in human nutrition. Report of an expert consultation. FAO Food Nutr Pap. 2010;91:1-166. 6. Adarme-Vega TC, Lim DK, Timmins M, et al. Microalgal biofactories: a promising approach towards sustainable omega-3 fatty acid production. Microb Cell Fact. 2012 Jul 25;11:96. 7. GRAS notice GRN0000137. U.S. Food and Drug Administration. Available at: http://www.accessdata.fda.gov/scripts/fcn/fcnDetailNavigation.cfm?rpt=grasListing&id=137 accessed date 23Aug2013 8. Wen XX, Li JP, Hou WW, et al. Microalgal docosahexaenoic acid: a new functional food additive. Food Science. 2010 Jun;31(21):446-450.

+ Per serving fat content in Wyeth Mama is about 1/3 of that in whole fat milk. (US Department of Agriculture. USDA National Nutrient Database for Standard Reference, Release 24, 2012.NDB No. 01211)

Nutritional needs may vary among individuals. Your patient may require different types of nutrition products according to her needs

Wyeth (Hong Kong) Holding Company Limited
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