Article

Timing of Dietary Progression After Mandibular Fracture Repair: The Role of Comorbidities and Their Impact on Postoperative Outcomes

Ann. Ital. Chir., 2025 96, 8: 1123–1130
https://doi.org/10.62713/aic.4006

Giulio Cirignaco[1,2], Lisa Catarzi[1], Gabriele Monarchi[1], Marzia Petrocelli[3], Umberto Committeri[4], Stefania Troise[5], Alessandro Tel[6], Luigi Angelo Vaira[7,8], Giuseppe Consorti[2,9]

[1]Department of Medicine, Section of Maxillo-Facial Surgery, University of Siena, 53100 Siena, Italy
[2]Division of Maxillofacial Surgery, Department of Neurological Sciences, Marche University Hospitals-Umberto I, 60126 Ancona, Italy
[3]Oral and Maxillo-Facial Unit, AUSL Bologna Bellaria-Maggiore Hospital, 40139 Bologna, Italy
[4]Department of Maxillofacial Surgery, S. Maria Hospital, 05100 Terni, Italy
[5]Maxillofacial Surgery Unit, Department of Neurosciences, Reproductive and Odontostomatological Sciences, University of Naples Federico II, 80138 Naples, Italy
[6]Clinic of Maxillofacial Surgery, Head-Neck and NeuroScience Department, University Hospital of Udine, 33100 Udine, Italy
[7]Maxillofacial Surgery Operative Unit, Department of Medicine, Surgery and Pharmacy, University of Sassari, 07100 Sassari, Italy
[8]Biomedical Science Department, PhD School of Biomedical Science, University of Sassari, 07100 Sassari, Italy
[9]Department of Biomedical Sciences and Public Health, Polytechnic University of Marche, 60126 Ancona, Italy

AIM: This retrospective study evaluated whether the timing of dietary progression after mandibular fracture repair influences postoperative complications (wound dehiscence, infection, and reoperation) and assessed how comorbidities, specifically diabetes and chronic kidney disease (CKD), affect these outcomes.
METHODS: A retrospective observational analysis was conducted of 1023 patients who underwent open reduction and internal fixation (ORIF) for mandibular fractures between 2012 and 2023. Patients were categorised into Early (<3 weeks), Standard (3 weeks), and Delayed (>4 weeks) groups according to the interval before the introduction of a solid diet. Postoperative complications were evaluated using multivariate logistic regression models adjusted for diabetes, CKD, and smoking.
RESULTS: Early dietary progression was initially associated with higher rates of wound dehiscence (15.2% vs. 9.6% vs. 6.6%) and reoperation (8.2% vs. 2.0% vs. 1.6%) than the Standard and Delayed groups ($p < 0.05$) in univariate analysis. However, after adjusting for confounders in multivariate analysis, CKD emerged as the strongest independent predictor of wound dehiscence (odds ratio (OR) = 2.77, $p < 0.001$), whereas the impact of early dietary advancement was no longer statistically significant (adjusted OR = 1.08, $p = 0.58$). Multivariate analysis also identified CKD as an independent predictor of both infection and reoperation, with affected patients having an odds ratio of 3.85 for requiring reoperation ($p < 0.001$), highlighting the impact of systemic metabolic dysfunction on postoperative complications. Diabetes showed a borderline association with wound dehiscence, although it did not reach statistical significance (OR = 1.59, $p = 0.067$).
CONCLUSIONS: Although early reintroduction of solid foods initially appeared to increase postoperative complications, CKD was identified as the primary independent predictor of impaired wound healing when adjusting for comorbidities. Progression to a solid diet after approximately three weeks appears generally safe; however, patients with CKD or diabetes may benefit from individualised dietary protocols that minimise mechanical stress on the fracture site. Prospective studies are recommended to validate these findings and refine dietary guidelines, based on individual patient risk profiles.

Keywords: mandibular fractures; dietary progression; wound dehiscence; infections; comorbidities

Introduction

Maxillofacial trauma significantly burdens emergency departments worldwide, and mandibular fractures are among the most frequently encountered injuries in facial trauma cases [1,2]. Such fractures typically result from interpersonal violence, road traffic accidents, falls, or sports-related injuries, and their management remains a subject of ongoing debate in oral and maxillofacial surgery [3,4]. The primary goals of treatment include restoring pre-injury occlusion, achieving anatomical reduction, and preventing long-term functional impairment [5]. The transition from maxillomandibular fixation to open reduction and internal fixation (ORIF) has significantly improved mandibular fracture management by providing rigid stabilisation, enabling early jaw mobilisation, and optimising long-term functional outcomes [6–8]. Despite these advances, postoperative recovery remains critical, with multiple factors—including

Submitted: 18 February 2025 Revised: 22 March 2025 Accepted: 27 March 2025 Published: 26 June 2025
Correspondence to: Giuseppe Consorti, Division of Maxillofacial Surgery, Department of Neurological Sciences, Marche University Hospitals-Umberto I, 60126 Ancona, Italy; Department of Biomedical Sciences and Public Health, Polytechnic University of Marche, 60126 Ancona, Italy (e-mail: g.consorti@pm.univpm.it).

surgical technique, patient comorbidities, and adherence to postoperative recommendations—affecting healing [9]. Among these factors, dietary progression has been hypothesised as a potential determinant in reducing complications such as wound dehiscence and infection [10].

Standard clinical protocols generally recommend a gradual return to a normal diet over 3 to 6 weeks, beginning with a soft-diet phase to minimise mechanical strain on the fracture site [11]. However, adherence to these recommendations varies among patients: some resume solid food intake earlier than advised, while others delay dietary normalisation due to concerns about pain or fear of compromising fracture healing. The impact of these variations remains controversial: some studies suggest that early mastication may increase wound stress and dehiscence, while others indicate that prolonged dietary restrictions may be unnecessary and could cause nutritional deficiencies [10,12–15].

The three-week threshold in our study aligns with the standardised protocol in our institution, aiming to balance adequate and early mobilisation of the jaw with cautious protection of the healing surgical site. We hypothesise that patients with comorbidities, such as diabetes and chronic kidney disease (CKD), may require a more conservative dietary progression to minimise the risk of complications. These conditions are known to impair wound healing and immune function, yet their interaction with dietary progression remains underexplored. The primary objective of this study is to evaluate whether the timing of dietary progression influences postoperative complications (wound dehiscence, infections, and need for reoperation) in patients undergoing ORIF for mandibular fractures. The secondary objective is to assess the impact of comorbidities, particularly diabetes and CKD, on these outcomes. Understanding the implications of dietary progression could help optimise rehabilitation protocols, minimise complications, and enhance patient-centred care.

Materials and Methods

This retrospective observational study was conducted at the Marche University Hospital, Ancona, Italy, from 1 January 2012, to 31 December 2023. The study adhered to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines to ensure methodological rigour [16,17]. All patients underwent standard clinical protocols, with ORIF as the primary treatment strategy. Senior maxillofacial surgeons performed the surgeries to ensure consistency in treatment and minimise operator-dependent variability [18].

Study Population

The study population consisted of adult patients diagnosed with mandibular fractures who underwent ORIF via an intraoral approach. Eligibility criteria required radiological confirmation of the fracture and complete clinical documentation, including demographic details, comorbid conditions, surgical details, and follow-up records. Patients were excluded if they were younger than 18 years, had self-inflicted injuries, had incomplete medical records, or were treated exclusively with extraoral surgical access. Patients admitted to the intensive care unit with prolonged intubation or enteral feeding were also excluded, as their perioperative management and nutritional intake differed significantly from the standard postoperative dietary protocol. Given the retrospective nature of the study, no formal sample size was calculated. However, all eligible cases within the study period were included to maximise statistical power and generalisability.

Data Collection and Variables

Patient data were extracted from medical records, operative notes, and radiological archives. Collected variables included demographic information, trauma aetiology, fracture classification, presence of systemic comorbidities (e.g., diabetes and CKD), surgical details, and postoperative complications such as wound dehiscence, infection, and reoperation. Fractures were classified anatomically and functionally according to the AO-Craniomaxillofacial trauma criteria [19,20]. Mandibular fractures were categorised into specific subtypes (symphysis, body, angle, ramus, condyle, and coronoid), with special attention to multifocal fractures or those with contralateral associations. Radiological imaging, primarily computed tomography (CT) scans, played a central role in diagnosis and surgical planning [21]. Images were evaluated by two independent investigators (GCir and GCon) to ensure accuracy and consistency; any discrepancies were resolved by consensus.

Dietary Management and Postoperative Follow-Up

Following surgical management of mandibular fractures, patients were instructed to follow a structured dietary regimen to facilitate healing and minimise postoperative complications. In the first two days after surgery, a clear liquid diet was implemented to reduce the risk of food particles interfering with the surgical site. This phase focused on hydration, including water, diluted juices, and clear broths, while minimising mechanical stress on the healing tissues. After this initial period, patients transitioned to a soft, non-chew diet of smoothly blended foods requiring minimal oral effort. Recommended options included protein-rich shakes, yoghurt, pureed fruit, and well-strained soups. For individuals requiring maxillomandibular fixation, food was blended to a consistency thin enough to be consumed through a straw to ensure adequate caloric intake.

The third postoperative week onward, a gradual reintroduction of soft solid foods was advised, incorporating items such as well-cooked vegetables, mashed potatoes, scrambled eggs, and finely minced proteins. Throughout recovery, the emphasis was on maintaining sufficient caloric and protein intake to prevent excessive weight loss and support optimal tissue healing.

Adherence to dietary recommendations varied among patients. Some resumed solid food intake prematurely, while others delayed dietary progression due to pain or concerns about compromising fracture healing. Patients were retrospectively categorised into three groups based on the timing of solid diet resumption: Early (<3 weeks), Standard (3 weeks), and Delayed (>4 weeks). These thresholds were defined according to institutional protocols and prior literature suggesting that soft-diet progression within 3 weeks is generally associated with optimal bone healing and a reduced risk of wound dehiscence [11,21,22]. The >4 weeks cut-off for delayed progression was chosen to reflect a meaningful deviation, capturing patients who either reported significant pain or anxiety about chewing or were advised by the clinical team to remain on soft foods longer. Assessment of dietary adherence was based on follow-up visits at one week, one month, and three months postoperatively, during which patients' self-reports were corroborated with clinical evaluations. The professional oral hygiene protocol adopted in our department included a full supragingival scaling performed 48 hours preoperatively and the use of Chlorhexidine 0.20% [Broxo Mouthwash (Drug), 200 mg/100 g, 001694552, SITPharma S.r.l., Milan, Italy] three times daily for one minute each time over seven days postoperatively. The postoperative therapy administered to patients was based on Cefazolin 1 g [Cefazolin 1 g Teva (Drug), 000064007, Teva Italia S.r.l., Milan, Italy] three times daily; Metronidazole 500 mg [Metronidazole 500 mg/100 mL Baxter (Drug), 001018871, Baxter Italia S.p.A., Milan, Italy] three times daily; and Paracetamol 1 g [Paracetamol 1 g Galenica (Drug), 041160072, Galenica Senese, Siena, Italy] three times daily. All drugs were uniformly administered to all patients in the immediate postoperative period [23].

Statistical Analysis

Statistical analyses were performed using Jamovi Statistics (The jamovi project 2025, 2.6.17.0, https://www.jamovi.org). Continuous variables were reported as means with standard deviations or medians with interquartile ranges, depending on the normality of their distribution, while categorical variables were presented as frequencies and percentages. Groups were initially compared using chi-square or Fisher's exact tests for categorical variables and *t*-tests or Mann–Whitney U tests for continuous variables, where appropriate. To account for potential confounding factors, a multivariate logistic regression model was constructed, adjusting for fracture type, smoking, diabetes, and CKD. Adjusted odds ratios with 95% confidence intervals were reported. Interaction terms were included in the model to assess whether comorbidities such as CKD modified the effect of dietary progression on postoperative complications. To compare continuous variables across the Early, Standard, and Delayed groups, one-way analysis of variance (ANOVA) or the Kruskal-Wallis test was used, depending on distribution normality. When significant overall differences were found, post hoc pairwise comparisons (Tukey's test for ANOVA or Dunn's test for Kruskal-Wallis) were conducted to identify specific group differences. The normality of continuous variables was checked with the Shapiro-Wilk test. A two-sided p-value < 0.05 was considered statistically significant. Multiple comparisons were adjusted using the Bonferroni method, where indicated. To account for variations in CKD severity and potential confounders, an exploratory subgroup analysis was performed. Patients with CKD were stratified according to documented stages (when available) and aetiology of renal dysfunction (e.g., diabetic nephropathy, hypertensive nephrosclerosis) to assess whether more advanced stages were associated with higher complication rates.

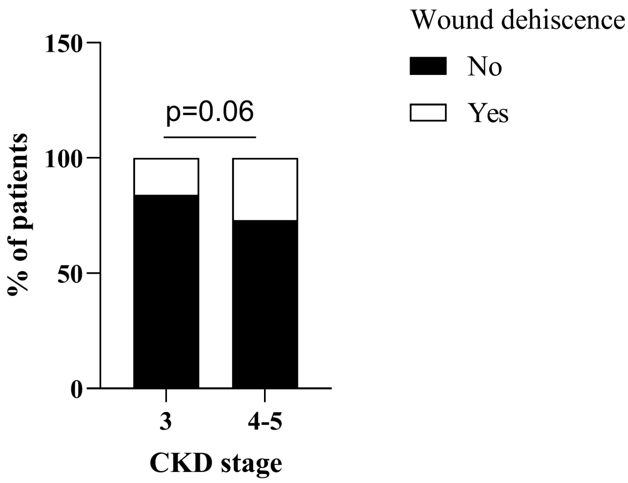

Fig. 1. Comparison of wound dehiscence between patients with CKD Stage 3 and those with CKD Stages 4–5. The stacked bar chart illustrates the percentage of patients with or without wound dehiscence in each group. A trend toward statistical significance is observed. CKD, chronic kidney disease.

Results

A total of 1023 patients diagnosed with mandibular fractures were treated at our centre during the 12-year study period. The mean age of the study population was 42.3 ± 16.4 years (range: 18–78), with a clear male predominance (66.9% males vs. 33.1% females). The most common causes of fractures were road traffic accidents (37.4%), followed by interpersonal violence (30%), accidental falls (20%), and sports-related injuries (10%). Regarding fracture distribution, symphysis fractures were the most frequent (30%), followed by angle (25%), condylar (20%), body (15%), ramus (5%), and coronoid fractures (5%). Additionally, 198 patients (19.3%) presented with multiple mandibular fractures, most commonly involving the symphysis and condyle or the angle and body.

Among the study population, 15.1% (n = 154) had diabetes, 40% (n = 409) were active smokers, and 4.6% (n = 47) had CKD. Patients with these comorbidities were evaluated to determine their impact on postoperative complications, including wound dehiscence and infection.

Postoperative Dietary Timing and Complications

The overall complication rate was 16.8%, with 10.3% of patients experiencing intraoral wound dehiscence and 6.5%

Table 1. Descriptive and univariate analysis of postoperative outcomes according to dietary timing.

Variable	Early (<3 weeks) n = 256 (25%)	Standard (3 weeks) n = 511 (50%)	Delayed (>4 weeks) n = 256 (25%)	Test (χ^2 or F)	*p*-value
Age (years), Mean SD	39.2 ± 14.3	42.1 ± 16.1	44.1 ± 17.0	F = 2.12	0.12
Male, n (%)	171 (66.8)	342 (66.9)	171 (66.8)	χ^2 = 0.002	1.00
Smokers, n (%)	102 (39.8)	205 (40.1)	102 (39.8)	χ^2 = 0.008	1.00
Diabetes, n (%)	39 (15.2)	77 (15.1)	38 (14.8)	χ^2 = 0.015	0.99
CKD, n (%)	12 (4.7)	23 (4.5)	12 (4.7)	χ^2 = 0.02	0.99
Cause of fracture				χ^2 = 1.22	0.88
Road traffic accidents, n (%)	77 (30.1)	204 (39.9)	102 (39.8)	-	-
Interpersonal violence, n (%)	77 (30.1)	153 (29.9)	77 (30.1)	-	-
Accidental falls, n (%)	51 (19.9)	102 (20.0)	51 (19.9)	-	-
Sports injuries, n (%)	26 (10.2)	52 (10.2)	26 (10.2)	-	-
Fracture classification				χ^2 = 4.22	0.90
Symphysis, n (%)	77 (30.1)	153 (29.9)	77 (30.1)	-	-
Angle, n (%)	64 (25.0)	128 (25.0)	64 (25.0)	-	-
Condylar, n (%)	51 (19.9)	102 (20.0)	51 (19.9)	-	-
Body, n (%)	38 (14.8)	77 (15.1)	38 (14.8)	-	-
Ramus, n (%)	13 (5.1)	26 (5.1)	12 (4.7)	-	-
Coronoid, n (%)	13 (5.1)	25 (4.9)	17 (6.6)	-	-
Intraoral wound dehiscence, n (%)	39 (15.2)	49 (9.6)	17 (6.6)	χ^2 = 10.77	0.005
Infections, n (%)	23 (9.0)	33 (6.5)	11 (4.3)	χ^2 = 4.61	0.10
Reoperation, n (%)	21 (8.2)	10 (2.0)	4 (1.6)	χ^2 = 23.71	0.001

Table 1 presents the demographic variables, comorbidities, fracture causes, fracture classification, and postoperative outcomes (wound dehiscence, infections, and reoperation) among 1023 patients with mandibular fractures treated by ORIF. Patients were stratified into three groups, based on the timing of solid diet resumption (Early: <3 weeks, Standard: 3 weeks, and Delayed: >4 weeks). Continuous variables were analysed via one-way ANOVA (F-value), whereas categorical variables were evaluated using chi-square tests (χ^2). A single chi-square test was performed for multi-category variables (fracture causes, fracture classification). *p*-values < 0.05 were considered statistically significant. Abbreviations: ANOVA, analysis of variance; CKD, chronic kidney disease; ORIF, open reduction and internal fixation; SD, Standard Deviation.

developing postoperative infections. Based on the timing of dietary progression, patients were categorised into three groups: Early (<3 weeks, n = 256, 25%), Standard (3 weeks, n = 511, 50%), and Delayed (>4 weeks, n = 256, 25%). Univariate analysis indicated that the early dietary group had higher rates of wound dehiscence (15.2%) and reoperation (8.2%) compared with the standard (9.6% and 2.0%, respectively) and delayed groups (6.6% and 1.6%, respectively) (Table 1). This initial finding suggested that prematurely reintroducing solid foods might mechanically stress the surgical site, potentially raising complication rates.

Impact of Comorbidities and Fracture Type on Complications

Multivariate logistic regression analysis demonstrated that CKD patients had an odds ratio of 2.77 for developing wound dehiscence ($p < 0.001$), reinforcing the hypothesis that impaired renal function and associated metabolic disturbances contribute to delayed wound healing. To further investigate whether CKD influenced the effect of dietary timing on wound healing, we included an interaction term (CKD × dietary timing) in the regression model. The analysis revealed that CKD amplified the risk of wound dehiscence, particularly in the early dietary group (odds ratio (OR) = 3.42, $p = 0.002$); the effect was less pronounced in the standard and delayed groups (Table 2). These results suggest that patients with CKD may require a more conservative dietary progression to mitigate the risk of impaired wound healing. Within the 47 patients classified as having CKD, 32 had Stage 3 disease and 15 had Stage 4 or 5. Although not statistically significant ($p = 0.06$), those in more advanced stages (4–5) demonstrated a higher rate of wound dehiscence (27%) compared to those in Stage 3 (16%), suggesting that advanced renal dysfunction may further increase the risk of postoperative complications (Fig. 1).

Patients presenting with multiple fractures also exhibited an overall increased risk of dehiscence and infection, likely due to greater mechanical stress and more extensive surgical sites. Data are presented in Table 1.

Reoperation Rate and Long-Term Outcomes

Among the 1023 patients, 35 (3.4%) required reoperation due to severe wound dehiscence or inadequate fracture healing. Sixty percent of these cases (n = 21) occurred in the early dietary group, supporting the hypothesis that excessive masticatory forces might compromise soft-tissue integrity. Multivariate analysis further demonstrated that CKD independently predicted reoperation, with affected patients having an OR of 3.85 ($p < 0.001$) com-

Table 2. Multivariate logistic regression model for intraoral wound dehiscence.

Variable	Intraoral wound dehiscence/OR (95% CI)/p-value	Infection/OR (95% CI)/p-value	Reoperation/OR (95% CI)/p-value
Early (<3 weeks) vs. Standard	1.08 (0.74–1.56), p = 0.58	0.88 (0.62–1.25), p = 0.44	1.20 (0.64–2.15), p = 0.31
Delayed (>4 weeks) vs. Standard	0.85 (0.51–1.30), p = 0.34	0.80 (0.50–1.18), p = 0.53	0.90 (0.50–1.70), p = 0.48
Diabetes	1.59 (0.96–2.53), p = 0.067	1.42 (0.90–2.20), p = 0.11	1.40 (0.80–2.50), p = 0.18
Smoking	1.13 (0.70–1.69), p = 0.73	1.15 (0.68–1.77), p = 0.58	1.20 (0.76–1.80), p = 0.42
CKD	2.77 (1.48–5.20), $p < 0.001$*	2.50 (1.10–4.50), p = 0.01*	3.85 (1.80–6.25), $p < 0.001$*

Multivariate logistic regression models for postoperative complications in mandibular fracture repair. Each column represents a separate outcome—wound dehiscence, infection, or reoperation—showing the adjusted odds ratios (ORs) and 95% confidence intervals (CIs) for dietary timing groups (Early, Delayed) and comorbidities (diabetes, smoking, and chronic kidney disease). Statistically significant results ($p < 0.05$) are indicated by an asterisk (*). Abbreviation: CKD, chronic kidney disease.

pared to those without CKD (Table 2). Notably, 75% of reinterventions involved patients with either CKD or diabetes, underscoring the key role systemic metabolic dysfunction can play in delayed healing and treatment failure. Nonetheless, not all individuals who advanced their diets before three weeks experienced complications, suggesting that other factors such as overall health status, surgical technique, and compliance with postoperative instructions are also critical in determining outcomes.

Additional Analyses: Univariate vs. Multivariate Findings

After adjusting for systemic factors in multivariate analysis, early dietary progression no longer significantly predicted complications. For wound dehiscence, early dietary timing showed an OR of 1.08 (p = 0.58), whereas for infection, the OR was 0.88 (p = 0.44). Diabetes emerged as a possible contributor to wound dehiscence (OR = 1.59, p = 0.067), although it did not reach formal statistical significance. Smoking was not a significant predictor in the multivariate model (p = 0.73 for dehiscence, and p = 0.58 for infection), possibly due to variable smoking habits and perioperative smoking cessation efforts. CKD strongly correlated with wound dehiscence (OR = 2.77, $p < 0.001$), highlighting how renal dysfunction may exacerbate both soft tissue and bone healing challenges (Table 2).

No statistically significant difference in age was found across the Early, Standard, and Delayed groups (p = 0.12). Stratifying patients into three age categories (<40 years, 40–60 years, and >60 years) did not reveal significant differences in wound dehiscence (p = 0.21) or infection (p = 0.34), suggesting that age alone was not a major determinant of postoperative complications in this cohort.

Discussion

Postoperative complications in mandibular fracture repair are multifactorial. While univariate analysis suggested that early dietary progression is associated with increased wound dehiscence and reoperation, the multivariate models demonstrated that comorbidities, particularly CKD, play a more significant role. These findings align with previous literature indicating that CKD is associated with chronic inflammation, impaired collagen synthesis, and delayed neovascularisation, all of which contribute to poor wound healing outcomes [24–27]. Moreover, the increased risk of wound dehiscence in CKD patients, especially in those who resumed solid diets early, points to a possible synergistic effect of mechanical stress and metabolic dysfunction. Consequently, these patients may benefit from a more personalised dietary schedule, such as an extended soft-diet phase with gradual increases in mastication, coupled with close regular renal function monitoring and nephrological consultations. Such collaboration could optimise protein intake, manage electrolyte imbalances, and support tissue repair in this vulnerable population. Our subgroup analysis indicates that patients in more advanced CKD stages (4–5) may have an even greater risk of wound dehiscence compared to those in earlier stages (3), although this is limited by the sample size.

A key clinical insight from this study is the increased complication trend in the early dietary group, primarily among patients with inadequate oral hygiene or significant comorbidities. Although findings from Elsayed *et al.* [1] have reported that early dietary reintroduction may raise the risk of intraoral wound dehiscence, our data indicate that dietary timing per se is less influential once systemic factors are considered. However, it is important to interpret these findings with caution, as the multivariate analysis did not adjust for all potential confounding variables, including age, gender, and fracture cause. Hence, unaccounted confounders may have influenced the observed associations and should be considered in future studies. This suggests that rigid dietary progression protocols may not be necessary for all patients and should instead be tailored to individual risk profiles. Specifically, mechanical stress from early mastication can combine with systemic risk factors to worsen outcomes [28]. Moreover, not all patients in the early group had complications, implying that stable ORIF, careful suturing, and good patient compliance can mitigate risk even under early loading [29]. A multidisciplinary approach to postoperative care is therefore vital. Besides optimising surgical technique, strategies such as professional oral hygiene, structured patient education, and nutritional support play key roles in successful rehabilitation [23].

Although smoking did not emerge as a significant factor in the multivariate model, it remains a well-documented risk factor for poor wound healing [30–32]. Variations in smoking intensity, as well as cessation or reduction around the time of surgery, may have lessened its observable impact in our sample, even if it is a significant factor for complications [33–36]. While diabetes and CKD compromise wound healing through pathways not easily reversed in the short term, such as hyperglycaemia-induced immune dysfunction and reduced bone remodelling, clinicians can address nutritional and metabolic issues proactively [32,36,37]. Proper glycaemic control, adequate protein intake, and enhanced oral hygiene measures may help offset these risks [38,39].

From a practical standpoint, although a three-week progression to solid foods remains our institutional standard for most patients, individualised care with balanced sufficient rest for soft tissues and bone is paramount. Comorbidities and patient-specific factors (e.g., overall health status and motivation) should guide clinicians in determining whether to maintain or extend soft-diet phases.

Despite the insights provided by this retrospective analysis, several limitations should be acknowledged. First, the single-centre design restricts the generalisability of the findings to broader populations, as local referral patterns and surgical protocols may differ from those of other institutions. Second, reliance on medical records for data collection introduces potential information bias, particularly regarding patients' self-reports on dietary adherence and oral hygiene. Third, the retrospective nature of the study also precludes the ability to establish definitive causality with certainty. Fourth, although the overall sample size is large, certain subgroups, such as advanced-stage CKD patients, remain relatively small, limiting the power to detect nuanced differences. Fifth, we did not collect detailed data on perioperative glycaemic control in diabetic patients, which might have clarified the impact of diabetes on wound healing. Sixth, while our analysis focused on comorbidities such as diabetes and CKD, future studies should evaluate additional risk factors in greater depth. Gender-related differences in bone density and hormonal regulation may affect healing but were not specifically stratified in our dataset. Additionally, bone-related conditions like osteoporosis or osteopenia could influence the structural integrity of the mandible and hence the risk of dehiscence. Seventh, our follow-up period spanned only a few months, primarily capturing early complications such as wound dehiscence and acute infection. However, delayed complications—such as hardware loosening, chronic infection, or long-term functional deficits—may manifest beyond this timeframe. Extending the follow-up to at least 6–12 months could provide a more comprehensive understanding of the interactions among dietary timing, comorbidities, and longer-term outcomes. We recommend that future research include more prolonged observation periods to detect late complications and assess the stability of the fracture site over time. Eighth, variables such as operative time, intraoperative blood loss, and the American Society of Anaesthesiologists classification were not included in our dataset. These factors can significantly influence postoperative outcomes in mandibular fracture repair by contributing to tissue hypoxia, surgical stress, or overall physiological resilience. Ninth, another issue that emerged when interpreting our data concerns the role of patient education in dietary progression. Although in this study adherence was considered primarily in terms of timing, we did not specifically evaluate the extent to which knowledge of potential complications—such as increased mechanical stress on the fracture site or a heightened risk of infection—influenced patients' dietary choices. It is plausible that a structured educational programme, clearly explaining the possible outcomes of premature solid food intake, could improve adherence to dietary guidelines and reduce postoperative complications. Tenth, as stated above, the multivariate analysis did not adjust for confounding variables; therefore, unaccounted confounders may have influenced the observed associations. Future prospective studies should include a formal evaluation of educational interventions and patient learning outcomes to provide robust data on the best practices in postoperative management. Such an approach would further support the development of tailored protocols for patients with comorbidities or specific risk factors.

Conclusions

This retrospective study indicates that dietary timing alone is not a dominant risk factor for postoperative complications in patients undergoing ORIF for mandibular fractures. Although early reintroduction of solid foods can increase the risk of wound dehiscence and infection in univariate analyses, these associations lose significance when comorbidities, particularly diabetes and CKD, are considered. While a three-week dietary progression is generally safe, clinicians should prioritise individualised protocols, particularly for patients with CKD or diabetes, to reduce mechanical stress on intraoral wounds and optimise healing. Individuals with diabetes, renal dysfunction, or inadequate oral hygiene may benefit from more conservative protocols and closer follow-up to mitigate mechanical stress on intraoral wounds.

Future research should develop patient-specific dietary protocols that integrate nutritional optimisation, metabolic control, and perioperative hygiene strategies to improve healing outcomes. Prospective studies with longer follow-up periods could also elucidate long-term complications and evaluate whether extended smoking cessation and tighter metabolic control offer sustained benefits. Tailoring dietary guidelines according to comorbidity severity and patient-specific risk factors may prove essential in minimising complications and improving overall care in mandibular fracture repair.

Availability of Data and Materials

The data generated and analyzed during this study are not publicly available due to institutional and privacy policies

but are available from the corresponding author upon reasonable request.

Author Contributions

GCir, GCon, GM and MP designed the research study. GCon, UC, ST, LAV, AT, MP performed the research. GCir, GCon, LC, GM analyzed the data. GCir, GCon, ST, UC, AT, LAV drafted this manuscript. All authors contributed to important editorial changes in the manuscript. All authors read and approved the final manuscript. All authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

The study was approved by the Institutional Ethics Committee (CET Marche with protocol 17/4755/24). Informed consent was obtained from all individual participants included in the study. Patients signed informed consent regarding publishing their data. The study conformed to the provisions of the Declaration of Helsinki.

Acknowledgment

Not applicable.

Funding

This research received no external funding.

Conflict of Interest

The authors declare no conflict of interest.

References

[1] Elsayed SA, Abdullah AAB, Dar-Odeh N, Altaweel AA. Intraoral Wound Dehiscence After Open Reduction Internal Fixation of Mandibular Fractures: A Retrospective Cohort Study. Wounds: a Compendium of Clinical Research and Practice. 2021; 33: 60–64.

[2] Petrocelli M, Ruggiero F, Feraboli L, Allegri D, Cutrupi S, Baietti AM, *et al*. The Evolution of the Epidemiology of Facial Fractures Before, During and After the COVID-19 Pandemic. Journal of Maxillofacial and Oral Surgery. 2025; 24: 130–136. https://doi.org/10.1007/s12663-024-02153-0.

[3] Gualtieri M, Pisapia F, Fadda MT, Priore P, Valentini V. Mandibular Fractures Epidemiology and Treatment Plans in the Center of Italy: A Retrospective Study. The Journal of Craniofacial Surgery. 2021; 32: e346–e349. https://doi.org/10.1097/SCS.0000000000007118.

[4] Petrocelli M, Ruggiero F, Allegri D, Cutrupi S, Baietti AM, Salzano G, *et al*. Changes in hospital admissions for facial fractures during and after COVID 19 pandemic: national multicentric epidemiological analysis on 2938 patients. Oral and Maxillofacial Surgery. 2024; 28: 753–759. https://doi.org/10.1007/s10006-023-01201-2.

[5] Troise S, De Fazio GR, Committeri U, Spinelli R, Nocera M, Carraturo E, *et al*. Mandibular reconstruction after post-traumatic complex fracture: Comparison analysis between traditional and virtually planned surgery. Journal of Stomatology, Oral and Maxillofacial Surgery. 2025; 126: 102029. https://doi.org/10.1016/j.jormas.2024.102029.

[6] Abbate V, Committeri U, Troise S, Bonavolontà P, Vaira LA, Gabriele G, *et al*. Virtual Surgical Reduction in Atrophic Edentulous Mandible Fractures: A Novel Approach Based on "in House" Digital Work-Flow. Applied Sciences 2023; 13: 1474. https://doi.org/10.3390/app13031474.

[7] Omeje KU, Rana M, Adebola AR, Efunkoya AA, Olasoji HO, Purcz N, *et al*. Quality of life in treatment of mandibular fractures using closed reduction and maxillomandibular fixation in comparison with open reduction and internal fixation–a randomized prospective study. Journal of Cranio-maxillo-facial Surgery: Official Publication of the European Association for Cranio-Maxillo-Facial Surgery. 2014; 42: 1821–1826. https://doi.org/10.1016/j.jcms.2014.06.021.

[8] El-Anwar MW, Sayed El-Ahl MA, Amer HS. Open Reduction and Internal Fixation of Mandibular Fracture without Rigid Maxillomandibular Fixation. International Archives of Otorhinolaryngology. 2015; 19: 314–318. https://doi.org/10.1055/s-0035-1549154.

[9] Perez D, Ellis E, 3rd. Complications of Mandibular Fracture Repair and Secondary Reconstruction. Seminars in Plastic Surgery. 2020; 34: 225–231. https://doi.org/10.1055/s-0040-1721758.

[10] Popat SP, Rattan V, Rai S, Jolly SS, Malhotra S. Nutritional intervention during maxillomandibular fixation of jaw fractures prevents weight loss and improves quality of life. The British Journal of Oral & Maxillofacial Surgery. 2021; 59: 478–484. https://doi.org/10.1016/j.bjoms.2020.10.009.

[11] Manzie T, David MC, Bobinskas A. Return to normal diet following mandibular fractures - how long is long enough? The British Journal of Oral & Maxillofacial Surgery. 2021; 59: 1050–1055. https://doi.org/10.1016/j.bjoms.2021.02.020.

[12] Ludwig DC, Huang K, Lynch S, Koceja L, Tressel W, Dillon JK. What is the role of nutrition counseling in the management of isolated mandible fractures? Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology. 2019; 128: 464–471. https://doi.org/10.1016/j.oooo.2018.12.005.

[13] Oksa M, Haapanen A, Marttila E, Furuholm J, Snäll J. Postoperative wound dehiscence in mandibular fractures. Acta Odontologica Scandinavica. 2023; 81: 555–561. https://doi.org/10.1080/00016357.2023.2211156.

[14] Kong TH, Chung KJ, Kim YH. Analysis of the risk factors influencing complications in surgical treatment of mandibular fractures: A retrospective study. Journal of Cranio-maxillo-facial Surgery: Official Publication of the European Association for Cranio-Maxillo-Facial Surgery. 2022; 50: 929–933. https://doi.org/10.1016/j.jcms.2022.12.001.

[15] Cohn JE, Othman S, Zaransky S, Zwillenberg S. Factors Associated With Complications and Failure in Transoral, Mandible Fracture Repair. The Journal of Craniofacial Surgery. 2024; 35: 456–459. https://doi.org/10.1097/SCS.0000000000009961.

[16] von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP, *et al*. Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. BMJ (Clinical Research Ed.). 2007; 335: 806–808. https://doi.org/10.1136/bmj.39335.541782.AD.

[17] Consorti G, Paglianiti M, Monarchi G, De Tomaso S, Cirignaco G, Gasperoni M, *et al*. New test for systematic skills enhancement and improvement in maxillofacial surgery training: multicentre pilot study. The British Journal of Oral & Maxillofacial Surgery. 2024; 62: 716–721. https://doi.org/10.1016/j.bjoms.2024.07.004.

[18] Buitrago-Téllez CH, Cornelius CP, Prein J, Kunz C, di Ieva A, Audigé L. The Comprehensive AOCMF Classification System: Radiological Issues and Systematic Approach. Craniomaxillofacial Trauma & Reconstruction. 2014; 7: S123–S130. https://doi.org/10.1055/s-0034-1389565.

[19] Audigé L, Cornelius CP, Kunz C, Buitrago-Téllez CH, Prein J. The Comprehensive AOCMF Classification System: Classification and Documentation within AOCOIAC Software. Craniomaxillofacial Trauma & Reconstruction. 2014; 7: S114–S122. https://doi.org/10.1055/s-0034-1389564.

[20] Frosolini A, Catarzi L, Benedetti S, Latini L, Chisci G, Franz L, *et al*. The Role of Large Language Models (LLMs) in Providing Triage for Maxillofacial Trauma Cases: A Preliminary Study. Diagnostics (Basel, Switzerland). 2024; 14: 839. https://doi.org/10.3390/diagnostics14080839.

[21] Egelko A, Kahler D, Donovan B, Gardella R, Reddy S, Jones C. Food Desert Residence Is Not Associated With Dietary Adherence or

Complication Rates in Patients With Isolated Mandibular Fractures. Journal of Oral and Maxillofacial Surgery: Official Journal of the American Association of Oral and Maxillofacial Surgeons. 2024; 82: 191–198. https://doi.org/10.1016/j.joms.2023.10.009.

[22] Hurrell MJL, David MC, Batstone MD. Patient compliance and mandible fractures: a prospective study. International Journal of Oral and Maxillofacial Surgery. 2019; 48: 759–768. https://doi.org/10.1016/j.ijom.2018.11.011.

[23] Consorti G, Cirignaco G, Monarchi G, Catarzi L, Paglianiti M, Betti E, *et al*. The role of professional oral hygiene in enhancing outcomes of maxillofacial trauma surgery. Journal of Stomatology, Oral and Maxillofacial Surgery. 2025; 102269. https://doi.org/10.1016/j.jormas.2025.102269.

[24] De Gregorio V, Barua M, Lennon R. Collagen formation, function and role in kidney disease. Nature Reviews. Nephrology. 2025; 21: 200–215. https://doi.org/10.1038/s41581-024-00902-5.

[25] Huang P, Mai Y, Zhao J, Yi Y, Wen Y. Association of systemic immune-inflammation index and systemic inflammation response index with chronic kidney disease: observational study of 40,937 adults. Inflammation Research. 2024; 73: 655–667. https://doi.org/10.1007/s00011-024-01861-0.

[26] Foresto-Neto O, Menezes-Silva L, Leite JA, Andrade-Silva M, Câmara NOS. Immunology of Kidney Disease. Annual Review of Immunology. 2024; 42: 207–233. https://doi.org/10.1146/annurev-immunol-090122-045843.

[27] Maroz N, Simman R. Wound Healing in Patients With Impaired Kidney Function. The Journal of the American College of Clinical Wound Specialists. 2014; 5: 2–7. https://doi.org/10.1016/j.jccw.2014.05.002.

[28] Hsieh TY, Funamura JL, Dedhia R, Durbin-Johnson B, Dunbar C, Tollefson TT. Risk Factors Associated With Complications After Treatment of Mandible Fractures. JAMA Facial Plastic Surgery. 2019; 21: 213–220. https://doi.org/10.1001/jamafacial.2018.1836.

[29] Xu F, Wang F. Analysis of Risk Factors and Preventive Measures for Perioperative Incision Infection in Patients Receiving Rigid Internal Fixation of Maxillofacial Fractures. Annali Italiani Di Chirurgia. 2025; 96: 213–220. https://doi.org/10.62713/aic.3853.

[30] Panesar K, Susarla SM. Mandibular Fractures: Diagnosis and Management. Seminars in Plastic Surgery. 2021; 35: 238–249. https://doi.org/10.1055/s-0041-1735818.

[31] Ragsdale LB, Kreh CC, Zhang A, Keller R, Chen K. Challenging the Paradigm: Rates of Mandibular Infection Following Fracture. The Journal of Craniofacial Surgery. 2025; 36: 1152–1155. https://doi.org/10.1097/SCS.0000000000011141.

[32] Van der Cruyssen F, Forrest M, Holmes S, Bhatti N. A Systematic Review and Meta-Analysis of Fracture-Related Infections in Maxillofacial Trauma: Incidence, Risk Factors, and Management Strategies. Journal of Clinical Medicine. 2025; 14: 1332. https://doi.org/10.3390/jcm14041332.

[33] Vandenbroucke JP, von Elm E, Altman DG, Gøtzsche PC, Mulrow CD, Pocock SJ, *et al*. Strengthening the Reporting of Observational Studies in Epidemiology (STROBE): explanation and elaboration. PLoS Medicine. 2007; 4: e297. https://doi.org/10.1371/journal.pmed.0040297.

[34] Ahmed A, Wu E, Sarai R, Williams R, Breeze J. Potentially modifiable patient factors in mandible fracture complications: a systematic review and meta-analysis. The British Journal of Oral & Maxillofacial Surgery. 2022; 60: 266–270. https://doi.org/10.1016/j.bjoms.2021.07.005.

[35] Resnick E, Hassan BA, Er S, Pope P, Lamaris GA, Grant MP, *et al*. Risk Factors for Postoperative Complications Following Mandibular Fracture Repair. The Journal of Craniofacial Surgery. 2025; 36: 66–70. https://doi.org/10.1097/SCS.0000000000010759.

[36] Howard R, Albright J, Osborne N, Englesbe M, Goodney P, Henke P. Impact of a regional smoking cessation intervention for vascular surgery patients. Journal of Vascular Surgery. 2022; 75: 262–269. https://doi.org/10.1016/j.jvs.2021.07.103.

[37] Raikundalia M, Svider PF, Hanba C, Folbe AJ, Shkoukani MA, Baredes S, *et al*. Facial fracture repair and diabetes mellitus: An examination of postoperative complications. The Laryngoscope. 2017; 127: 809–814. https://doi.org/10.1002/lary.26270.

[38] Podkowińska A, Formanowicz D. Chronic Kidney Disease as Oxidative Stress- and Inflammatory-Mediated Cardiovascular Disease. Antioxidants (Basel, Switzerland). 2020; 9: 752. https://doi.org/10.3390/antiox9080752.

[39] Ekmektzoglou KA, Zografos GC. A concomitant review of the effects of diabetes mellitus and hypothyroidism in wound healing. World Journal of Gastroenterology. 2006; 12: 2721–2729. https://doi.org/10.3748/wjg.v12.i17.2721.