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Research Paper
Trauma

Patient compliance and mandible fractures: a prospective study

M. J. L. Hurrell[1], M. C. David[2], M. D. Batstone[3]
[1]School of Medicine, University of Queensland, Brisbane, Queensland, Australia; [2]School of Public Health, University of Queensland, Brisbane, Queensland, Australia; [3]Oral and Maxillofacial Department, Royal Brisbane and Women's Hospital, Brisbane, Queensland, Australia

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Abstract. Fractures of the facial skeleton place a burden on healthcare systems at the individual and population level. It is suggested that a high proportion of such patients are non-compliant with various aspects of their care. It stands to reason that non-compliance would contribute to adverse outcomes and increased costs in general. The intent of this study was two-fold: to determine factors associated with poor compliance in the studied population of 215 patients with 359 mandible fractures, and to determine whether poor compliance is associated with an increased incidence of treatment complications. Being male, an illicit drug user, non-employed, and living furthest from care were the factors associated with non-compliance in the studied population. Compliance with soft diet, mouthwash, oral antibiotics, cigarette cessation, and review appointment attendance was 74%, 96%, 96%, 16%, and 58%, respectively. Global compliance scores of low, medium, and high were assigned to 27%, 59%, and 14% of participants, respectively. None of the individual postoperative compliance variables was found to be significantly associated with outcomes of treatment at the 5% level. Borderline associations were found. Globally non-compliant patients were significantly more likely to experience wound dehiscence. The utility of the current postoperative regimen should be further elicited.

Key words: mandible; trauma; compliance; outcomes; demographic.

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Fractures of the facial skeleton continue to place a significant burden on healthcare systems at the individual and population level worldwide[1–3]. Due to their relative prevalence, urgency, and complication rate, mandible fractures likely take the greatest toll. In many developing countries, the aetiology of facial fractures is most commonly motor vehicle related[4,5]. Developed countries often see the majority of facial fractures in relation to interpersonal violence between young men, frequently in conjunction with alcohol or other illicit substance abuse[1–3,6–13]. It is regularly suggested that a comparatively high proportion of such patients are non-compliant with various aspects of their care[2,3,12,14]. It stands to reason that such non-compliance would contribute to adverse outcomes, and thus to increased costs in general[2,4,9,12].

Although several studies identify compliance as a potential causative or contributing factor of adverse outcomes of facial

fractures[2,4,9,12], the current literature is unable to adequately quantify its prevalence or effects. Recently, Radabaugh et al. conducted a study with the goal of identifying factors associated with increased compliance in the postoperative management of patients with mandible fractures[2]. In a study of 344 mandible fractures, they found no association between treatment complications and postoperative compliance. However, their only measure of compliance was postoperative review appointment attendance. Similarly, Stewart and Chen identified factors associated with postoperative review appointment attendance in facial trauma patients. However, treatment outcomes were not assessed in their study[11]. In a relatively dated paper, Marciani et al. attempted to analyse the effects of compliance on outcomes of facial fracture treatment[14]. Despite finding no significant association between compliance and outcomes, the study was vastly underpowered with a sample size of 25 and four different facial fracture subgroups.

The intent of this study was two-fold: to determine the factors associated with poor compliance in the studied population of patients with mandible fractures, and to determine whether poor compliance is associated with an increased incidence of treatment complications. With an improved understanding of the causes and effects of poor treatment compliance, targeted strategies may be employed to reduce the associated costs.

Methods

Study design

This study largely utilized data from a related project that collected data in a continuous, prospective manner, over an 18-month period, at a single institution[15]. The data were analysed independently from the previously mentioned project, and reveal new information that sheds light on a poorly defined area of clinical practice. The study was undertaken in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement[16].

Setting

This study was undertaken in the oral and maxillofacial unit of a public tertiary hospital in Brisbane, Australia.

As previously reported in a related project[15], definitive assessment and management of mandible fractures at the study institution, although likely to change, has until now been undertaken in an inpatient setting in a semi-urgent manner, with patients usually receiving surgical treatment within 4 days of injury. Uncomplicated mandible fractures are usually managed primarily by a trainee surgeon, under varying levels of supervision. Difficult fractures such as the heavily comminuted, grossly displaced or infected, or those requiring extraoral access are usually managed more directly by experienced consultant-level surgeons. Treatment plans are ultimately prescribed by consultant-level surgeons, with miniplate, load-sharing open reduction and internal fixation (ORIF) utilized most frequently. When necessary, extraoral approaches, varying forms of intermaxillary fixation (IMF), and endoscopic assistance are utilized. Patients with isolated mandible fractures are usually discharged after anaesthetic recovery, the acquisition of postoperative plain-film imaging, confirmation of occlusion, and the delivery of postoperative instructions. Patients are discharged with a single course (5–7 days) of oral antibiotics. The choice of antibiotics is made according to local guidelines, and is usually a combination of amoxicillin and either clavulanic acid or metronidazole. Patients with hypersensitivity to penicillin are prescribed clindamycin. All patients are prescribed a chlorhexidine-containing mouthwash to be used three to four times per day for at least 1 week, or until oral wounds have healed. All patients are instructed to refrain from smoking cigarettes. A soft diet is stipulated for 6 weeks postoperatively. Patients are advised to strictly avoid chewing for the first 4 weeks.

Postoperative review for patients with mandible fractures usually begins approximately 1 week post-surgery. Such timing allows for the identification and rectification of early complications, as well as providing the surgical team with an opportunity to monitor compliance with, and reinforce postoperative instructions. If the surgical team is satisfied with the progress achieved at the first review, patients are usually re-booked to attend the outpatient department again at approximately 6 weeks post-surgery. The 6-week review allows for the assessment of healing and restitution of function, and allows for the identification of more delayed complications. Additional review appointments are made when clinically warranted.

Participants

As per an earlier study utilizing the same dataset[15], patients who required active treatment for a fracture or fractures of the mandible and who were treated in the oral and maxillofacial unit at the study hospital between January 27, 2014 and July 26, 2015 were included in the study.

Variables

The following demographic variables were collected for each patient: age, sex, distance to maxillofacial service, dental status, alcohol use, cigarette use, illicit drug use, employment status, and injury aetiology.

Compliance with postoperative instructions was assessed using the following variables for each patient: soft diet, mouthwash, oral antibiotics, cigarette cessation, and review appointment attendance.

The treatment outcome was assessed using the following variables for each patient: local postoperative infection, wound dehiscence, malocclusion, fracture non-union, hardware exposure, nerve damage, trismus, and return to theatre.

Data sources/measurement

As per an earlier study utilizing the same dataset[15], data were collected and recorded on a pre-planned data collection sheet. Information was obtained from patients at admission and at routine postoperative appointments, from medical records, from patient radiographs, and from the hospital's Operating Room Management Information System (ORMIS).

Bias

As per an earlier study utilizing the same dataset[15], the first author was not a member of the oral and maxillofacial unit at the study hospital and as such had no conflict of interest in reporting the unit's surgical results. The second author, a biostatistician from the School of Population Health at the University of Queensland, who had no professional connection with the oral and maxillofacial unit or the first or third author, conducted the statistical analysis independently. The third author was the primary operator for only two of the 215 patients.

Study size

As per an earlier study utilizing the same dataset[15], a total of 215 consecutive patients with 359 mandible fractures were included.

Quantitative variable handling

Demographic variables

Age and cigarette use were measured as continuous variables. Distance to the maxillofacial service was measured using Google Maps with the patient's home postcode and the study hospital postcode[17]. Distances were divided into three groups: 0–49 km, 50–299 km, and ≥300 km.

Dental status was determined by preoperative radiographic analysis as good, moderate, or poor. Concerning the effects of dental status on mandible fracture outcomes, occlusal instability and bacterial load were considered the primary risk factors for poorer outcomes. Therefore, participants with 26 or more teeth, with fewer than three obvious carious lesions, and without obvious periodontal bone loss were considered as having a good dental status. Participants with at least 20 teeth but fewer than 26 teeth were considered as having a moderate dental status, unless severe periodontal bone loss or gross caries was evident. Similarly, participants with more than 26 teeth were considered as having a moderate dental status if more than two obvious carious lesions or moderate periodontal bone loss was evident. Participants with fewer than 20 teeth and those with severe periodontal bone loss or gross caries were considered to have a poor dentition.

Alcohol use was defined as non-drinker, binge drinker, low-regular drinker, and high-regular drinker. Alcohol use was determined by questioning the patients upon admission to hospital. It is well recognized that binge drinking is associated with a large proportion of mandible fracture presentations and that regular heavy alcohol use is associated with poorer overall health and healing. For these reasons, it was determined that the categorization of alcohol use should account for both forms of use. The Australian Government National Health and Medical Research Council recommends that for both men and women, no more than two standard drinks on any day reduces the lifetime risk of harm from alcohol-related disease or injury, and that for both men and women, drinking no more than four standard drinks on a single occasion reduces the risk of alcohol-related injury arising from that occasion[18]. A standard drink is defined as one can of mid-strength beer, a 30 ml nip of spirits, or 100 ml of wine (13.5%)[18]. Therefore, participants who usually drank every week, but within the above recommendations, were considered as low-regular drinkers. Participants who usually drank every week, and who drank more than the above recommendations on more than 1 day per week, were considered as high-regular drinkers. Participants who usually drank more than four standard drinks on a single occasion, and who usually drank at a frequency of once per week or less, were considered as binge drinkers, and participants who did not drink or drank within the above recommendations but at a frequency of less than once per week were considered as non-drinkers.

Illicit drug use was recorded as yes or no. Injury aetiology was defined as assault or non-assault. Employment status was defined as employed or non-employed. Students and retirees were allocated to the non-employed group.

Compliance variables

Soft diet, mouthwash, oral antibiotics, and cigarette cessation were all recorded as yes or no. Review appointment attendance was initially measured in three groups: attended all review appointments, attended some review appointments, and attended no review appointments. The variable was later compressed from a trivariate to a bivariate model for statistical purposes.

Outcome variables

Local postoperative infection, wound dehiscence, fracture non-union, hardware exposure, nerve damage, trismus, and return to theatre were all defined as yes or no. Malocclusion was measured as an ordinal variable.

Local postoperative infection was defined as any clinical sign of infection such as erythema and purulence at the site of surgery during the follow-up period. Wound dehiscence was defined as any clinically significant breakdown of any related surgical incision at any time during the follow-up period. Fracture non-union was defined radiographically as any permanent failure of healing of related fracture sites at any time during the follow-up period. Hardware exposure was defined as any exposure of metal work to the oral cavity or externally through the skin at any time during the follow-up period. Nerve damage was defined as any objectively altered sensation in the distribution of the mental nerve at the final postoperative review appointment, irrespective of preoperative status. Return to theatre was defined as any return to theatre at any time for the correction of complications directly related to the mandible fracture or fractures treated within the study. Trismus was defined at the final postoperative review appointment as any limitation of mouth opening because of the injury or treatment within the study.

Malocclusion was defined at the final postoperative review appointment as any alteration of occlusion because of the injury or treatment within the study. Three groups were defined: no, subjective, and objective. Subjective malocclusion was defined as a sensation of abnormal bite by the patient that could not be correlated clinically by the reviewer. Objective malocclusion was defined as a clinically observable alteration of bite by the reviewer, such as a premature contact or open bite.

Statistical methods

The statistical analysis was undertaken in three parts. Backwards elimination was utilized to select a set of variables (at a *P*-value of 0.25), with age and sex being forced into each multivariable regression model.

Part 1—effects of individual demographic variables on individual compliance variables

The effect of individual demographic variables (independent variables) on individual compliance variables (dependent variables) was examined using multivariable binary logistic regression. As one of the primary aims of the study was to quantify the effects of the eight demographic variables on each compliance variable, none were excluded from the multivariable modelling. Diagnostic testing was undertaken on each model. All models were determined to have good model fit and specification, the former by way of the Hosmer–Lemeshow test[19], and the latter by way of Pregibon's link test[20]. In addition, the Box–Tidwell test was used to assess the significance of departures from linearity in the logit[21].

Part 2—effects of individual compliance variables on treatment outcomes

The independent effects of the five individual compliance variables (independent variables) on each of the eight individual treatment outcome variables (dependent variables) were examined using multivariable binary logistic regression for all outcomes except malocclusion. For malocclusion, multivariable ordinal logistic regression was used. For the same reasons as for part 1, all compliance variables were included in the multivariable modelling. As assessed by Pregibon's link test[20],

no model was deemed to be misspecified or have poor model fit[19,22]. For the outcome of malocclusion, the assumption of proportional odds was also found to be valid[23], as was the assumption of linearity[21].

Part 3—effects of overall compliance variables on treatment outcomes

The effect of a global compliance variable (independent variable) on each of the eight individual treatment outcome variables (dependent variables) was quantified using multivariable binary logistic regression for all outcomes except malocclusion. For malocclusion, multivariable ordinal logistic regression was used. The global compliance variable consisted of three levels: (1) compliant on zero or one compliance variables; (2) compliant on two or three compliance variables; and (3) compliant on four or five compliance variables. As assessed by Pregibon's link test[20], no model was deemed to be misspecified, have poor model fit[19,22], or violate the assumption of linearity[21]. For the outcome of malocclusion, the assumption of proportional odds was also found to be valid[23].

Results for all parts are presented as odds ratios (OR) and accompanying 95% confidence intervals (95% CI). Statistical analyses were firstly undertaken with only patients who provided data on all variables required in the modelling. Consequently, and to assess the effect that missing data might have on estimates produced by such an approach, all analyses were replicated using a chained multiple imputation approach, and corresponding estimates compared for significance and directional effect. All statistical tests were two-tailed and statistical significance was assigned to a P-value of <0.05. The statistical analysis was performed using Stata version 15.0 (StataCorp, College Station, TX, USA).

Results

Participants

A continuous sample of 215 patients with 359 mandible fractures was achieved. Of the 215 patients, 90% were treated primarily with transoral ORIF, 7% primarily with extraoral ORIF, and 3% with IMF in isolation. Forty-four percent of patients presented with a single fracture, 47% with two fractures, and 9% with three or more fractures. Comminuted fractures were identified in 11% of patients. A tooth was present in 77% of fractures.

Whilst there was a substantial level of missing data, as shown in Figs. 1–3, a comparison of point and interval estimates obtained from complete-case analysis and chained multiple imputation showed a high degree of similarity. As a consequence, results reported emanate from a complete-case perspective.

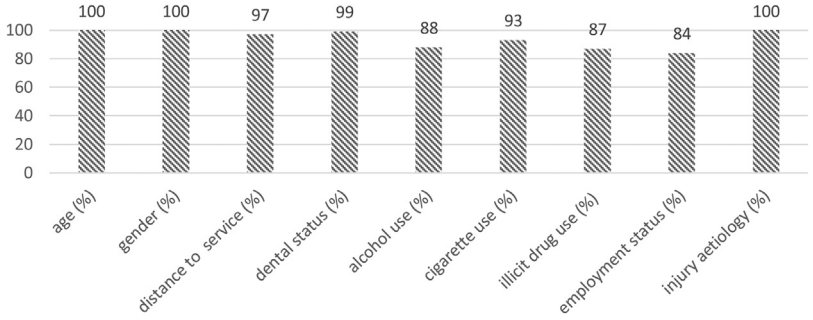

Fig. 1. Demographic data: observations complete per variable (percentage).

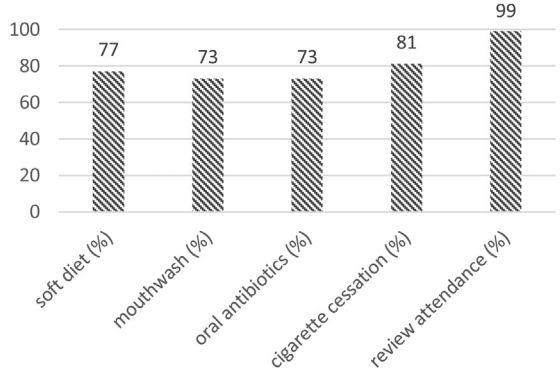

Fig. 2. Compliance data: observations complete per variable (percentage).

Outcome data

Demographic variables

The oral and maxillofacial unit at the study hospital provides a tertiary referral service for facial trauma for a large metropolitan and regional area. Thirty percent of participants lived more than 300 km from the hospital, and a further 32% lived between 50 km and 300 km from the hospital. Eighty-four percent of participants were male, and the mean age was 31 years. Fifty-five percent of participants were deemed to have good dental status, 29% moderate, and 16% poor. Cigarette use, illicit drug use, employment status, injury aetiology, and alcohol use values are shown in Figs. 4 and 5. The mean number of cigarettes smoked per day for smokers was 15.

Compliance variables

Compliance values are shown in Fig. 6. The mean number of cigarettes smoked per day before treatment for the participants compliant with cigarette cessation was 9. Of the 42% of participants who were non-compliant with review appointment attendance, 13% did not attend any postoperative review appointments.

Outcome variables

Outcome values are demonstrated in Fig. 7 (local postoperative infection, wound dehiscence, fracture non-union, hardware exposure, nerve damage, trismus, and return to theatre) and Fig. 8 (malocclusion).

Main results

Part 1—effects of individual demographic variables on individual compliance variables

Significant associations were found for the compliance variables soft diet and smoking cessation (Table 1).

Males compared to females (OR 0.13, 95% CI 0.01–1.08), and illicit drug users compared to non-users (OR 0.55, 95% CI 0.11–0.93) were both significantly more likely to be non-compliant with soft diet instructions.

Males compared to females (OR 0.02, 95% CI 0.01–0.25), non-employed compared to employed (OR 19.23, 95% CI 1.48–86), and participants living further than 300 km from the service compared to

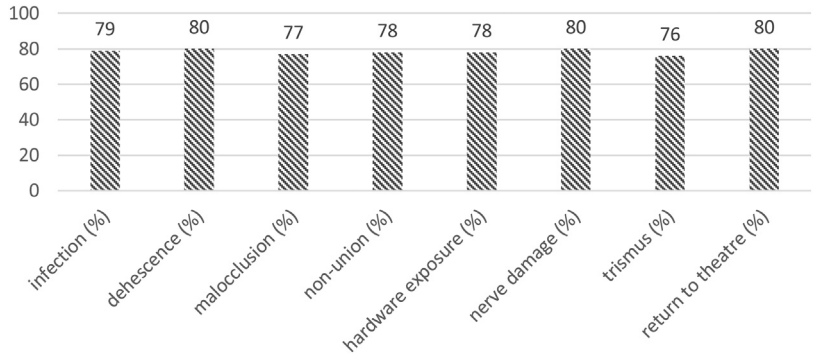

Fig. 3. Outcome data: observations complete per variable (percentage).

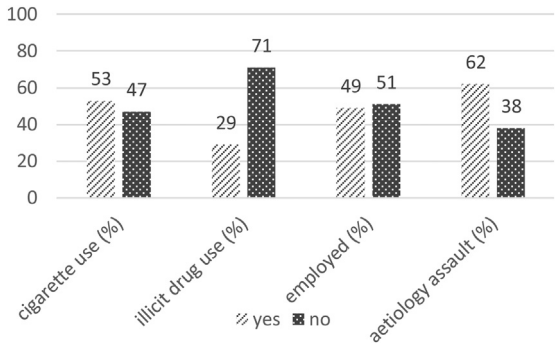

Fig. 4. Demographic data: cigarette use, illicit drug use, employment status, injury aetiology (percentage).

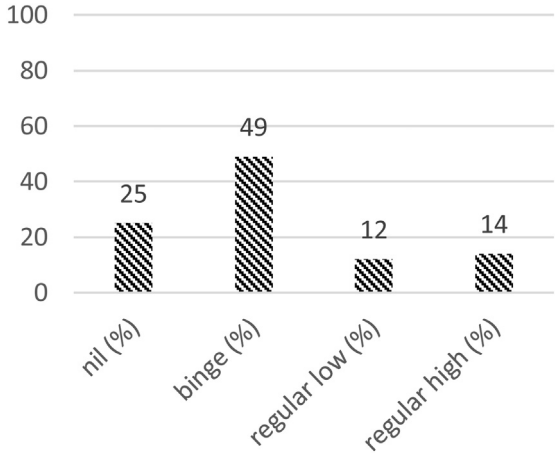

Fig. 5. Demographic data: alcohol use (percentage).

participants living within 50 km (OR 0.07, 95% CI 0.01–0.49) were all significantly more likely to be non-compliant with cigarette cessation advice.

Part 2—effects of individual compliance variables on treatment outcomes

Borderline significant associations were found for the outcome variables postoperative infection, trismus, and return to theatre (Table 2).

Participants who were compliant with postoperative review appointments compared to participants who were not were less likely to be diagnosed with a postoperative infection, or to return to theatre.

Compared to participants who were not compliant with mouthwash instructions, participants who were compliant were less likely to be diagnosed with trismus.

Part 3—effects of overall compliance variables on treatment outcomes

Twenty-seven percent of participants were found to have an overall compliance level categorized as low, whereas 59% were moderately compliant overall and 14% were highly compliant overall. Since moderate overall compliance was most common, this level was used as the reference level in the regression analyses.

The overall compliance level was found to be significantly associated with the outcome variable wound dehiscence (Table 3). Compared to participants with an overall compliance level of moderate, participants with an overall compliance level of low were significantly more likely to have a wound dehiscence (OR 8.43, 95% CI 1.89–37.49).

Discussion

Being male, a known illicit drug user, non-employed, and living furthest from oral and maxillofacial care were the demographic factors most likely to be associated with non-compliance with postoperative instructions in this study population. The causation for these findings is difficult to elicit. A heavily cited study by Jin et al., examining factors affecting therapeutic compliance, highlighted the difficulty in examining pure associations with demographic variables due to the complex influences of various cultural, socioeconomic, and psychological factors[24]. Despite this, these findings were not surprising within the studied demographic. These findings are probably relatively generalizable, as the demographics of the studied population are consistent with those reported from other similar institutions involved in the management of mandible fractures.

Compliance with cigarette cessation was 16%. This effect is magnified by the high proportion of cigarette smokers in the study population at 53%, considerably higher than the Australian average of approximately 15%[25]. Along with its well-studied effects on systemic wound healing and carcinogenesis, smoking has been associated with complications in many oral and maxillofacial surgical procedures such as orthognathic surgery, dental implantology, maxillary sinus augmentation, dentoalveolar surgery, and facial trauma surgery[26–31].

Compliance with review appointment attendance was 58%, which is consistent with similar populations reported previously in the literature[2,11,12]. One of the

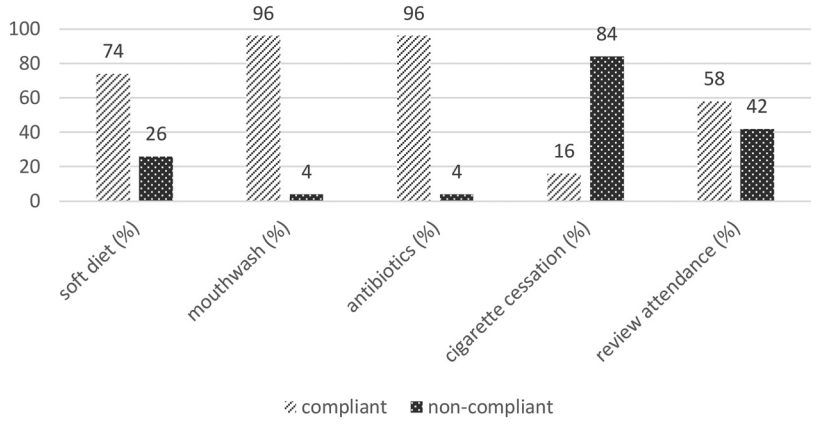

Fig. 6. Compliance data: soft diet, mouthwash, antibiotics, cigarette cessation, review attendance (percentage).

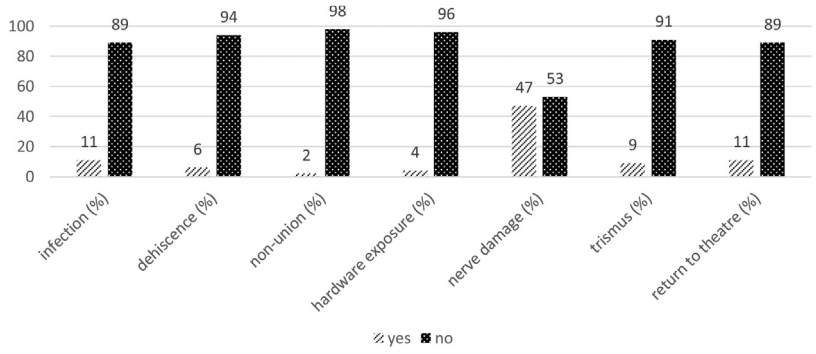

Fig. 7. Outcome data: infection, dehiscence, non-union, hardware exposure, nerve damage, trismus, return to theatre (percentage).

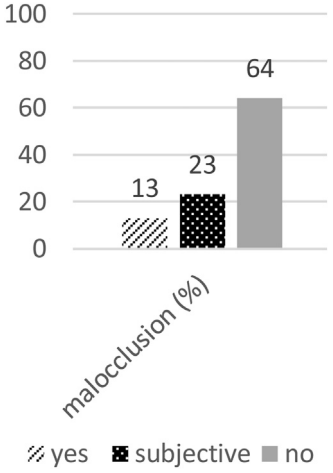

Fig. 8. Outcome data: malocclusion (percentage).

study participants who was completely lost to follow-up was discharged from hospital with arch bars. Concerns regarding the implications of long-term retention of hardware such as arch bars, bridle wires, and intermaxillary fixation screws, as well as non-resorbable sutures, are validated with such poor figures. Radabaugh et al. recently commented that ''the mantra to treat and street has favoured operative techniques that can adequately treat a fracture but do not require as rigorous a postoperative follow-up course''[2], which may be a valid proposition.

Compliance with soft diet instructions was 74%. Of the non-compliant participants, most reported a gradual reintroduction of chewable foods at approximately 3 weeks post-surgery. Several participants admitted to chewing steak or burgers within a week of surgery, and two were witnessed chewing solid foods at the 1-week postoperative review appointment. A common criticism of treatment by participants was that the dietary restrictions were unreasonable, despite education regarding the implications of treatment failure. Interestingly, in 1978, in their landmark study ''Mandibular osteosynthesis by miniature screwed plates via a buccal approach'', Champy et al. recommended return to normal diet from the tenth postoperative day[32].

Compliance was high for antibiotic and mouthwash usage (both 96%). This is likely explained by the fact that the antibiotic and mouthwash regimens required very little time commitment or lifestyle sacrifice and both were provided free of charge to the participants in the study. A proportion of the studied population also placed a disproportionately high value on the use of antibiotics. A recent systematic review by Shridharani et al., examining

Table 1. Effects of individual demographic variables on individual compliance variables.

	Soft diet			Mouthwash			Antibiotics			Cigarette cessation			Review attendance		
	OR	95% CI	*P*-value	OR	95% CI	*P*-value	OR	95% CI	*P*-value	OR	95% CI	*P*-value	OR	95% CI	*P*-value
Age	1.01	0.96–1.06	0.7	0.97	0.90–1.06	0.52	0.98	0.90–1.07	0.62	0.86	0.77–0.96	0.01	0.97	0.93–1.01	0.18
Sex															
Female	1			1			1			1			1		
Male	0.13	0.01–1.08	0.02	0.38	0.02–6.20	0.5	0.83	0.05–15.38	0.9	0.02	0.01–0.25	< 0.01	2.15	0.57–8.20	0.26
Distance to service (km)															
0–49	1			1			1			1			1		
50–299	0.49	0.18–1.33	0.16	1.1	0.20–5.98	0.91	0.51	0.07–3.90	0.52	0.6	0.06–6.35	0.67	1.66	0.65–4.28	0.29
300+	0.5	0.19–1.58	0.25	4.42	0.28–69.19	0.29	0.73	0.06–9.08	0.81	0.07	0.01–0.49	0.01	2.5	0.92–6.83	0.07
Dental status															
Good	1			1			1			1			1		
Moderate	1.44	0.44–4.69	0.55	1.98	0.19–21.60	0.58	0.53	0.05–5.49	0.6	0.07	0.01–2.51	0.15	1.05	0.38–2.89	0.93
Poor	1.24	0.16–9.32	0.84	1.69	0.08–37.12	0.74	1.34	0.03–55.45	0.88	7.92	0.12–89.65	0.34	2.72	0.52–14.18	0.24
Alcohol use															
Non-drinker	1			1			1			1			1		
Regular-low drinker	0.92	0.23–3.66	0.06	0.22	0.03–2.04	0.19	0.45	0.07–3.00	0.41	0.72	0.01–60.60	0.27	1.13	0.33–3.90	0.84
Regular-high drinker	0.77	0.22–2.61	0.91	0.24	0.02–2.45	0.23	0.5	0.04–6.28	0.59	0.88	0.34–87.11	0.72	0.42	0.11–1.70	0.23
Binge drinker	1.43	0.42–4.91	0.67	0.26	0.02–3.89	0.33	4.34	0.18–105.22	0.37	1.23	0.01–3.95	0.91	0.32	0.10–1.06	0.06
Cigarette use	1	0.95–1.06	0.93	0.95	0.87–1.04	0.28	0.98	0.89–1.08	0.71	0.88	0.76–1.03	0.11	1.03	0.98–1.08	0.28
Illicit drug use															
No	1			1			1			1			1		
Yes	0.55	0.11–0.93	0.04	0.2	0.03–1.19	0.08	0.19	0.03–1.19	0.08	0.9	0.07–12.28	0.94	2.14	0.78–5.87	0.14
Employment status															
No	1			1			1			1			1		
Yes	1.36	0.51–3.60	0.54	0.69	0.11–4.22	0.69	2.55	0.38–16.91	0.33	19.23	1.48–86.04	0.02	0.45	0.18–1.14	0.09
Injury aetiology															
Assault no	1			1			1			1			1		
Assault yes	0.59	0.24–1.49	0.27	1.39	0.18–10.55	0.75	1.98	0.14–28.59	0.62	1.24	0.39–31.06	0.83	0.52	0.21–1.27	0.15

OR, odds ratio; CI, confidence interval.

Table 2. Effects of individual compliance variables on treatment outcomes.

	Wound dehiscence			Malocclusion			Non-union			Hardware exposure		
	OR	95% CI	*P*-value	OR	95% CI	*P*-value	OR	95% CI	*P*-value	OR	95% CI	*P*-value
Antibiotics												
No	1			1			1			1		
Yes	0.71	0.06–9.23	0.8	3.41	0.32–36.76	0.31	0.2	0.01–2.96	0.24	0.56	0.04–7.42	0.66
Cigarette cessation												
No	1			1			1			1		
Yes	0.44	0.01–14.99	0.65	1.28	0.34–4.88	0.72	0.42	0.01–31.98	0.69	0.67	0.02–22.75	0.82
Mouthwash												
No	1			1			1			1		
Yes	0.31	0.02–4.43	0.39	3.46	0.31–38.89	0.31	0.09	0.01–1.83	0.12	0.29	0.02–4.11	0.36
Review attendance												
No FTAs	1			1			1			1		
Some/all FTAs	10.24	0.51–96.73	0.13	2.58	0.88–7.54	0.08	3.56	0.15–86.17	0.44	6.52	0.31–91.06	0.23
Soft diet												
No	1			1			1			1		
Yes	2.04	0.26–16.04	0.5	1.37	0.41–4.59	0.61	2.37	0.13–42.94	0.56	1.32	0.15–11.74	0.81

	Infection			Nerve damage			Trismus			Return to theatre		
	OR	95% CI	*P*-value	OR	95% CI	*P*-value	OR	95% CI	*P*-value	OR	95% CI	*P*-value
Antibiotics												
No	1			1			1			1		
Yes	0.43	0.06–3.20	0.41	0.06	0.01–1.44	0.08	1	0.07–13.84	1	0.3	0.04–2.22	0.24
Cigarette cessation												
No	1			1			1			1		
Yes	0.53	0.06–4.91	0.57	1.58	0.43–5.83	0.5	2.95	0.60–14.50	0.18	2.89	0.38–21.97	0.31
Mouthwash												
No	1			1			1			1		
Yes	0.21	0.02–1.78	0.15	2.16	0.24–19.14	0.49	0.12	0.01–1.01	0.05	0.38	0.05–2.75	0.34
Review attendance												
No FTAs	1			1			1			1		
Some/all FTAs	4.7	0.99–22.23	0.05	1.08	0.39–2.97	0.89	0.61	0.12–3.05	0.55	7.03	0.99–49.80	0.05
Soft diet												
No	1			1			1			1		
Yes	1.46	0.32–6.77	0.63	1.12	0.36–3.56	0.84	0.57	0.12–2.69	0.48	1.48	0.26–8.33	0.66

OR, odds ratio; CI, confidence interval; FTA, failed to attend.

the role of postoperative antibiotic use in the management of mandible fractures, suggested that antibiotics beyond 24 hours may not be required except in select cases, but that higher level evidence is required[33]. Several other studies support this assertion[34–37]. Despite its widespread use and intuitiveness, the authors are unaware of any published evidence directly evaluating the efficacy of postoperative chlorhexidine mouthwash, or any other mouthwash, in the prevention of infection in the management of mandible fractures. Similarly, there seems to be a sparsity of literature available regarding the significance of oral hygiene specifically in relation to surgery for mandible fractures.

The findings of this study demonstrate clearly that patient compliance cannot be relied upon within the average oral and maxillofacial trauma cohort. In addition, it seems likely that non-compliance has little bearing on clinical outcomes. None of the five individual postoperative compliance variables, as prescribed and assessed in the studied population, were found to be significantly associated with outcomes of treatment at the 5% level. However, a borderline significant outcome benefit was seen for participants who attended postoperative review appointments and who were compliant with postoperative mouthwash use. When compliance variables were combined to make a global compliance variable, those participants considered generally non-compliant overall were significantly more likely to experience a wound dehiscence.

The findings of this study are subject to a number of caveats. Firstly, patients notoriously downplay their non-compliance, although one would assume that an entirely accurate measure of the variables assessed would only strengthen the findings. Secondly, there was substantial missingness across the data. However, while response on specific variables was low, estimates did not appear to be unduly biased. Lastly, the presence of residual confounding cannot be entirely discounted, but given the adequacy of model specification, it is unlikely (as with missing data) that its effect was significant. The authors feel that many important questions have been raised and could be answered with higher level research. The exact utility of mouthwash, postoperative antibiotics, soft diet, and postoperative review appointments should be further elicited, whist cigarette cessation advice should be given at every opportunity. If found to be important, validated screening methods could be developed further and measures taken to improve compliance. It may be possible to stratify patients with mandible fractures and other fracture types into various groups with different postoperative compliance requirements. For example, to reduce costs to the patient and the healthcare system, it may be possible in certain patient subsets to safely reduce or eliminate the postoperative review appointment altogether.

Table 3. Effects of overall compliance variables on treatment outcomes.

	Number	OR	95% CI	*P*-value	Overall *P*-value
Wound dehiscence	171				
Low		8.43	1.89–37.49	0.01	
Moderate		1			
High		2.03	0.36–11.65	0.45	0.02
Non-union	168				
Low		3.97	0.34–46.42	0.27	
Moderate		1			
High		1.98	0.17–22.61	0.58	0.54
Hardware exposure	168				
Low		1.95	0.20–18.62	0.56	
Moderate		1			
High		0.98	0.11–9.05	0.98	0.84
Infection	169				
Low		1.44	0.29–7.18	0.66	
Moderate		1			
High		2.42	0.82–17.17	0.11	0.28
Nerve damage	171				
Low		2.42	0.84–6.97	0.1	
Moderate		1			
High		1.6	0.73–3.54	0.24	0.17
Trismus	164				
Low		0.77	0.09–6.49	0.81	
Moderate		1			
High		1.16	0.30–4.49	0.83	0.94
Return to theatre	171				
Low		1.26	0.26–6.22	0.78	
Moderate		1			
High		1.49	0.44–5.06	0.52	0.8
Malocclusion	166				
Low		2.61	0.93–7.33	0.07	
Moderate		1			
High		1.62	0.75–3.51	0.22	0.13

OR, odds ratio; CI, confidence interval.

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Competing interests

None.

Ethical approval

Royal Brisbane and Women's Hospital Human Research Ethics Committee approval obtained (HREC/15/QRBW/211). The study was performed in accordance with the National Statement on Ethical Conduct in Human Research (2007).

Patient consent

Not required.

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Address:
Michael J. L. Hurrell
School of Medicine
University of Queensland
Brisbane
Queensland
Australia
Tel.: +61 400034155
E-mail: michael.hurrell@uqconnect.edu.au