Maxillofacial injury: A retrospective analysis of time lapse between injury and treatment in a South African academic maxillofacial and oral surgery unit

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Background. The study was undertaken in an academic maxillofacial and oral surgical unit in a large quaternary hospital attached to the Medical School of the University of the Witwatersrand, Johannesburg, between 2002 and 2006.
Objective. To investigate the number of days in seven patient management intervals from facial fracture occurrence to discharge from hospital, to gain insight into reasons for treatment delays.
Results. Facial fractures were treated a mean of 20.4 days from occurrence. There was a mean of 10.3 days from fracture to hospital presentation, and an identical period from hospital presentation to treatment. Statistical analysis showed that delay times decreased from 2002 to 2006.
Conclusion. More rapid referral to the maxillofacial and oral surgical unit is the most practical way to reduce delays further.

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South Africa's public health system provides care for about 80% of the population; the remainder is provided by a private health industry. The public healthcare system has four categories of hospitals, district, regional, tertiary and quaternary, each offering different levels of service.[1,2] There are two quaternary hospitals: Charlotte Maxeke Johannesburg Academic Hospital (CMJAH) in Johannesburg and Groote Schuur Hospital in Cape Town. The Division of Maxillofacial and Oral Surgery (DMFOS) in the Faculty of Health Sciences of the University of the Witwatersrand, Johannesburg, provides specialist care at CMJAH and at a tertiary hospital in Soweto (Chris Hani Baragwanath Hospital).

There is no official referral system around Johannesburg that dictates which government clinic or hospital refers to the two hospitals served by the DMFOS; a rather unofficial system, which has developed over time, operates. Patients with maxillofacial injuries may therefore initially present at CMJAH itself or be referred there. CMJAH has 1 088 beds;[2] within the hospital the DMFOS has a 21-bed ward dedicated to maxillofacial and oral surgery, with additional patient responsibilities in other surgical wards and intensive care units. At the time of the study the staff complement was 2 full-time consultants, 8 part-time consultants, 4 full-time registrars and 1 full-time dental officer.

Facial trauma forms the bulk of cases treated in the DMFOS at CMJAH. Desai *et al.*[3] described a typical demographic of 133 patients with mandibular fractures during 2004. Interpersonal violence was the cause of fracture in 86%, and accidents of all types, including motor vehicle accidents, were responsible for 14%. Alcohol was associated with the fractures in 65% of cases.

DMFOS staff at CMJAH have an anecdotal belief that facial fractures are treated about 3 weeks after injury. Staff have noted that patients typically attend three assessments before any treatment:

- First attendance: a patient presents to the DMFOS ward with a referral letter from the trauma unit ('accident and emergency' in the UK), an outlying hospital/clinic or another department at CMJAH. After pain relief, a patient is given an outpatient clinic appointment for full assessment.
- Second attendance: a patient is assessed at the outpatient clinic and an appointment for treatment is arranged.
- Third attendance: the fracture is treated under either local or general anaesthesia.

In an ideal world, treatment should be provided as soon as possible, since delayed treatment of facial fractures has physical, psychological and economic implications for a patient.

Although Desai *et al.*[3] list many published clinical audits of facial fractures in South Africa, no study of the timing of the stages from facial fracture to treatment has been reported from South Africa or elsewhere.

This investigation aimed to improve service planning and delivery in the DMFOS by examining where the primary cause of delayed treatment might lie – with the patient or with the DMFOS.

Materials and methods

Before starting the study, clearance was obtained from the Human Research Ethics Committee (Medical) of the University of the Witwatersrand (Clearance number M070425), after which the Chief Executive Officer of the CMJAH gave permission to access archived patient files.

Inclusion criteria for the study were any patients with facial fractures admitted to the DMFOS in 2002, 2004 and 2006. Gaps between the study years gave increased contrast. Initial data were obtained from the ward admission books and comprised hospital number, name, age, race, gender, type of fracture sustained and treatment performed. These data were recorded on a Microsoft Excel spreadsheet using a numerical code for each patient to maintain confidentiality. Next, each patient's file was manually located in the hospital archives in the basement of the CMJAH, where they had to be examined because for legal reasons files may not be removed from the archives – this was very time consuming.

The following data were recorded: mechanism of injury, whether the patient had been referred or not, where they had been referred from, date of injury, date of referral, date of presentation at the DMFOS, date of admission, date of treatment, date of discharge, whether the patient had been intoxicated at the time of injury, if interpersonal violence was implicated in the injury, other injuries sustained at the time of the fracture, fracture type and site, fracture treatment, and whether the treatment was done under local or general anaesthesia.

Seven time intervals (in days) were calculated from the dates in the patient files: injury occurrence to presentation at DMFOS, injury occurrence to referral (if referred), referral of patient to presentation at DMFOS, presentation to treatment, referral to treatment, treatment to discharge, and presentation to discharge.

Statistical analysis was performed using SAS for Windows (version 9.1, SAS Institute, Cary NC, USA). For descriptive statistics, Proc Freq, Proc Means and Proc Univariate were used. The continuous data distributions for the dependent variables were markedly skewed, and the Wilks-Shapiro test showed that these distributions failed the test for normality. Consequently, on the advice of our statistician, the continuous data variables were categorised for the non-parametric chi-squared test. When cross-tabulation cells contained low frequencies, indicating that the chi-squared test was not appropriate, categories were combined on the recommendation of the statistician. The level of statistical significance was set at $p<0.05$.

Results

General demographics by study year and for the combined sample are shown in Table 1. There was little variation between the study years. Numbers admitted per year ranged between 234 and 246, with males comprising 86% of patients. Interpersonal violence was the dominant fracture cause (79%), while referral to the DMFOS increased from 52% in 2002 to 76% in 2006.

The mean number of days and spread of results for each of the seven time intervals are listed in Table 2 by study year and for the combined sample. The mean number of days in each time interval decreased between 2002 and 2006.

Table 3 shows the data in another way, with categorisation of times into logical groupings for non-parametric statistical analysis. We regard 0 - 1 days as good and 2 - 7 days as realistic, followed by mild (8 - 14 days), moderate (15 - 30 days) and extreme (≥31 days) delays. The changes between the study years are best understood through the percentage prevalence per grouping. In general, there is a shift from the higher number of days per grouping to the shorter ones.

Using the chi-squared test, the effects of the following independent variables were examined for each of the seven time groupings – age in decades, gender, injury mechanism, race, referral and year of study. Statistically significant effects were found in five of the time groupings: (*i*) occurrence - presentation (year $\chi^2=18.65$, $p=0.0169$); (*ii*) occurrence - treatment (year $\chi^2=17.19$, $p=0.0282$; referred $\chi^2=12.78$, $p=0.0124$); (*iii*) referral - treatment (year $\chi^2=32.46$, $p<0.0001$); (*iv*) presentation - treatment (race $\chi^2=17.45$, $p=0.0257$; year $\chi^2=16.39$, $p=0.0371$); and (*v*) presentation - discharge (year $\chi^2=34.4$, $p<0.0001$).

Discussion

A careful search of the published literature did not find any similar investigations for comparison.

From the results for the combined sample, it can be seen that the main problem is that facial fractures are being

Table 1. Summary of patient demographics by study year

Variable	2002 *n* (%)	2004 *n* (%)	2006 *n* (%)	All years combined *n* (%)
Gender				
Male	201 (85.9)	213 (86.6)	212 (86.5)	626 (86.3)
Female	33 (14.1)	33 (13.4)	33 (13.5)	99 (13.7)
Race				
Black	180 (76.9)	177 (72.0)	188 (76.7)	545 (75.2)
Other	18 (7.7)	20 (8.1)	20 (8.2)	58 (8.0)
White	36 (15.4)	49 (19.9)	37 (15.1)	122 (16.8)
Mechanism of injury				
Interpersonal violence	196 (83.8)	182 (74.0)	194 (78.9)	572 (78.9)
Other	13 (5.6)	24 (9.8)	18 (7.3)	55 (7.6)
Vehicle accident	25 (10.7)	40 (16.3)	33 (13.5)	98 (13.5)
Referred				
Yes	121 (51.7)	181 (73.6)	185 (75.5)	487 (67.2)
No	113 (48.3)	65 (26.4)	60 (24.6)	238 (32.8)

Table 2. Summary of results of all the study time intervals (days) for the combined sample and by study year

Variable	Fracture occurrence - presentation	Fracture occurrence - treatment	Referral - presentation	Referral - treatment	Presentation - treatment	Treatment - discharge	Presentation - discharge
All years combined							
n	725	725	333	335	725	725	725
Mean (±SD)	10.3 (±12.7)	20.4 (±17.6)	4.5 (±8.3)	14.6 (±15.6)	10.3 (±11.8)	1.3 (±2.0)	11.7 (±12.8)
Min. - max.	0 - 120	0 - 140	0 - 80	0 - 130	0 - 119	0 - 33	0 - 131
Median	6	18	1	12	8	1	9
2002							
n	234	234	71	73	234	234	234
Mean (±SD)	12.5 (±15.0)	24 (±22.3)	6.8 (±12.5)	18.2 (±23.9)	11.4 (±14.8)	1.7 (±2.9)	13.7 (±16.5)
Min. - max.	0 - 120	0 - 140	0 - 80	0 - 130	0 - 119	0 - 33	0 - 131
Median	7	20	2	13	7.5	1	9
2004							
n	246	246	116	116	246	246	246
Mean (±SD)	8.7 (±10.8)	18.5 (±12.8)	4 (±5.7)	14.4 (±9.8)	10.2 (±8.7)	1.2 (±1.6)	11.1 (±8.5)
Min. - max.	0 - 64	0 - 68	0 - 33	0 - 45	0 - 45	0 - 13	0 - 53
Median	5	17	1	14	9	1	10
2006							
n	245	245	146	146	245	245	245
Mean (±SD)	9.7 (±11.8)	18.8 (±16.2)	3.9 (±7.3)	12.9 (±13.6)	9.4 (±11.2)	1.0 (±1.0)	10.5 (±12.3)
Min. - max.	0 - 80	0 - 113	0 - 48	0 - 115	0 - 111	0 - 8	0 - 114
Median	6	16	1	10	8	1	9

SD = standard deviation.

treated a mean of 20.4 days after occurrence, which is close to the 3-week estimate of DMFOS staff. This delay is equally split between the time from fracture occurrence to presentation to the DMFOS, and from presentation to treatment.

The time interval that is of most interest is from fracture occurrence to fracture treatment; the other time intervals influence this in one way or another. From a practical perspective the time intervals may be subdivided into those influenced by a patient or referring clinic/hospital (from fracture occurrence to fracture treatment), and the remainder – those influenced by the DMFOS and CMJAH.

Delay influenced by patients or referring clinic/hospital

Why are patients presenting to the DMFOS an average of 10 days after the fracture has occurred? This seems a long time to wait before seeking treatment for an injury; suggested reasons are as follows:

- Alcohol is involved in 53.8% of fractures that present to the DMFOS. People may be too 'hung over' to realise the seriousness of their situation and seek treatment for a fracture.
- People may expect the injury to heal by itself, only seeking treatment when the injury 'doesn't go away'. This may be influenced by the low socio-economic status of many patients.
- People may seek treatment from traditional healers before seeking orthodox medical care.
- In cases of pan-facial fractures, where a large force to the body is required (i.e. a serious motor vehicle accident or severe inter-personal violence), there are often associated injuries which require more urgent treatment. The more life-threatening injuries are addressed first – such as haemo-pneumothorax, head injuries and spinal injuries. These injuries are relatively uncommon in the DMFOS.

Table 3. Frequency distribution for the five time groups (days) by study year and for all years combined

Days	2002 (*N*=234) *n* (%)	2004 (*N*=246) *n* (%)	2006 (*N*=245) *n* (%)	All years combined (*N*=725) *n* (%)
Fracture occurrence - presentation				
0 - 1	37 (15.8)	53 (21.5)	42 (17.1)	132 (18.2)
2 - 7	83 (35.5)	101 (41.1)	101 (41.2)	285 (39.3)
8 - 14	38 (16.2)	48 (19.5)	53 (21.6)	139 (19.2)
15 - 30	56 (23.9)	30 (12.2)	35 (14.3)	121 (16.7)
≥31	20 (8.6)	14 (5.7)	14 (5.7)	48 (6.6)
Fracture occurrence - treatment				
0 - 1	13 (5.6)	16 (6.5)	11 (4.5)	40 (5.5)
2 - 7	36 (15.4)	31 (12.6)	38 (15.5)	105 (14.5)
8 - 14	36 (15.4)	58 (23.6)	63 (25.7)	157 (21.7)
15 - 30	95 (40.6)	103 (41.9)	103 (42.0)	301 (41.5)
≥31	54 (23.1)	38 (15.5)	30 (12.2)	122 (16.8)
Presentation - treatment				
0 - 1	72 (30.8)	53 (21.5)	55 (22.5)	180 (24.8)
2 - 7	45 (19.2)	55 (22.4)	64 (26.1)	164 (22.6)
8 - 14	45 (19.2)	62 (25.2)	74 (30.2)	181 (24.9)
15 - 30	58 (24.8)	71 (28.9)	49 (20.0)	178 (24.6)
≥31	14 (6.0)	5 (2.0)	3 (1.2)	22 (3.0)
Treatment - discharge				
0 - 1	170 (72.7)	205 (83.3)	207 (84.5)	582 (80.3)
2 - 7	59 (25.2)	38 (15.5)	37 (15.1)	134 (18.5)
8 - 14	3 (1.3)	3 (1.2)	1 (0.4)	7 (1.0)
15 - 30	1 (0.4)	-	-	1 (0.1)
≥31	1 (0.4)	-	-	1 (0.1)
Presentation - discharge				
0 - 1	22 (9.4)	21 (8.5)	20 (8.2)	63 (8.7)
2 - 7	83 (35.5)	77 (31.3)	83 (33.9)	243 (33.5)
8 - 14	45 (19.2)	69 (28.1)	83 (33.9)	197 (27.2)
15 - 30	63 (26.9)	74 (30.1)	56 (22.9)	193 (26.6)
≥31	21 (9.0)	5 (2.0)	3 (1.2)	29 (4.0)
Referral - presentation	*N*=71	*N*=116	*N*=146	*N*=333
0 - 1	33 (46.5)	59 (50.9)	86 (58.9)	178 (53.5)
2 - 7	19 (26.8)	35 (30.2)	38 (26.0)	92 (27.6)
8 - 14	9 (12.7)	16 (13.8)	11 (7.5)	36 (10.8)
15 - 30	6 (8.5)	5 (4.3)	10 (6.9)	21 (6.3)
≥31	4 (5.6)	1 (0.9)	1 (0.7)	6 (1.8)
Referral - treatment	*N*=73	*N*=116	*N*=146	*N*=335
0 - 1	15 (20.6)	14 (12.1)	26 (17.8)	55 (16.4)
2 - 7	15 (20.6)	20 (17.2)	22 (15.1)	57 (17.1)
8 - 14	8 (11.0)	25 (21.6)	50 (34.3)	83 (24.8)
15 - 30	22 (30.1)	52 (44.8)	39 (26.7)	113 (33.7)
≥31	13 (17.8)	5 (4.3)	9 (6.2)	27 (8.1)

- People seek treatment at primary healthcare clinics. This is a potential delay, but those clinics that refer to tertiary/quaternary hospitals do shorten the time between fracture occurrence and presentation by a mean of 2 days. Most patients referred by an outlying hospital present to the DMFOS within a day, but there has been a delay in seeking the initial care.
- Transport difficulties, lack of money to pay for transport and for treatment, and inability to take time away from work or home may be additional factors causing delays.

Delays influenced by the DMFOS and CMJAH

Public healthcare providers face unique challenges in the two-tier South African healthcare system. In the private care system based on medical insurance, doctors and dentists have a higher earning potential and anecdotally have greater job satisfaction because they work for themselves and do the type of work that they enjoy with modern equipment.

The majority of South Africans, however, cannot afford medical insurance so are compelled to use public health facilities, which are overcrowded and inadequately funded for the workload. Most of the doctors who work in the public health sector are there because they are furthering their training by specialising, resulting in a heavy workload for relatively few healthcare practitioners; this is the case in the DMFOS. Freezing of posts in the present climate of financial stringency may also cause delays in treatment. A common, almost daily, bottleneck occurs when patients require general anaesthesia for fracture treatment, as there are shortages of anaesthetists, operating theatre staff, anaesthetic drugs and available operating theatres. Delays owing to these factors are not easily reduced, because the causes are beyond the control of the DMFOS. A theoretical delay factor could be ward space in the DMFOS, but since time from treatment to discharge has been consistently low over the 3 years, and was reduced to a mean of 1 day in 2006, this is unlikely. There is a high turnover in the ward; patients are not unnecessarily kept in the ward for days or weeks after their operation, so there is seldom a bed availability problem.

Conclusion

The problem that the DMFOS is faced with is multifaceted. That there is a delay in obtaining treatment for facial fracture is clear. At the moment the most suitable delay to tackle is to shorten the time from facial fracture occurrence to presentation at the DMFOS. Two possible approaches are:

- increasing public awareness of the importance of early diagnosis of injuries likely to be facial fractures through media campaigns
- increasing the knowledge of practitioners at primary healthcare clinics/outlying hospitals on how to diagnose facial fractures, and providing a standard approach for referral to the DMFOS.

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