

Operative timing and patient-reported recovery in panfacial fractures: a retrospective cohort analysis of intermediate surgical delay at a government teaching hospital in northwestern India

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Research Article

Keywords: panfacial fractures, intermediate surgical delay, patient-reported outcomes, government hospital, bureaucratic barriers, operating theatre scheduling, socioeconomic disadvantage, retrospective cohort study

Posted Date: July 14th, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-9769953/v1>

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Additional Declarations: No competing interests reported.

Abstract

Purpose

To determine whether panfacial fracture surgery performed between 8 and 30 days after injury is independently associated with inferior patient reported functional and aesthetic outcomes, and to characterise the institutional and socioeconomic barriers driving this intermediate delay at a government teaching hospital where titanium fixation hardware is centrally procured but subject to administrative approval processes and competing operating theatre demand.

Methods

Retrospective cohort study of 120 adults (18–65 years) with computed tomography confirmed panfacial fractures treated between January 2022 and June 2024. Patients were allocated to an early surgery cohort (seven days or fewer; $n = 54$) or a delayed surgery cohort (8–30 days; $n = 66$). Primary outcomes were the Oral Health Impact Profile-14 (OHIP-14), Functional Disability Index (FDI), and Facial Aesthetic Index (FAI) at 12 months. Multivariable logistic regression identified independent predictors of composite poor outcome.

Results

Delayed surgery was associated with significantly worse 12-month OHIP-14 (mean difference 6.2, 95% CI 4.8–7.6; $p < 0.001$), FDI (mean difference 4.8, 95% CI 3.5–6.1; $p < 0.001$), and FAI scores (mean difference – 10.0, 95% CI – 12.1 to – 7.9; $p < 0.01$). Kaplan–Meier analysis confirmed superior complication-free survival in the early cohort (log-rank $p < 0.05$). Delayed surgery (adjusted OR 2.30, 95% CI 1.51–3.62; $p < 0.01$) and socioeconomic disadvantage (adjusted OR 1.80, 95% CI 1.20–2.90; $p < 0.05$) were independent predictors of poor outcome. Below Poverty Line (BPL) status was present in 88% of the delayed cohort versus 37% of the early cohort ($p < 0.01$). Chart review identified hardware indent processing, scheme pre-authorisation, and emergency operating theatre overload as the principal delay mechanisms.

Conclusion

Panfacial fracture surgery performed 8–30 days after injury is independently associated with inferior functional and aesthetic recovery at 12 months. In a government tertiary setting where hardware is available but subject to bureaucratic procurement delays and constrained theatre scheduling, streamlining administrative pathways and protecting operating theatre capacity for complex craniomaxillofacial trauma hold greater promise for improving outcomes than further modification of surgical technique.

Introduction

Panfacial fractures, defined by simultaneous disruption of at least two facial thirds, impose a surgical burden disproportionate to their incidence. Restoring facial projection, dental occlusion, and skeletal width requires sequential re-establishment of disrupted horizontal and vertical buttresses under anatomical conditions that deteriorate progressively with post-injury time [1, 2]. AO Foundation principles and international practice guidelines recommend definitive open reduction and internal fixation (ORIF) within the first seven days, when fracture haematoma remains unorganised, periosteal planes are distinct, and bony segments respond to manipulation [3, 4]. This window is routinely achieved in high-volume trauma systems with streamlined resources; in resource-constrained settings, it frequently is not [5].

Government teaching hospitals in India occupy a specific and underexamined position in this landscape. Titanium fixation hardware, including miniplates, lag screws, and mesh for multi-site panfacial ORIF, is centrally procured and held in the hospital medical stores; patients are not expected to purchase hardware independently. Under the government health scheme, patients are entitled to receive it without direct cost. The barrier to timely surgery is therefore not hardware availability in principle, but the multi step administrative pathway required to access it: surgical indent submission, medical stores approval, and scheme pre-authorisation for eligible patients, a sequence that spans two to five working days under routine conditions and extends further during administrative backlogs or audit cycles [6]. Simultaneously, a government referral hospital serving a catchment of approximately 20 million people runs a continuous stream of polytrauma, abdominal, and orthopaedic emergencies that fills the available operating theatre lists [6, 7, 8, 9]. Panfacial fractures, which are severely disabling but rarely immediately life-threatening, are classified as semi-elective within this triage framework and scheduled as next-available-slot; in periods of peak census this slot may not materialise for 10 to 14 days. Rural patients referred from district hospitals face the additional burden of transport, subsistence, and family logistics over distances of up to 400 km.

The biological consequence of this institutional delay pattern is well characterised: the 8–30-day intermediate window represents a transitional phase during which the fracture haematoma undergoes fibrous organisation, periosteal planes consolidate around displaced segments, and soft-tissue contracture begins [10, 11]. Surgery in this window is mechanically more demanding than acute repair, yet formal corrective osteotomies are not yet required. Whether this intermediate delay translates into measurable patient-reported functional and aesthetic deformities has not been quantified in this specific government hospital setting, where the mechanisms of delay differ fundamentally from other-hospital contexts.

This study was undertaken with two explicitly stated aims: first, to determine whether ORIF performed in the 8–30-day window is independently associated with inferior patient-reported functional and aesthetic outcomes at 12 months compared with surgery within seven days; and second, to characterise the institutional and socioeconomic determinants of this delay, distinguishing administrative-bureaucratic

and theatre-scheduling barriers from the hardware-cost barriers described in private-sector LMIC literature. The distinction carries direct policy implications for government hospital administration.

Materials and Methods

Study design and setting

This retrospective cohort study was conducted at the Department of Dental Surgery, of a medical college Hospital, the principal craniomaxillofacial trauma referral centre for Western part of an Indian State. The study conformed to the STROBE statement for reporting of observational studies [12]. Multidetector CT is performed without direct cost to patients under the Mukyamantri Aryoga Ayushman(M A A) Insurance Scheme. Titanium fixation hardware is held in the central medical stores and is dispensed via institutional indent and scheme pre-authorisation processes. Formal ethics committee approval was not required under institutional policy for retrospective audits of de-identified clinical data; the study adhered to the Declaration of Helsinki.

Participants

Records of all consecutive patients treated for panfacial fractures between 1 January 2022 and 30 June 2024 were reviewed. Inclusion criteria: age 18–65 years; CT confirmed fracture involving two or more facial thirds; definitive ORIF; and documented 12-month follow up. Exclusion criteria: pathological fractures; prior facial surgery; severe concomitant traumatic brain injury (Glasgow Coma Scale below 13 on admission); and missing primary outcome data. Patients with missing data constituted fewer than 5% of the screened cohort and were handled by complete-case analysis. Patients undergoing surgery after 30 June 2024 were excluded to ensure a uniform 12-month follow-up window.

Exposure: surgical timing groups

Patients were allocated to an early surgery cohort (ORIF within seven days of injury) or a delayed surgery cohort (ORIF between day 8 and day 30). This 8–30-day interval was defined a priori as the intermediate window characterised by progressive fibrous callus formation and soft-tissue contracture, during which anatomical reduction becomes mechanically demanding but formal corrective osteotomies are not yet required [10, 11]. Patients presenting beyond 30 days represent established malunion and were excluded as a biologically distinct population.

Delay determinant documentation

Because diagnostic CT was provided without cost at this institution, structured chart review focused on institutional and socioeconomic delay mechanisms. Three categories were extracted: (i) hardware indent and scheme pre-authorisation processing, recorded as the interval between surgical decision and

stores confirmation of hardware availability; (ii) operating theatre scheduling delay, defined as time from OT booking to confirmed slot allocation; and (iii) patient-side barriers, including rural transportation logistics and family assembly. Socioeconomic disadvantage was operationalised as possession of a government-issued card or a social-worker assessment documenting financial vulnerability; it was analysed as a binary variable in the regression model. Chart review confirmed that CT imaging access was not a cause of delay in any case.

Clinical variables

Extracted variables included: age, sex, mechanism of injury, fracture severity (moderate: two facial thirds; severe: three facial thirds with comminution), and admission oral hygiene by the Simplified Oral Hygiene Index (OHI-S). Systemic comorbidities were extracted where documented; inconsistent recording precluded their inclusion in multivariable modelling, an acknowledged limitation.

Outcome measures

Functional outcomes were assessed using Hindi-translated versions of the OHIP-14 (range 0–56; higher scores indicate greater oral health-related disability) [13] and the Functional Disability Index (FDI; range 0–48; higher scores indicate greater limitation in jaw function and mastication). Aesthetic outcome was assessed by the Facial Aesthetic Index (FAI; range 0–100; higher scores indicate better facial form). Instruments were culturally adapted and pre-tested; formal psychometric revalidation in a trauma-specific Indian cohort was not performed. Research assistants blinded to group allocation administered all instruments at six and 12 months; inter-observer calibration preceded data collection. A composite poor outcome was defined a priori as the presence of any major post-operative complication (clinically palpable facial asymmetry, chronic pain beyond three months, surgical site infection, or re-intervention requirement) or an FAI score below 75 at 12 months.

Statistical analysis

Analysis used SPSS version 26.0 (IBM Corp., Armonk, NY). Continuous variables were compared by independent-samples t-test; categorical variables by chi-square test. PROM differences were reported as mean differences with 95% confidence intervals (CIs). Kaplan–Meier survival analysis with log-rank testing modelled time to first complication. Multivariable binary logistic regression identified independent predictors of poor outcome; the model included surgical timing, socioeconomic status, fracture severity, OHI-S score, age, and sex. Sex was retained as a pre-specified covariate regardless of significance. Adjusted odds ratios (aOR) with 95% CIs are reported. No a priori power calculation was performed; the sample comprised all eligible patients during the study period. All tests were two-tailed; $p < 0.05$ was considered significant.

Results

Cohort characteristics

One hundred and twenty patients completed 12-month follow-up. Mean age was 32 ± 10 years. Males constituted 88% ($n = 106$), reflecting the preponderance of young men among road traffic accident victims, which accounted for 82% ($n = 98$) of injuries [7, 8]. Fracture severity was moderate in 58% and severe in 42%. Early surgery was performed in 54 patients (45%) and delayed surgery in 66 (55%). Groups were closely matched for age, sex, mechanism, and fracture severity at baseline (Table 1; all $p > 0.05$). CT was performed in all 120 patients within 48 hours of admission; structured chart review confirmed no delay attributable to imaging access.

Table 1
Sociodemographic and clinical characteristics of the study cohort ($n = 120$)

Variable	Total (n = 120)	Early ORIF ≤ 7 d (n = 54)	Delayed ORIF 8–30 d (n = 66)	p value
Age (years), mean $\pm$ SD	32 ± 10	31.5 ± 9.2	32.4 ± 10.8	0.62 χ^2
Sex, n (%)				0.86 χ^2
Male	106 (88)	48 (89)	58 (88)	
Female	14 (12)	6 (11)	8 (12)	
Mechanism, n (%)				0.95 χ^2
Road traffic accident	98 (82)	44 (81)	54 (82)	
Assault / fall / other	22 (18)	10 (19)	12 (18)	
Fracture severity, n (%)				0.81 χ^2
Moderate (2 facial thirds)	70 (58)	32 (59)	38 (57)	
Severe (3 thirds + comminution)	50 (42)	22 (41)	28 (43)	
Socioeconomic status, n (%)				< 0.01 χ^2 *
BPL-status (disadvantaged)	78 (65)	20 (37)	58 (88)	
Non-BPL	42 (35)	34 (63)	8 (12)	
χ^2 Independent-samples t-test. χ^2 Chi-square test. * $p < 0.05$. BPL, Below Poverty Line; d, days; ORIF, open reduction and internal fixation; SD, standard deviation.				

Among the 66 delayed cases, structured review identified the following delay mechanisms, often in combination: hardware indent and scheme pre-authorisation processing in 48 patients (73%); operating theatre scheduling due to emergency surgical demand in 41 patients (62%); and rural transportation or family assembly constraints in 29 patients (44%). BPL status was documented in 58 of 66 delayed

patients (88%) versus 20 of 54 early patients (37%); chi-square 14.2, $p < 0.01$. BPL-status patients faced the cumulative burden of all three delay categories: mandatory scheme documentation for administrative processing, lower scheduling priority under the semi-elective classification, and greater dependence on rural referral networks with limited subsistence support.

Patient-reported outcomes at 12 months

All three outcome instruments showed consistently worse scores in the delayed cohort at 12 months (Table 2; Fig. 2). Mean OHIP-14 was 18.7 ± 4.5 in the delayed group versus 12.5 ± 3.2 in the early group (mean difference 6.2, 95% CI 4.8–7.6; $p < 0.001$). This gap in self-reported oral health-related disability was already present at the six-month assessment and widened further by 12 months, indicating a diverging rather than converging recovery trajectory. Mean FDI was 20.1 ± 3.9 versus 15.3 ± 2.8 (mean difference 4.8, 95% CI 3.5–6.1; $p < 0.001$). Mean FAI was 75.0 ± 6.2 versus 85.0 ± 5.0 (mean difference –10.0, 95% CI –12.1 to –7.9; $p < 0.01$), reflecting persistent facial form asymmetry at one year despite operative correction.

Table 2
Patient-reported functional and aesthetic outcomes at 12-month follow-up

Outcome instrument	Early surgery (n = 54) Mean $\pm$ SD	Delayed surgery (n = 66) Mean $\pm$ SD	Mean difference (95% CI)	p value
OHIP-14 (0–56)⊠	12.5 $\pm$ 3.2	18.7 $\pm$ 4.5	6.2 (4.8 to 7.6)	< 0.001*
FDI (0–48)⊠	15.3 $\pm$ 2.8	20.1 $\pm$ 3.9	4.8 (3.5 to 6.1)	< 0.001*
FAI (0–100)⊠	85.0 $\pm$ 5.0	75.0 $\pm$ 6.2	–10.0 (–12.1 to –7.9)	< 0.01*

⊠ Higher scores = greater disability or limitation. ⊠ Higher scores = better aesthetic outcome. * $p < 0.05$. CI, confidence interval; FAI, Facial Aesthetic Index; FDI, Functional Disability Index; OHIP-14, Oral Health Impact Profile-14; SD, standard deviation.

Complication-free survival and post-operative morbidity

Kaplan–Meier analysis demonstrated superior complication-free survival throughout the 12-month period in the early surgery group (log-rank $p < 0.05$; Fig. 1). The survival curves diverged within the first three post-operative months and the gap widened progressively to 12 months. Clinically palpable facial asymmetry occurred in 25% of delayed patients versus 12% of early patients ($p < 0.05$). Chronic pain beyond three months affected 28% versus 15% ($p < 0.05$). Re-intervention was required in 14% versus 4% ($p < 0.05$). Surgical site infection rates were numerically higher in the delayed group but did not achieve significance (10% vs. 5%; $p = 0.18$; Table 3).

Table 3
Post-operative complications by surgical timing group

Complication	Early surgery (n = 54) n (%)	Delayed surgery (n = 66) n (%)	p value
Clinically palpable facial asymmetry	6 (12)	17 (25)	< 0.05*
Chronic pain (> 3 months)	8 (15)	18 (28)	< 0.05*
Surgical site infection	3 (5)	7 (10)	0.18
Need for re-intervention	2 (4)	9 (14)	< 0.05*
* $p < 0.05$.			

Multivariable predictors of poor outcome

Three variables independently predicted composite poor outcome on multivariable regression (Table 4; Fig. 3). Delayed surgery was the strongest predictor (aOR 2.30, 95% CI 1.51–3.62; $p < 0.01$), confirming the association with inferior outcomes after adjustment for fracture severity, oral hygiene, age, and sex. Socioeconomic disadvantage was the second independent predictor (aOR 1.80, 95% CI 1.20–2.90; $p < 0.05$), reflecting a direct effect of financial vulnerability on outcome beyond its role as a mediator of delay. Poor admission oral hygiene (OHI-S above 3.0) was equally significant (aOR 2.10, 95% CI 1.30–3.40; $p < 0.01$). Severe fracture pattern showed a non-significant trend toward worse outcomes (aOR 1.40, 95% CI 0.95–2.10; $p = 0.08$). Age and sex were not significant predictors.

Table 4
Multivariable logistic regression: independent predictors of composite poor outcome[‡]

Predictor variable	Adjusted OR (aOR)	95% CI	p value
Delayed surgery (8–30 d) vs. early surgery (≤ 7 d)	2.30	1.51–3.62	< 0.01*
Poor admission oral hygiene (OHI-S > 3.0) vs. ≤ 3.0	2.10	1.30–3.40	< 0.01*
Socioeconomic disadvantage (BPL) vs. non-BPL	1.80	1.20–2.90	< 0.05*
Severe fracture pattern vs. moderate	1.40	0.95–2.10	0.08
Age (per year)	1.02	0.98–1.05	0.45
Male sex vs. female	1.15	0.60–2.20	0.65

[‡] Composite poor outcome = any major post-operative complication (clinically palpable asymmetry, chronic pain > 3 months, surgical site infection, or re-intervention) or Facial Aesthetic Index score below 75 at 12 months. * $p < 0.05$. BPL, Below Poverty Line; CI, confidence interval; d, days; OHI-S, Simplified Oral Hygiene Index; OR, odds ratio.

Discussion

The principal findings of this study are internally consistent and answer the two stated aims directly. Panfacial fracture ORIF performed in the 8–30-day window is independently associated with inferior patient-reported functional and aesthetic outcomes at 12 months, and the dominant drivers of this delay at a government teaching hospital are bureaucratic hardware procurement processes and emergency operating theatre overload, not hardware unavailability per se.

The 8–30-day intermediate window produces inferior outcomes for reasons that are well grounded in fracture biology and operative anatomy. Within the first seven days after injury, fracture haematoma remains unorganised, bony segments are mobile, periosteal planes are dissectible, and muscular attachments have not yet re-established traction on displaced fragments [10, 11]. The surgeon operating in this window works with, rather than against, fracture anatomy. Between day 8 and day 30, fibroblastic infiltration progressively converts this haematoma into a fibrous callus of increasing tensile strength; by day 14–21 the masseter and temporalis muscles are re-establishing fibrous traction across displaced fragments, and the intercanthal, malar, and occlusal reference planes are actively deteriorating [1, 2]. The operating surgeon must overcome this resistance by force and judgment rather than by following preserved anatomy, with correspondingly less precision in final segment position [3, 4]. This is the mechanism by which the mean FAI deficit of 10 points and the 13-percentage-point excess of clinically palpable asymmetry accumulate in the delayed cohort.

Situating these findings within the existing literature clarifies their contribution. Hermans et al. [14] reported significantly higher complication rates with delayed maxillofacial fracture repair in a Dutch cohort. He et al. [15] demonstrated that panfacial fractures treated late required substantially more complex secondary procedures and yielded inferior aesthetic results. Shiju et al. [16], reporting from a comparable Indian government centre, described analogous challenges including hardware-access delays and OT overload as contributors to deferred panfacial repair, but did not assess outcomes with validated PROMs. Our study extends this evidence by quantifying the outcome penalty within the specific 8–30-day intermediate window using three validated instruments in a government hospital context, and by disaggregating delay mechanisms beyond the single-factor hardware-cost narrative.

The patient-reported functional deficit carries substantial quality-of-life implications. A mean OHIP-14 increment of 6.2 points at 12 months, sustained beyond any expected inflammatory recovery curve, reflects persistent difficulty chewing solid food, reduced comfort in social interaction, and ongoing limitation in speech — deficits reported by patients in their daily lives rather than identified only on clinical examination [17, 18]. The 3.5-fold higher re-intervention rate in the delayed cohort (14% vs. 4%) compounds this burden: each unplanned re-operative episode adds anaesthetic exposure, theatre resource consumption, and additional recovery time in a population already dealing with the economic consequences of the original injury.

The characterisation of delay mechanisms in this cohort requires institutional specificity because the barrier profile differs fundamentally from the hardware-cost narrative that dominates LMIC trauma

literature [5, 6]. At this institute, as at comparable government medical colleges in India, hardware is available in the central stores and is dispensed without direct cost to patients. Chart review confirmed that not a single delay in this cohort was attributable to CT imaging access. The primary mechanism was administrative: hardware indent approval and scheme pre-authorisation accounted for delay in 73% of delayed cases. This is not a hardware supply problem; it is a process problem. The second major mechanism was OT scheduling: 62% of delayed cases cited emergency surgical demand consuming available theatre time before the panfacial case could be accommodated. Cheema and Amin [19] reported analogous scheduling-driven delays in a government trauma centre in Lahore, suggesting this is a structural characteristic of high-volume government teaching hospitals across South Asia rather than a local aberration. Recognition of this distinction is clinically important because the correct intervention is not additional hardware subsidy hardware is already subsidised but administrative process reform and protected OT capacity.

Poor admission oral hygiene emerged as an independent predictor of poor outcome (aOR 2.10), with an OHI-S exceeding 3.0 indicating a heavy plaque and calculus burden across multiple sextants. This finding is consistent with the mandibular fracture complication literature [20, 21] and is applicable to any ORIF procedure involving intraoral incisions. The intervention is inexpensive and implementable within the existing waiting-period framework: supervised oral hygiene, chlorhexidine irrigations, and targeted scaling before ORIF can partially mitigate the infection risk associated with unavoidable delay without adding meaningful cost to a government hospital workflow.

Three targeted administrative reforms could compress intermediate delay rates at institutions. A dedicated fast-track administrative pathway for panfacial fracture cases, with a 24-hour stores and pre-authorisation turnaround as a standard of care rather than an exception, would eliminate the largest single delay category. Designation of a protected weekly theatre session for complex craniomaxillofacial trauma would decouple panfacial ORIF from competition with general emergency cases [22]. A craniomaxillofacial trauma coordinator, responsible for documentation, scheme enrolment, and transport logistics facilitation at the point of admission, would address the patient-side delay component. These are administrative and scheduling interventions that require institutional will rather than capital expenditure.

Several limitations require explicit acknowledgement. The retrospective design introduces survivor bias: patients with the worst outcomes may have been disproportionately lost to follow-up before 12 months, potentially underestimating the true delay deformities. No prospective power calculation was performed; the sample was determined by case availability, limiting power for secondary comparisons. Systemic comorbidities were not consistently recorded and could not be included in multivariable modelling. The translated PROMs were culturally adapted but not formally revalidated in this trauma population [13], limiting precision in cross-setting score comparisons. This is a single-centre study from a government teaching hospital in northwestern India; the specific barrier profile particularly the administrative and OT scheduling mechanisms may not generalise to private institutions,, or government centres with different

administrative structures or patient volumes. Intraoperative variables including surgeon experience, operative time, and hardware configuration were not captured.

Conclusion

Panfacial fracture surgery performed in the 8–30-day intermediate window is independently and significantly associated with inferior patient-reported functional and aesthetic outcomes at 12 months. At this government teaching hospital where hardware is centrally provided, the primary drivers of intermediate delay are bureaucratic procurement processes and emergency operating theatre overload in a high-volume system, not hardware unavailability. Surgical technique cannot compensate for the mechanical disadvantage imposed by fibrous callus formation and soft-tissue contracture. Streamlined administrative pathways and protected OT capacity for complex craniomaxillofacial trauma offer a more viable route to outcome improvement than any modification of surgical approach.

Declarations

Ethical approval

This retrospective study used deidentified data extracted from existing medical records at Dr. S.N. Medical College and Hospital (DrSNMCH), Jodhpur. The study was reviewed by the Institutional Ethics Committee, Dr. S.N. Medical College and Hospital, Jodhpur, Rajasthan, India, and was granted exemption from full review on the grounds that it involved retrospective analysis of anonymised records without active patient contact or intervention. The study was conducted in accordance with the Declaration of Helsinki and its later amendments.

Human Ethics and Consent to Participate

This study involved retrospective analysis of de-identified clinical records and did not require active recruitment, contact, or intervention involving human participants. In accordance with the decision of the Institutional Ethics Committee, Dr. S.N. Medical College and Hospital, Jodhpur, Rajasthan, India, a waiver of individual informed consent was granted for this retrospective audit. Human Ethics and Consent to Participate declarations: not applicable for this retrospective observational study design.

Conflict of interest

The authors declare no conflicts of interest.

Funding

No funding was received for this study from any public, commercial, or not-for-profit funding body. The authors received no financial support for the research, authorship, or publication of this article.

Data availability

Deidentified summary data are available from the corresponding author on reasonable request. The full dataset is not publicly deposited owing to institutional patient privacy considerations.

Author contributions

Chandrashekhar Chattopadhyay: conceptualisation, study design, data curation, formal analysis, original draft, review and editing, corresponding author. Vikas Deo, Charu Chouhan, Mamta Patel, Ayush Garg, Priti Airun: Kamal Singh data collection, Editing .

Clinical trial number

Clinical trial number: not applicable. This study is a retrospective observational cohort analysis and was not prospectively registered as a clinical trial.

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Figures

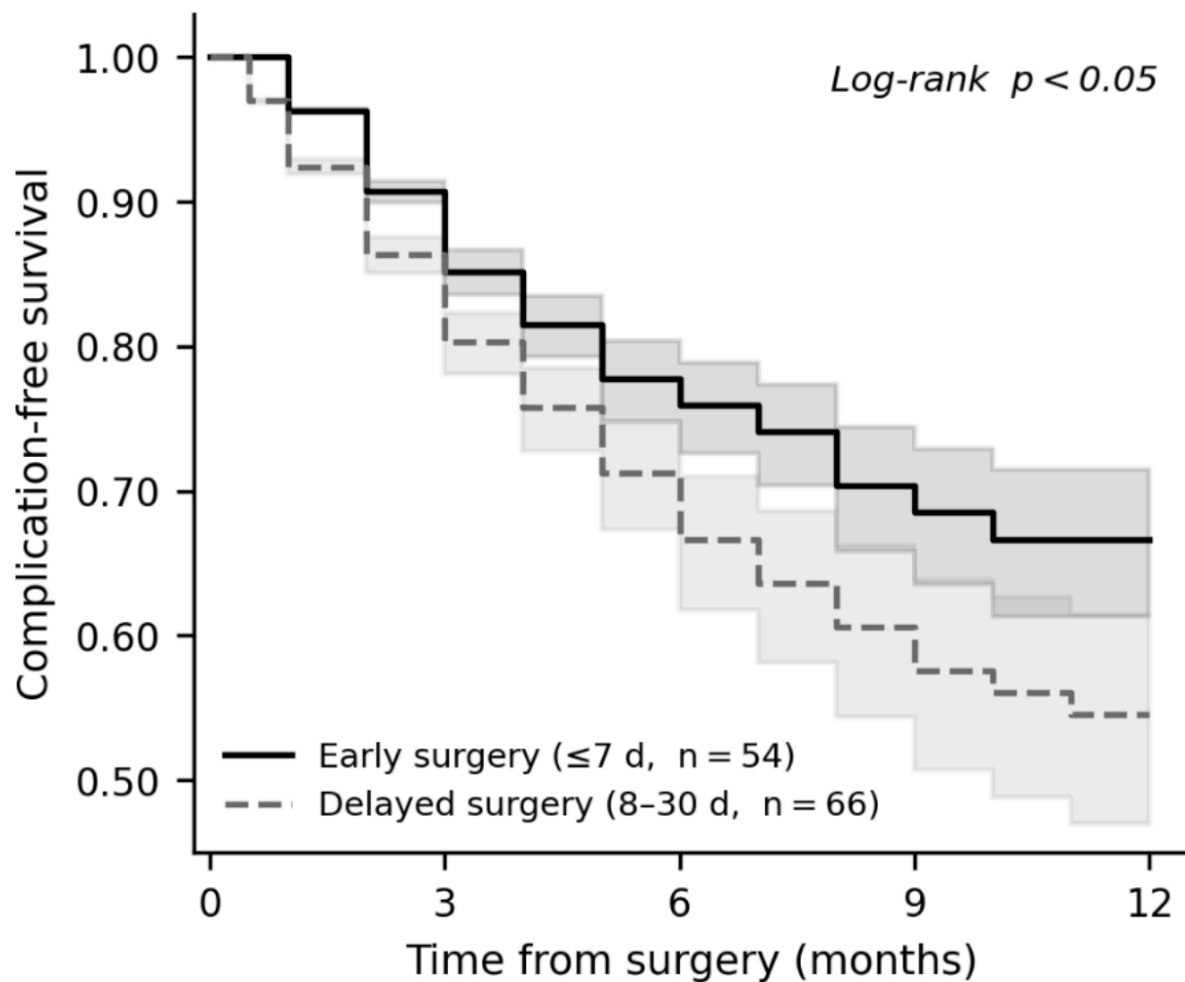


Figure 1

Kaplan–Meier complication-free survival curves for the early surgery cohort (≤ 7 days; n = 54, solid line) and delayed surgery cohort (8–30 days; n = 66, dashed line). The outcome event was first occurrence of any post-operative complication (clinically palpable facial asymmetry, chronic pain beyond three months, surgical site infection, or need for re-intervention). Shaded bands represent 95% confidence intervals; tick marks denote censored observations. Log-rank $p < 0.05$. Curves diverge within the first three post-operative months and widen progressively, indicating an early and sustained disadvantage of intermediate delay.

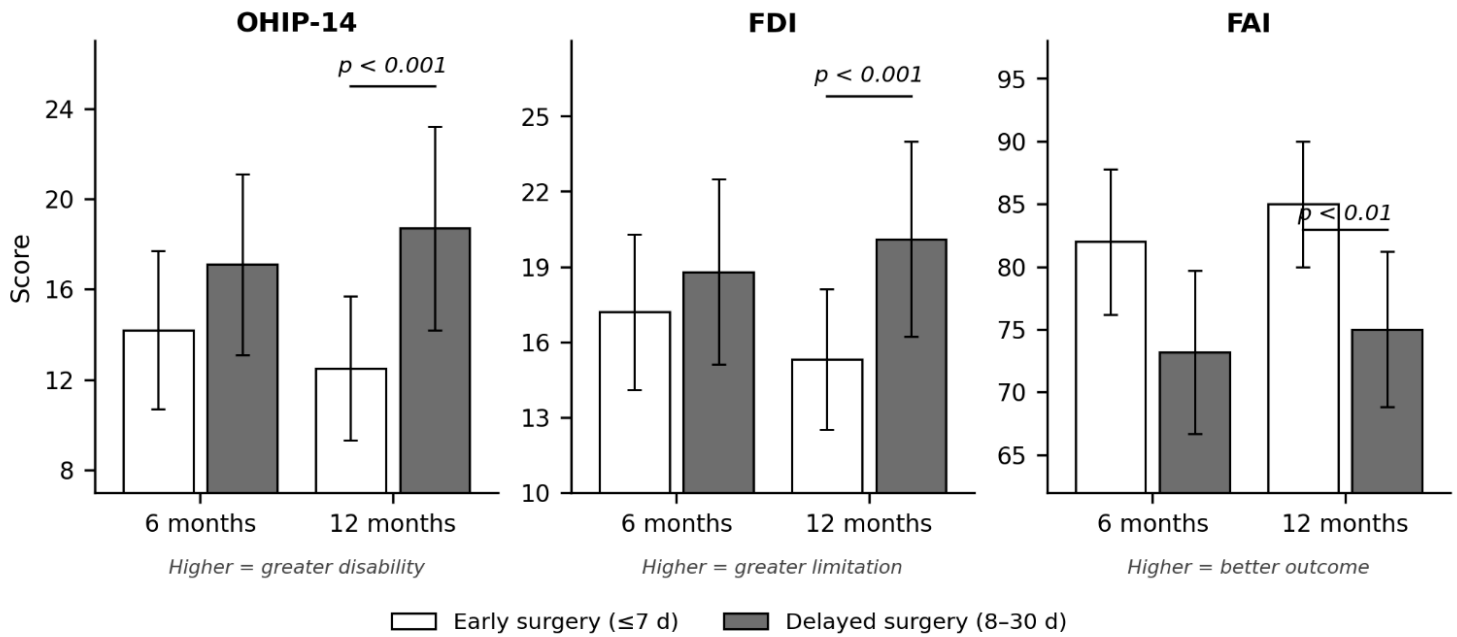


Figure 2

Mean scores on the three validated outcome instruments at six and 12 months for the early (white bars) and delayed (grey bars) surgery cohorts. Left panel: OHIP-14 (range 0–56; higher = greater disability). Centre panel: FDI (range 0–48; higher = greater functional limitation). Right panel: FAI (range 0–100; higher = better aesthetic outcome). Error bars represent one standard deviation. Asterisks indicate statistically significant between-group differences at 12 months (OHIP-14, FDI: $p < 0.001$; FAI: $p < 0.01$). FAI, Facial Aesthetic Index; FDI, Functional Disability Index; OHIP-14, Oral Health Impact Profile-14.

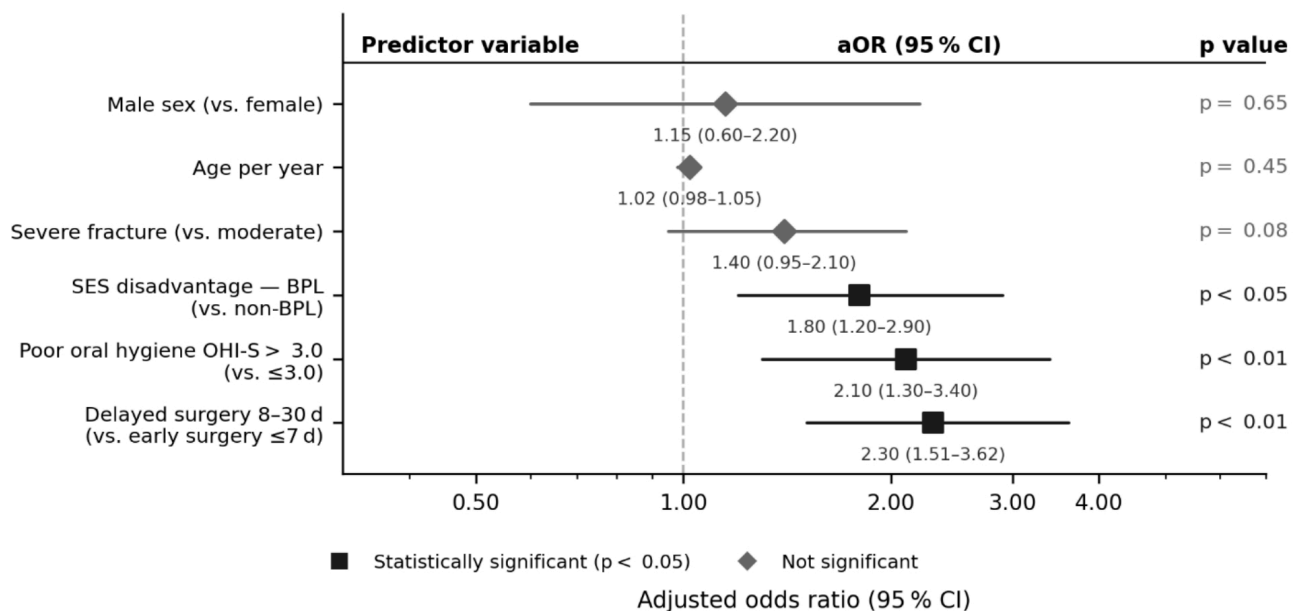


Figure 3

Forest plot of adjusted odds ratios (aOR) with 95% confidence intervals from multivariable binary logistic regression for independent predictors of composite poor outcome (major complication or FAI < 75 at 12 months; n = 120). Reference groups are shown in parentheses. Dashed vertical line at aOR = 1.0 denotes the null. Delayed surgery: aOR 2.30 (95% CI 1.51–3.62; $p < 0.01$). Poor oral hygiene (OHI-S > 3.0): aOR 2.10 (95% CI 1.30–3.40; $p < 0.01$). Socioeconomic disadvantage (BPL): aOR 1.80 (95% CI 1.20–2.90; $p < 0.05$). Age and sex were not significant. BPL, Below Poverty Line; FAI, Facial Aesthetic Index; OHI-S, Simplified Oral Hygiene Index.