Tripolitana Medical Journal; 2019, Vol.8 , No. I, pp. 6 - 11

Research Article

ISSN 2077-5628

Early Management of Gunshot Injuries to the Mandible and Mid Face

Salaheddin Kurdi@, Ahmed Sasi and Hanna Ishtebaa

Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, University of Tripoli ,Tripoli, Libya

Received 18 March 2019/Accepted 29April 2019

ABSTRACT

To determine pattern and presentation in terms of site of injury, airway, associated injuries; and early management of gunshot injuries to the mandible and mid face occurred in Tripoli -Libya from 2011 to 2018 .

A total of 409 patients were treated from 1st February 2011 to 15th February 2018 have been included. Medical documentation of the patient was compiled. All the mandible & mid face gunshot and warfare injuries were treated by oral and maxillofacial surgeon. Other concomitant bodily injuries were treated by pertinent consultant specialists.

A total of 409 patients with gunshot wounds to the face were identified. Age ranged from 15 to 42 years with mean of 28+4.98 years. All patients are males. one hundred and nineteen patients (29.1%) required airway management. The most frequent site involved was mandible in 294 patients (71.9%) while mid-face was involved in 115 patients (28.1%). Open reduction and internal fixation (ORIF) was performed in 271 patients (66.3%), while 138 patients (33.7%) were managed conservatively. Out of 409 patients, 61 patients (14.9%) had some complications; trismus, sinusitis and infection.

The most of our patient required surgical intervention for treatment of their mandible and mid face gunshot injuries. Primary treatment of soft and skeletal facial structures at the time of surgical debridement was possible in the majority of our patients. Early management and operative intervention for repair of the soft and skeletal facial structures leads to satisfactory results. Facial gunshot wounds frequently involve mandible with more likely requirement of establishment of emergency airway and (ORIF). The most soft tissue defects can closed by local flaps.

Key word- *Gunshot; Mandible; Mid face; ORIF.*

INTRODUCTION

Management of facial gunshot wounds poses a challenge not only for the oral and maxillofacial surgeons but also for the reconstructive surgeons.

Facial gunshot wounds bear a lot of morbidity for the affected patients.[1,2] Inordinate attention has been given in the past to wound classification based merely on the projectile's velocity.[1]

These wounds can appropriately be classified as penetrating, perforating and avulsive wounds.

Management of facial gunshot wounds has been evolving through ages from conservative delayed operative repair to early aggressive single stage approach.[1]

Penetrating and perforating wounds, mainly resulting from low velocity projectiles, are managed in the same way as blunt facial trauma, ranging from closed reduction to open reduction and internal fixation with minimal debridement and primary closure.[2,3]

While management of avulsive wounds resulting from high velocity projectiles has been evolving through ages with controversies involving early and delayed reconstruction as it suffers an evolving type of tissue necrosis.[2,4,5] Recently Futran and colleagues have proposed a phased approach for management of avulsive wounds.[6]

The first phase involves evaluation of the ABC, life and limb threatening injuries, intracranial, ocular, facial

nerve, vascular and other major injuries, excision of all necrotic tissue and maintenance of tissue of questionable prognosis, maintenance of occlusal relationships, maintaining mandibular segments with reconstructive plates and maxillary defects and soft tissue envelope with temporary bone grafts to avoid later tissue contracture. Pre-operative planning should also be done for anticipated definitive reconstruction with 3-D CT scan and stereo-lithography.[7,8]

Second phase involves definitive reconstruction which should be as early as possible.

The third phase focuses on aesthetic and functional refinements which may occur over weeks to years in

which free flap debulking and contouring is required.[7,8]

Dental rehabilitation with tissue borne or implant borne prosthesis, additional cosmetics, facial prosthesis and tissue tattooing may be done.[7,8]

The timing and sequence of different stages in the management of facial gunshot wounds with reconstruction and rehabilitation is of prime importance for successful

@ Author to whom correspondence should be addressed: Dr Salah Eddin Kurdi; *Tel:00218925229492 E-mail:* kurdisalah@hotmail.com

aesthetic and functional outcomes, if inadequate may lead to graft rejection and frequent infection and as such multiple revisional operations.[9,10]

With the development of microsurgical techniques and local tissue advancement to distant free flaps

reconstruction, cosmetic and functional outcomes have markedly improved.

Delayed definitive surgical management of the avulsive gunshot wounds in the past has given way to the early definitive management.[10-12]

The objective of the study was to determine the pattern and presentation (site of injury, airway and associated injuries), implications for evaluation and management of patients with mandible and mid face gunshot injuries.

MATERIALS AND METHODS

This was an observational and clinical study carried out at Tripoli, from 15th February 2011 to 15th February 2018 have been included.

All patients with gunshot injuries of the mandible and mid face were included by convenient sampling method. Patients were treated by four participating services; maxillofacial surgeons, general surgeons, neurosurgeons and orthopedic surgeons.

Most of those patients suffered gunshot injuries in the field and were managed initially there with normalization of vital signs and then referred to the study centre for definitive management.

The face was identified to be from supraorbital margin to the chin inferiorly and the area anterior to the external auditory meatus.

The entry site of projectile was further subdivided into two anatomic sub sites i.e. mandible - (lower face) (Figure 1, 2) and mid face (Figure 3).

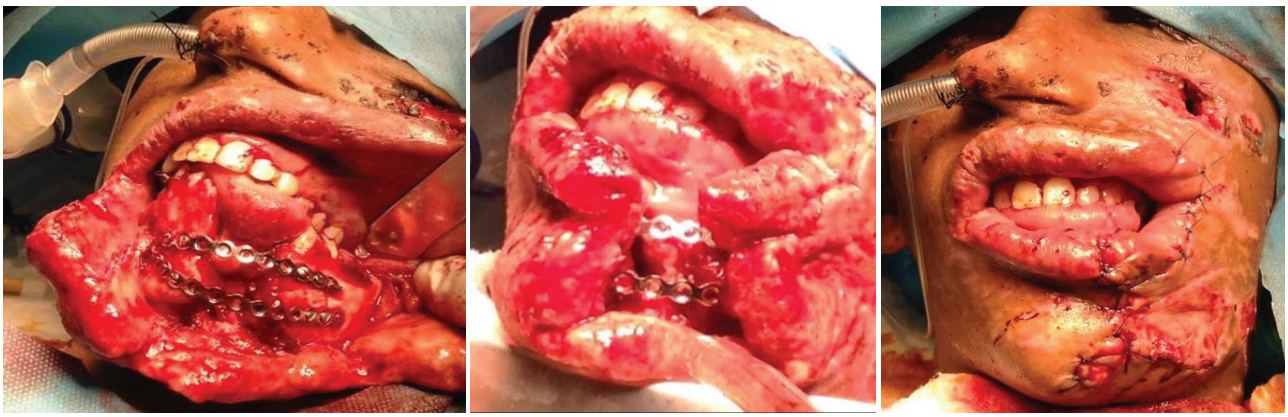
Patients with projectile entry site away from face like neck, chest etc. and secondarily involving face were included in the study (Figure 4).

Data was analyzed by using SPSS version 10. Descriptive statistics were used to calculate the data. Mean and standard deviation were calculated for all quantitative variables like age.

Frequency and percentages were presented for qualitative variables like gender, entry site of projectile, emergency airway establishment by entry site, types of emergency airway, wounds with underlying bone fractures managed with open reduction and internal fixation (ORIF) (Figure 5). Wounds managed conservatively, injury to associated structures (facial nerve, parotid, cranium, globe and vessel), wounds with bony reconstruction and complications following the management of those cases (Figure 6).

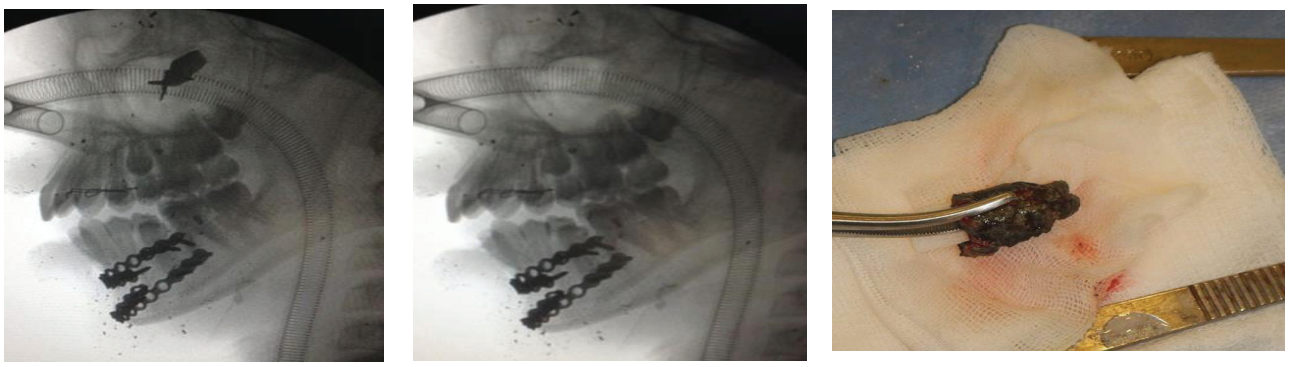
a b

Figure 1(a,b): Severe facial trauma (post explosion injury)



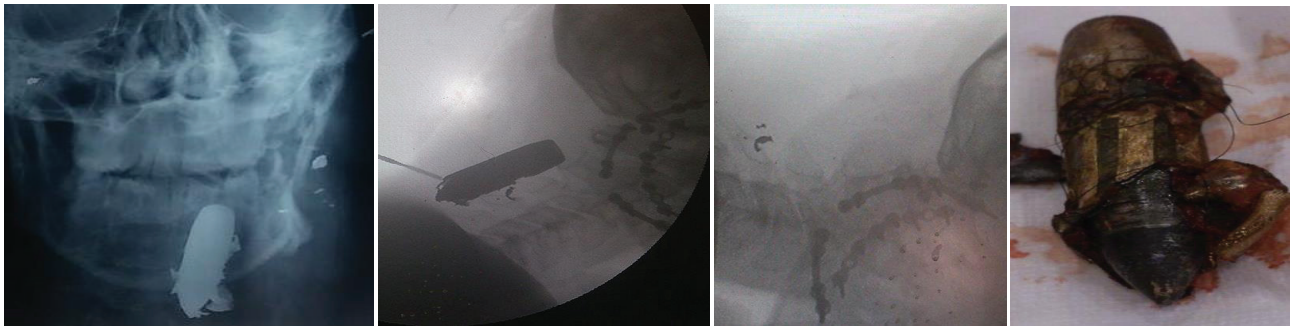
a b c

Figure 2 (a,b,c): Severe facial trauma (intra operative picture – ORIF and closed the defect by local skin flap)



a b c

Figure 3 (a,b,c): Foreign body in the left maxillary sinus (intra operative C-arm fluoroscopy).



a b c d

Figure 4 (a,b,c,d): Metallic foreign body at the level of C2, entry site mid face

a b c

Figure 5 (a,b,c): Open reduction and internal fixation (ORIF) of the orbital floor (injury caused by metallic foreign body).

a b

(**Figure 6 (a,b):** Severe facial trauma - post explosion injury (intra operative picture

RESULTS

There were a total of 409 patients with gunshot injuries to the mandible and mid face during the study period. Their age ranged from 15 to 42 years with mean age of 28 + 4.98 years.

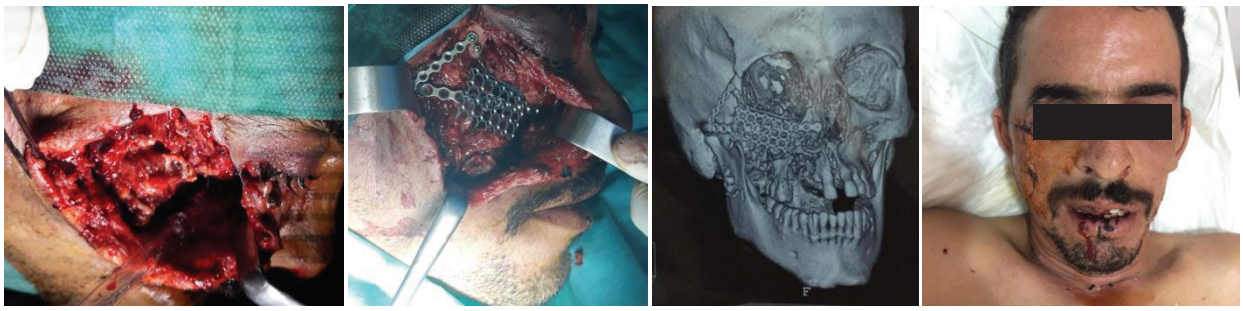
All patients are males. The specific type of weapon used was unidentified. Projectile entry site was divided into mid face and mandible (lower face).

Out of 409 gunshot wounds, 294 (71.9%) involved the mandible and 115 (28.1%) involved the mid face (Figure 7).

Out of 294 patients with mandibular entry sites, 89 (30.3%) patients required emergency airway, whereas out of 115 patients of mid face entry sites, 30 (26.1%) patients required emergency airway.

Types of emergency airway establishment according to entry site are given in (Table 1).

Out of 409 patients, 271 (66.3%) patients required open reduction and internal fixation (ORIF) in the form of plating (Figure 8).



a b c d

Figure 7 (a,b,c,d): Gunshot injury involved mid face (ORIF of zygomaticoorbital complex)

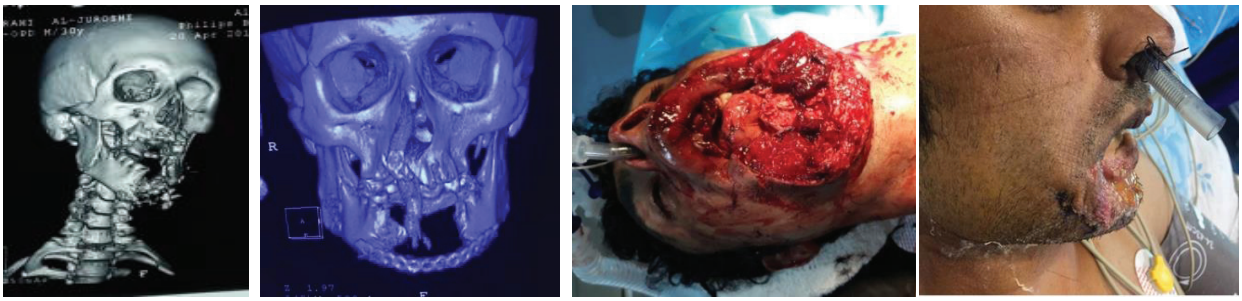
Table 1: Emergency airway establishment according to entry site.

Type of emergency airway	(Mandible (n=294	(Midface (n=115
Cricothyroidotomy	(3.0%) 9	(1.7%) 2
Tracheostomy	(11.2%) 33	(9.6%) 11
Emergency airway	(15.9%) 47	(14.8%) 17

Table 2: Type of treatment according to entry site.

Type of treatment Mandible	(Mandible (n=294	(Midface (n=115
ORIF	(67.3%) 198	(63.5%) 73
Conservative	(32.7%) 96	(36.5%) 42
Total	(100%) 294	(100%) 115

ORIF=Open reduction and internal fixation.



a b c d

Figure 8 (a,b,c,d): Gunshot injury involved mandible (ORIF and closer the soft tissue defects by local flaps).

The frequency of patients managed with open reduction and internal fixation (ORIF) and those managed conservatively according to entry site is given in (Table 2).

There were a total of 29 (7.1%) patients with injury of the facial nerve; 8 (1.9%) had complete transection of the nerve and 21 (3.9%) had neuropraxia.

There were27(6.6%) patients with parotid injuries. Intracranial penetration was found in 18 (4.4%) patients. Globe was affected in 7 (1.7%) patients. There were 16 (3.9%) vascular injuries involving the facial artery and maxillary artery.

Out of 409 patients, 22 (5.4%) underwent reconstruction. Five patients with avulsion of complete mid face and anterior mandible, reported with the complaints of ill fitting dentures and poor aesthetics.

Delayed reconstruction was done with rib on-lay grafts and later on patient acquired good retention of his

dentures. Out of 22 patients, 4 (18.1%) patients underwent delay reconstruction with fibular free grafts.

Out of 409 patients,61 (14.9%) patients suffered complications while 348 (85.1%) of the patients did not have any complications following our management.

The complication included trismus, infection and sinusitis in 50 patients each; facial nerve palsy occurred in six and vision loss occurred in five patient.

DISCUSSION

Facial gunshot wounds and their management are very complex. Its management has to be refined with

evolving projectiles and increasing incidence of new victims in Africa, South Asia to reduce morbidity. In this study the pattern of gunshot injury with respect to site, injury to associated structures, their management and complications.[13]

Facial gunshot wounds is discussed. There are many classification systems for penetrating facial injuries but in this study entry site of facial gunshot wounds was divided into mid face injuries and lower third or mandible injuries as in other studies.[7,13]

In all trauma patients securing the airway is very important. The airway of all patients with facial gunshot

wounds is at the risk of collapse later on due to extensive necrosis associated with these wounds.

Studies reveal that gunshot wounds of lower face and especially with floor of the mouth entry sites are at

increased risk of collapse and require emergency airway intervention.[10,14,15]

There are other studies which indicate that these patients may initially appear to have a stable airway but may decompensate rapidly due to extensive inflammatory edema associated with these wounds. They suggest airway intervention in both upper and lower jaw.[10,16,17]

A frequency of 29.1% for emergency airway establishment was found in our study which is greater as compared to other studies with frequency of 15% and 20%.[10]

The reason for increased frequency of emergency airway management was that the most frequent entry site was mandible. The airway of most of those patients was managed in the field by general surgeons before referral. The need for emergency airway management differed according to entry site.

11.2% of the patients with mandibular entry site required tracheostomy and it was also needed for later reconstructive surgeries. The airway of patients with facial gunshot wounds and especially those involving lower third of face must be managed immediately before either extensive edema or bleeding may cause life threatening emergency.

Facial gunshot wounds may result in injury of adjacent vital structures like facial nerve, globe, cranium, parotid gland and vascular structures. The kinetic energy of projectiles is very important.

Greater the velocity of projectile greater will be the necrosis around its track and as such increased risk of damage to adjacent structures.[18] The type of bullet and density and resilience of the tissue influence the degree of damage.[3,14]

In this study, all patients with globe injury were referred to the concerned specialist. All of these globe injuries occurred in patients with mid face entry site.

So patients with mid face entry sites and possible involvement of globe should be referred to the ophthalmologist.

In this study, gunshot wounds were having almost equal frequency for cranial entry irrespective of entry site.

Plain face and lateral skull views should be immediately obtained in all patients to identify the path of projectile with no exit wound, to rule out potential intra-cranial penetration.

Advanced imaging techniques should also be utilized to assess the potential damage of projectiles.

In this study, facial nerve injuries mainly involved distal branches which did not require repair. There were 21 patients with neuropraxic injuries and were managed conservatively.

If there is need for frequent debridement than severed facial nerve branches should be tagged and repaired later on.138 patients did not require open reduction and internal fixation (ORIF) of mid face or mandible fracture which is in accordance with other studies.[14,18]

The aim was to fix the unstable, grossly comminuted fractures with plates and screws in case reconstruction is later required. Maximum effort was done to remove the bullets and its secondary fragments because of early and delayed sequelae.[16,19,20]

Intraoperative C-arm fluoroscopy is recommended to check the final position of the bullet, because a bullet may move spontaneously even in paranasal sinuses.[15,21,22]

Latest radiographic techniques may be used to avoid excessive radiation exposure associated with fluoroscopy.[8,22,23]

On the basis of patterns of injury, the importance of elective airway establishment is suggested in all facial gunshot patients especially with mandibular entry sites or if there is anticipated edema of airway. There must

be multidisciplinary approach with active involvement of anesthetists, neurosurgeons, ophthalmic surgeons, vascular surgeons and otolaryngologists in addition to the oral and maxillofacial surgeons in the acute phase.

Path of projectile must be assessed by latest radiographic techniques for its potential damage to adjacent vital structures cranium, globe, parotid gland etc. Avulsive wounds should be managed in minimum number of stages and as early as possible if general condition of the patient precludes this to avoid the potential consequences of scar tissue on aesthetic and functional outcomes.

Complications encountered in these patients were predominantly facial nerve palsy, sinusitis, trismus and infection requiring revisional operations.

CONCLUSION

The most of our patient required surgical intervention for treatment of their mandible and mid face gunshot injuries. Primary treatment of soft and skeletal facial structures at the time of surgical debridement was possible in the majority of our patients. Early management and operative intervention for repair of the soft and skeletal facial structures leads to satisfactory results. Facial gunshot wounds frequently involve mandible with more likely requirement of establishment of emergency airway and (ORIF). The most soft tissue defects can closed by local flaps.

Management of mandible and mid face gunshot injuries is highly individualized depending upon patient presentation, general condition of the patient, available resources and experience of operating team in the management of such patients.

Better pre-operative planning and early aggressive management approach towards facial gunshot wounds result in good functional and esthetic results with reduced morbidity.

REFERENCES

1. Majid OW (2008) Persistent oronasal fistula after primary management of facial gunshot injuries, *Br J Oral Maxillofac Surg*. **46**, 50-52.

2. Clark N, Birely B, Manson PN, Slezak S, Kolk CV, Robertson B, *et al.* (1996) High-energy ballistic and avulsive facial injuries: classification, patterns and an algorithm for primary reconstruction, *Plast Reconstr Surg*. **98**, 583-601.

3. Kincaid B and Schmitz JP (2005) Tissue injury and healing, *Oral Maxillofac Surg Clin North Am*. **17**, 241-250.

4. Cheema SA (2006) Gunshot trauma of the maxillofacial region: an analysis of 66 cases, *Pak J Surg*. **22**, 86-90.

5. Maki MH (2009) Management outline of oral and maxillofacial missile injuries in Iraq: the value of the intermediate phase, *J Craniofac Surg*. **20**, 873-877.

6. Futran ND, Farwell DG, Smith RB, Johnson PE and Funk GF (2005) Definitive management of severe facial trauma utilizing free tissue transfer, *Otolaryngol Head Neck Surg*. **132**, 75-85.

7. Chen AY, Stewart MG and Raup G (1996) Penetrating injuries of the face, *Otolaryngol Head Neck Surg*. **115**, 464-470.

8. Behnia H and Motamedi MH (1997) Reconstruction and rehabilitation of short-range, high-velocity gunshot injury to the lower face: a case report, *J Craniomaxillofac Surg*. **25**, 220-227.

9. Stuehmer C, Essig H, Schramm A, Rücker M, Eckardt A and Gellrich NC (2008) Intra-operative navigation assisted reconstruction of a maxillo-facial gunshot wound, *Oral Maxillofac Surg*.**12**,199-203 .

10. Dolin J, Scalea T, Mannor L, Sclafani S and Trooskin S (1992) The management of gunshot wounds to the face, *J Trauma*; **33**, 508-515.

11. Dojcinovic I, Broome M, Hugentobler M and Richter M (2007) Unusual ballistic trauma of the face with a less-lethal launcher, *J Oral Maxillofac Surg*. **65**, 2105-2107.

12. Doctor VS and Farwell DG (2007) Gunshot wounds to the head and neck, *Curr Opin Otolaryngol Head Neck Surg*. **15**, 213-218.

13. Cole RD, Browne JD and Phipps CD (1994) Gunshot wounds to the mandible and midface: evaluation, treatment and avoidance of complications, *Otolaryngol Head Neck Surg*. **111**, 739-745.

14. Kaufman Y, Cole P and Hollier L (2008) Contemporary issues in facial gunshot wound management, *J Craniofac Surg*. **19**, 421-427.

15. Yao ST, Vanecko RM, Corlery RD, Stutevlle OH and Shoemaker WC (1972) Gunshot wounds of the face, *J Trauma* **12**, 523-528.

16. Motamedi MH (2003) Primary management of maxillofacial hard and soft tissue gunshot and shrapnel injuries, *J Oral Maxillofac Surg*. **61**, 1390-1398.

17. Vayvada H, Menderes A, Yilmaz M, Mola F, Kzlkaya A and Atabey A (2005) Management of close-range, high-energy shotgun and rifle wounds to the face, *J Craniofac Surg*. **16**, 794-804.

18. Hollier L, Grantcharova EP and Kattash M (2001) Facial gunshot wounds: a 4-year experience, *J Oral Maxillofac Surg*. **59**, 277-282.

19. Kara MI, Polat HB and Ay S (2008) Penetrated shotgun pellets: a case report, *Eur J Dent*. **2**, 59-62.

20. Motamedi MH (2007) Primary treatment of penetrating injuries to the face, *J Oral Maxillofac Surg*. **65**, 1215-1218.

21. Karabagli H (2005) Spontaneous movement of bullets in the interhemispheric region, *Pediatr Neurosurg*. **41**, 148-150.

22. Holmes PJ, Miller JR, Gutta R and Louis PJ (2005) Intra-operative imaging techniques: a guide to retrieval of foreign bodies. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. **100**, 614-618.

23. Thompson M, Wright S, Cheng LH and Starr D (2003) Locating broken dental needles, *Int J Oral Maxillofac Surg*. **32**, 642-644.