Case Series

Rare etiological factor of maxillofacial injury: Case series seen and managed in a tertiary referral centre

Ramat Oyebunmi Braimah1, Adebayo Aremu Ibikunle1, Abdurrazaq Olanrewaju Taiwo1,2

1Department of Dental and Maxillofacial Surgery, Usmanu Danfodiyo University Teaching Hospital, Sokoto. 2Department of Surgery, Dental and Maxillofacial Surgery, College of Health Sciences, Usmanu Danfodiyo University, Sokoto, Nigeria

ABSTRACT

Entanglement injury from local milling/grinding machine with a conveyor belt is a rare etiology of maxillofacial injuries. While there is abundant literature on industrial cause of trauma, entanglement injury as a mechanism has not been reported in the literature. We present two cases of maxillofacial injury secondary to entanglement of the loose apparel into the conveyor belt of the local grinding machine. The community should be aware of this rare cause of trauma, and adequate protection of children using these facilities should be enforced. One of such measure is to provide physical barriers to guard against these machines.

Key Words: Conveyor belt, entanglement, local grinding machine, loose apparel, maxillofacial injury

INTRODUCTION

The causes of maxillofacial injuries vary from one country to another and also within the same country depending on socioeconomic, cultural, and environmental factors and level of infrastructural development, especially roadways and traffic regulations. Behavioral practices, for example, usage of psychoactive substances and alcohol consumption, will also modify causes of maxillofacial injuries. Major causes of maxillofacial injuries locally are motor vehicular accidents, gunshot injuries, and assault. Other etiologies such as falls, sports, animal-inflicted injuries, and industrial trauma are rare. Although industrial trauma is a well-recognized etiology of maxillofacial injuries, entanglement of clothing into the conveyor belt of local grinding machine has not been reported in the literature. We report two cases of such managed in a tertiary referral center in the northwest region of Nigeria.

CASE REPORTS

Case 1

A 12-year-old girl was referred to our facility from a general hospital on May 1, 2014, on account of moderate head injury and maxillofacial injuries. The patient was sent on errand by parents to grind grains when her apparel got trapped into the conveyor belt of the machine. She was slammed on the ground and lost consciousness immediately for about 5 min. There was bleeding from the mouth and swelling over the mandible. On general examination, the Glasgow Coma Scale (GCS) was 12. She was
not pale, acyanosed, and afebrile. Blood pressure on presentation was 100/60 mmHg. Posterior-anterior view of the skull and the left and right oblique lateral views of the mandible confirmed the diagnosis of mandibular fracture between lower right first and second molar. No associated soft-tissue injury [Figure 1a].

Urinalysis revealed hematuria, proteinuria, and bilirubinuria. An incidental finding of acute glomerulonephritis was made. Full blood count and blood chemistry were within normal range. The pediatric nephrologist was invited and was managed for 5 days with antibiotics. Following resolution of the acute glomerulonephritis, she was planned for open reduction and rigid internal fixation under general anesthesia on May 15, 2014. A 2.0 mm titanium plate and 9 mm long titanium screws were used to fix the fracture site following Champy technique (using six screws at lower border and four screws at upper border) [Figure 1b]. Postoperative management was uneventful. Postoperative check radiograph shows intact miniplate and miniscrews [Figure 1c]. She was discharged home on May 19, 2014.

Case 2

A 16-year-old girl was referred from specialist hospital on April 11, 2015, with a 6 hours history of the right arm injury and maxillofacial injuries following accidental entrapment of her apparel in the conveyor belt of grinding machine when she went to grind grains for family meal. She was slammed on the ground; however, there was no loss of consciousness. GCS on presentation was 15. Following examination and investigations, a diagnosis of right undisplaced zygomatic complex fracture, the left angle fracture of the mandible, and the right body fracture between lower right canine and first premolar [Figure 2a] and the right radio-ulna fracture was made. No associated soft-tissue injury [Figure 2b]. Full blood count, urinalysis, and blood chemistry were all within normal range. Intermaxillary fixation was done under local anesthesia and conscious sedation using upper and lower arch bars and tie wires on April 15, 2015, and discharged home the same day [Figure 2c].

**DISCUSSION**

Trauma was estimated to have caused 10% of all deaths occurring in 1990 worldwide. The details of trauma epidemic vary significantly from locations to location. The causes of traumatic death in the developed world are different to those in the developing world. Regardless of this variation, trauma remains the third largest cause of death in all regions of the world. Occupational and/or industrial causes of maxillofacial injuries are well-established etiology of facial injuries. In the developed countries, incidence has reduced due to changing pattern of workforce from construction and manufacturing to civil service. Even within the primary industries, administrative and managerial workers now form a larger proportion of the workforce. Republic of Korea reported a total of 116 deaths identified as accidents caused by machinery and by cutting and piercing instruments in 1998. In Nigeria and Sub-Saharan

Figure 1: (a) Clinical photograph of Case 1 patient without soft-tissue injuries. (b) Clinical photograph showing intraoperative fixation of fracture site. (c) Postoperative check radiograph showing intact miniplate and miniscrews of Case 1

Figure 2: (a) Preoperative radiograph of Case 2 showing fracture sites. (b) Clinical photograph of Case 2 patient without soft-tissue injuries. (c) Postoperative clinical photograph showing intermaxillary fixation of Case 2
Africa, statistics on industrial causes of maxillofacial trauma is still scarce.

Common injuries associated with machines are crushing, cutting, shearing, puncturing, abrasion, burns, tearing, stretching, or a combination of two or more of these. Other common injuries include electric shock, hearing loss, and chemical injury.[11] Injuries or harms to people by machinery include coming into contact or entanglement with parts of a machine or plant, for example, a worker being drawn into a machine or item of plant or being drawn into a position where they might sustain further injury; being caught between a moving section of machine or plant; coming into contact or entanglement with material being used in the machine or plant to manufacture a product; being caught between a machine, plant, machine part or plant part and a fixed structure such as a wall, column, or fixed machine; being struck by parts of the machine or plant during its failure or break-up; being struck by material ejected from the machine or item of plant; and being struck as a result of a release of potential energy in machine components or materials being processed.[11]

Entanglement involves being caught in a machine by loose items such as clothing, gloves, ties, jewelry, long hair, cleaning rags, bandages, or rough material being fed into the machine.[11] The types of body contact that may lead to entanglement include contact with a single rotating surface, being caught on projections or in gaps, contact with materials in motion, contact between counter-rotating parts, contact between rotating and fixed parts and contact between rotating and tangentially moving parts, for example, a power transmission belt and its pulley, a chain and chain wheel, a rack and pinion, a conveyor belt and any of its pulleys, and a rope and its storage reel.[11]

Although entanglement of loose clothing in the conveyor belt of the machine was the etiology of trauma in this case series, the mechanism of injury defers. While it is expected that entanglement will cause the victims to be trapped in between the machinery, the patients were rather slammed to the ground. Therefore, common injuries associated with machines such as crushing, cutting, shearing, puncturing, abrasion, burns, tearing, and stretching were not seen in both patients [Figures 1a and 2b]. We then concluded that this mechanism of injury is unique and should be classified as a rare mechanism of maxillofacial injuries.

In northern part of Nigeria, majority of the population are Muslims, therefore, wearing of loose garment is part of the culture. Some countries, such as Saudi Arabia and Qatar, do enforce a dress code. Women there are expected to cover their hair and wear some sort of loose fitting, full-length garment over their clothes. However, for the majority of Muslim women around the world, to cover, or not to cover, is a freely made choice. In northern part of Nigeria apart from religious inclination about wearing the loose apparel, it also has cultural background as non-Muslims do wear them to blend into the society. With this religious and cultural value about wearing loose apparel and the potential danger of entanglement injury in machineries, there should be proper protection to safeguard the lives of users. Anecdotal reports have identified entanglement injury as a sub-mechanism in motorcycle-related road traffic crash were the loose apparel get entangled in the spokes of the motorcycle tire.

To start addressing the risks from entanglement injuries from machineries, workers should not wear loose clothing or jewelry and must tie back long hair or wear head covering.[11] However, this measure may be difficult to enforce due to the religious and cultural background about the use of loose apparel in northern part of Nigeria. Other appropriate measure that will be suitable in this circumstance is the use of physical barriers. Many of the types of hazards including entanglement injury can be effectively managed by the installation of physical barriers.[11] The primary function of a guard is to provide a physical barrier between a worker and the dangerous parts of machinery or plant. When selecting controls such as guards, careful attention to design and layout can drastically reduce many of the risks to safety and health. The range of guards includes, but is not limited to, permanently fixed physical barriers, interlocked physical barriers, physical barriers securely fixed in position, and presence-sensing systems.[11] Sufficient physical barriers or fences securely fixed in position using fasteners, or other suitable devices may prevent access to dangerous areas, especially in the local setting as in our case series. Any access points through the barrier, for example, gates and doors, should be secured with a lock or interlocking system. Interlocked guards are suitable for pulleys and drives.[11] In some cases, a hinged section may be appropriate to enable access during machine setting. Such control measures should be designed and installed so that a tool is required to remove and replace a guard.[11]

**CONCLUSION**

Entanglement injury from local machinery utilizing conveyor belt is a rare possible cause of maxillofacial injury, and the community should be aware of this. Adequate protection of these machineries using barriers should be encouraged.

**Declaration of patient consent**

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/ their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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**Conflicts of interest**

There are no conflicts of interest.
REFERENCES

1. Adeyemo WL, Ladeinde AL, Ogunlewe MO, James O. Trends and characteristics of oral and maxillofacial injuries in Nigeria: A review of the literature. Head Face Med 2005;1:7.

2. Ugboko V, Udoye C, Ndulue K, Amole A, Aregbesola S. Zygomatic complex fractures in a suburban Nigerian population. Dent Traumatol 2005;21:70-5.

3. Olasoji HO, Tahir A, Bukar A. Jaw fractures in Nigerian children: An analysis of 102 cases. Cent Afr J Med 2002;48:109-12.

4. Akinwande JA,欧阳班波, Ladeinde A, Ogunlewe O, Obisesan BA, Oluseye T. Armed robbery gunshot injuries to the maxillofacial region. J Clin Pract 1998;1:9-14.

5. Ugboko VI, Owotade FJ, Oginni FO, Odusanya SA. Gunshot injuries of the oro-facial region in Nigerian civilians. SADJ 1999;54:418-22.

6. Olasoji HO. Maxillofacial injuries due to assault in Maiduguri, Nigeria. Trop Doct 1999;29:106-8.

7. Murray CJ, Lopez AD, editors. The global burden of disease. In: Global Burden of Disease and Injury. 1st ed., Vol. 1. Washington DC: The Harvard School of Public Health; 1996.

8. Bourbeau R. Comparative analysis of mortality due to violence in developed countries and in a few developing countries during the 1985-1989 period. World Health Stat Q 1993;46:34-32.

9. Drever F. Occupational Health Decennial Supplement. 1st ed. London: HMO; 1995.

10. World Health Organization. Geneva: World Health Statistics Annual, 1995.

11. Occupational Safety and Health Act 1984 (the OSH Act) and the Mines Safety and Inspection Act 1994 (the MSI Act). Government of Western Australia Department of Commerce and Department of Mines and Petroleum. [Last retrieved on 2015 Oct 10].