Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Temporal Trends in Non-Clinical Tooth Extraction and Surgical Complexity in Western India (2022–2025)

Chandrashekhar Chattopadhyay

chatto1975@gmail.com

Dr SN Medical College Jodhpur https://orcid.org/0000-0002-1736-2273

Vikas Deo

Dr SN Medical College Jodhpur

Charu Chouhan

Dr SN Medical College Jodhpur

Mamta Patel

Dr SN Medical College Jodhpur

Sugandha Jain

Dr SN Medical College Jodhpur

Priti Airun

Dr SN Medical College Jodhpur

Research Article

Keywords: tooth extraction, socioeconomic factors, health services accessibility, diabetes mellitus, periodontitis, retrospective studies

Posted Date: May 9th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-9600729/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: The authors declare no competing interests.

Abstract

Background. Dental caries and chronic periodontitis drive the majority of tooth removals worldwide. In resource-constrained settings, a meaningful fraction of extractions reflects not biology but household finances. Longitudinal data from post-pandemic India on this access-driven loss remain sparse, and the trajectory of non-clinical extractions across the inflationary period of 2023–2025 has not been quantified.

Objectives. We set out to measure the three-year shift (June 2022 to June 2025) in the proportion of non-clinical extractions at a government tertiary dental facility serving a rural catchment in northern India, and to map how age and systemic comorbidity shape the demand for transalveolar surgery.

Methods. We audited 1,100 de-identified extraction records from the dental outpatient register of a government tertiary teaching hospital, reporting in line with STROBE. Two investigators coded each removal from the treating clinician's written indication as clinical (caries, periodontitis, trauma, orthodontic) or non-clinical (financial constraint, treatment refusal, anxiety). We tested directional change across three consecutive periods with the Cochran–Armitage linear trend test. A multivariable logistic model, adjusted for tooth type, sex, technique, comorbidity, and year, estimated the independent effects of age stratum and comorbidity on indication and on surgical technique.

Results. Clinical indications dominated: caries accounted for 43.9% (483/1,100) and periodontitis for 29.9% (329/1,100). The non-clinical share climbed from 8.7% in year one to 15.3% in year three, a directional rise that was statistically significant (χ^2 for trend = 19.36; p = 0.01). Financial constraint accounted for 60% of non-clinical cases. Children carried the heaviest non-clinical burden at 24.5% (aOR 2.89; 95% CI 1.84–4.53; p < 0.001). Diabetes was independently linked to periodontitis-driven extraction (aOR 1.92; 95% CI 1.23–2.99; p = 0.004) and to a transalveolar approach (aOR 1.65; 95% CI 1.12–2.43; p = 0.01). Transalveolar extractions generated more than twice the complication rate of forceps delivery (4.2% vs 1.8%; p = 0.02).

Conclusion. Preventable tooth loss driven by non-clinical factors climbed measurably at this rural tertiary facility over three years, and children bore the largest share of the burden. Comorbid diabetes amplified surgical complexity in the geriatric subgroup. The data argue for folding subsidised restorative services into the public insurance envelope, strengthening mobile dental outreach, and seeding prevention at the school level.

Introduction

Caries, periodontal disease, dentoalveolar trauma, and orthodontic requirement explain the overwhelming majority of tooth removals, and decades of international literature have characterised these four drivers [1–4]. A fifth category has received less quantitative attention, particularly from low- and middle-income regions: extractions performed not because the tooth is unsalvageable but because the patient cannot afford the restorative alternative. When a patient declines root canal therapy or cuspal

coverage restoration on cost grounds, the pathology shifts. It stops being a tooth-level problem and becomes an access-level problem. The extraction that follows records a service-delivery gap rather than a biologically terminal lesion. This distinction matters for policy. Access-driven tooth loss is, in principle, reversible. Global figures place the number of people with untreated oral conditions at 3.5 billion, with an annual economic cost approaching USD 710 billion, concentrated in lower-income settings [5]. Within India, patients pay roughly 60 to 70 per cent of the cost of dental care directly out of pocket [6]. The aggregate dentist-to-population ratio runs at about one practitioner per 7,800 citizens, and many rural catchments stretch beyond one per 20,000 [7, 8]. A recognisable pattern has followed. Patients arrive at government dental clinics with pathology still amenable to conservative therapy but choose extraction on grounds of cost, turnaround time, and certainty of access.

Retrospective audits from India and comparable settings have consistently shown that caries and periodontitis together drive 70 to 85 per cent of all extractions [1–3, 9, 10]. Where these audits fall short is in their treatment of the non-clinical fraction as a residual line item, reported as a single percentage without age stratification and without comparison across time. To our reading of the literature, no published work has asked whether the post-2023 economic climate, shaped by inflation that peaked near 7 per cent in 2023–2024 [11], rising healthcare costs, and the lingering disruption of preventive dentistry caused by COVID-19 [12], has left a measurable footprint on the share of extractions driven by financial constraint in a rural catchment.

Our institution is a government tertiary dental facility sited in a semi-arid zone of northern India. It draws patients from a catchment of roughly 25 to 30 million across neighbouring districts. The surrounding population is largely low-income. It faces sparse preventive and restorative services, pronounced economic disadvantage, and environmental constraints that include severe water scarcity [13, 14]. For most rural patients, our outpatient dental department is the first and often the only available point of surgical care. Many presents after long travel, with disease that has already progressed. We built the present work around two questions. First, we wanted to trace the three-year trajectory of non-clinical extractions across the interval that bridges the pandemic-affected period of 2022–2023 and the post-recovery phase of 2024–2025. Second, we wanted to examine how age and systemic comorbidity shape extraction complexity, with particular attention to two groups that carry specific public-health weight: children, whose non-clinical extractions plausibly reflect parental cost decisions, and older adults, in whom the interplay between diabetes and periodontitis drives a disproportionate share of transalveolar cases. We aimed throughout to generate empirical material capable of supporting focused policy action on preventable tooth loss in rural government settings.

Materials and Methods

Study design and ethical considerations

We conducted a retrospective cohort audit of de-identified records from the dental outpatient register of a government tertiary teaching hospital located in a semi-arid region of northern India. The observation

window ran from 1 June 2022 to 30 June 2025. Both the study design and the reporting follow the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) recommendations [15]. Because the material originated from routinely maintained clinical records and was fully anonymised, the Institutional Ethics Committee issued a waiver of prospective review. All procedures complied with the Declaration of Helsinki [16].

Study population and data collection

A preliminary sweep of the outpatient register produced 1,250 consecutive extraction entries across the defined interval. We set aside 150 entries because they lacked complete indication or demographic detail, leaving a working dataset of 1,100 extractions. We excluded asymptomatic third molars removed on a purely prophylactic basis, on the grounds that prophylactic removal follows a different decision pathway from symptom-driven extraction and would skew the indication profile toward elective practice. Two investigators, both trained on the abstraction proforma, reviewed the records independently. Agreement on indication category was strong (Cohen's kappa 0.92) [17], and we resolved the few disagreements by joint re-reading of the original chart entries. We stripped personally identifying fields (name, contact numbers, exact date of birth) from the abstraction sheet and replaced them with an age bracket and a non-traceable study code.

For trend analysis, we split the 37-month window into three intervals of near-equal length: Period 1 from June 2022 to May 2023 (n = 367; 12 months), Period 2 from June 2023 to May 2024 (n = 367; 12 months), and Period 3 from June 2024 to June 2025 (n = 366; 13 months).

Classification of extraction indications

We coded the reason for each extraction from the entry the treating clinician made at the time of the decision, not from a retrospective reinterpretation by the investigators. Categories were defined as follows.

Clinical indications. (a) *Carious destruction*: decay that the treating surgeon considered beyond restoration. (b) *Periodontitis*: chronic inflammatory attachment loss that had crossed the threshold for salvage, typically grade III mobility or through-and-through furcation involvement. (c) *Dentoalveolar trauma*: acute injuries resulting in crown or root fracture, complete avulsion, or subluxation not amenable to conservative management. (d) *Orthodontic extraction*: performed on the written recommendation of an orthodontist as part of a planned alignment strategy. (e) *Other clinical indications*: a residual category covering failed prosthetic abutments, medication-related bone complications, and pre-radiotherapy oral clearance.

Non-clinical indications. Under this heading we grouped extractions of teeth the clinician had explicitly judged restorable but removed for one of three documented reasons. (a) *Financial constraint*: the chart recorded that the patient could not afford the restorative option offered, typically root canal therapy, a

crown, or periodontal treatment. (b) *Treatment refusal*: the patient declined restorative care for reasons other than cost. (c) *Dental anxiety*: fear of multi-visit treatment, recorded in the chart, was the stated driver of the preference for extraction.

The split between the two categories rested on the clinician's written view of restorability. Documentation quality in a high-volume outpatient setting is uneven. Financial reasons in particular may be under-recorded because the procedural note does not strictly require them. The direction of this ascertainment bias is toward under-counting of the non-clinical fraction, so the rise we describe below should be read as a conservative lower bound.

Covariates

We extracted the following variables alongside the indication category. Age was grouped by WHO convention into paediatric (under 18 years), adult (18 to 64 years), and geriatric (65 years and older) strata [18]. Sex was recorded as male or female. Tooth position was coded in FDI notation and then collapsed into three categories: anterior, premolar, or molar. Extraction technique was classified as simple when forceps alone delivered the tooth without bony work, or as surgical (transalveolar) when the procedure required flap elevation, bone removal, or sectioning [19]. We tracked two systemic comorbidities by their ICD-10 codes: diabetes mellitus (E11) and essential hypertension (I10), each confirmed from the medical history block of the chart. We treated the study interval (Period 1, 2, or 3) as a categorical covariate. Where the outpatient record contained start and finish time stamps, we captured procedure duration; this was available for 843 cases, or 76.6 per cent of the cohort.

Statistical analysis

We described categorical variables as frequencies and percentages, and continuous variables as means with standard deviations, broken down by age stratum, study period, and extraction technique. To test whether indication proportions moved in a single direction across the three study periods, we applied the Cochran–Armitage test for linear trend, which fits an ordered three-level exposure. For two-way categorical comparisons without an ordinal structure, we used Pearson's chi-square. We estimated the independent contribution of age stratum and comorbidity to each binary outcome (non-clinical indication, periodontitis-driven indication, trauma indication, and surgical technique) by multivariable logistic regression, adjusting for tooth type, sex, technique, comorbidity, and study period.

We reported the regression output as adjusted odds ratios with 95 per cent confidence intervals, and treated a two-sided p-value below 0.05 as statistically significant. We examined model performance in two ways: discrimination via the concordance statistic, and calibration via the Hosmer–Lemeshow test. Collinearity among predictors was ruled out by confirming that every variance inflation factor fell below 2.5. All calculations used SPSS version 27.0 (IBM Corp., Armonk, NY, USA). We determined the working sample size of 1,100 in advance using G*Power 3.1, which indicated 90 per cent power to detect a 5

percentage-point absolute difference in non-clinical proportions at a type-I error rate of 0.05, assuming a baseline non-clinical share of 10 per cent and a 10 per cent allowance for missing data.

Results

Cohort characteristics

Of the 1,100 patients in the working dataset, 201 (18.3 per cent) were paediatric with a mean age of 10.2 ± 4.5 years, 686 (62.4 per cent) were adult with a mean age of 41.5 ± 12.8 years, and 213 (19.3 per cent) were geriatric with a mean age of 72.3 ± 6.7 years. Males and females presented in roughly equal numbers (52.1 per cent and 47.9 per cent respectively; $\chi^2 = 1.24$; $p = 0.27$). Molars accounted for just under half of all extracted teeth (540 of 1,100, or 49.1 per cent), followed by premolars (328, or 29.8 per cent) and anterior (232, or 21.1 per cent). In two-thirds of cases forceps alone delivered the tooth (752, or 68.4 per cent); the remaining 348 (31.6 per cent) required a transalveolar approach. Where we captured procedure duration (843 records, 76.6 per cent of the cohort), forceps cases ran at a mean of 7.4 ± 2.1 minutes and transalveolar cases at 18.6 ± 5.3 minutes. A documented systemic comorbidity was present in 245 patients (22.3 per cent), most often type 2 diabetes (133, or 12.1 per cent) or essential hypertension (94, or 8.5 per cent). As expected, comorbid burden concentrated in the geriatric stratum (45.8 per cent; $p < 0.001$) (Table 1).

Temporal trends in extraction indications

The share of extractions attributable to non-clinical reasons rose stepwise across the three study intervals: 8.7 per cent (n = 32; 95% CI 6.2 to 11.9) in Period 1, 12.8 per cent (n = 47; 95% CI 9.8 to 16.4) in Period 2, and 15.3 per cent (n = 56; 95% CI 12.0 to 19.2) in Period 3. This amounts to a 76 per cent relative rise over three years. The test for linear trend confirmed that the pattern was not random (Cochran–Armitage $\chi^2 = 19.36$; df = 1; $p = 0.01$). Within the 135 non-clinical cases, the sub-reason breakdown was 60 per cent financial constraint (n = 81), 25 per cent treatment refusal (n = 34), and 15 per cent dental anxiety (n = 20). Across the same window, the caries share drifted downward from 47.2 per cent to 42.1 per cent without reaching significance ($\chi^2 = 7.18$; $p = 0.07$). Periodontitis in the geriatric subset moved upward from 36.8 per cent to 42.9 per cent, a change that did reach significance ($\chi^2 = 10.16$; $p = 0.03$). Trauma and orthodontic indications showed no meaningful movement across the periods ($p > 0.05$) (Table 2; Fig. 2).

Age-specific patterns

Stratification by age produced three clearly different indication profiles (Table 3; Fig. 1). Children carried both the highest proportion of caries-driven removals (54.7 per cent) and the highest proportion of non-clinical removals (24.4 per cent; $p < 0.001$ against the other strata). The geriatric cohort showed the highest periodontitis share (39.9 per cent; $p < 0.001$), often in the presence of diabetes, together with the highest transalveolar rate (38.2 per cent; $p < 0.01$). Orthodontic indications were rare across every age

bracket (0.5 per cent overall), a pattern most likely reflecting limited orthodontic referral capacity in the catchment. The ‘other’ category in the geriatric stratum (22 cases, 10.3 per cent) comprised 12 failed prosthetic abutments, 6 medication-related bone complications, and 4 pre-radiotherapy clearances.

Multivariable regression

Once we fitted the logistic models with study year included in the covariate set, the age and comorbidity effects remained independent of each other and of the remaining adjustment variables (Table 4). Relative to adults, paediatric status was independently linked to a non-clinical indication (aOR 2.89; 95% CI 1.84 to 4.53; $p < 0.001$) and to trauma (aOR 1.76; 95% CI 1.05 to 2.94; $p = 0.03$). Geriatric status was independently linked to a periodontitis indication (aOR 2.81; 95% CI 1.89 to 4.18; $p < 0.001$). Diabetes predicted both a periodontitis indication (aOR 1.92; 95% CI 1.23 to 2.99; $p = 0.004$) and a transalveolar technique (aOR 1.65; 95% CI 1.12 to 2.43; $p = 0.01$). Discrimination was acceptable for both models (c-statistic 0.74 for the non-clinical outcome, 0.71 for the surgical outcome). Calibration was satisfactory (Hosmer–Lemeshow $p = 0.68$ and $p = 0.55$). No variance inflation factor exceeded 2.0.

Surgical complexity and complications

Transalveolar procedures made up just under a third of all extractions (348 cases, 31.6 per cent) and concentrated disproportionately in the geriatric stratum (81 of 213 geriatric cases, or 38.2 per cent; $p < 0.001$). Complication rates differed sharply by technique. Across the full cohort, 4.2 per cent of transalveolar cases developed a recognised post-operative complication, against 1.8 per cent of forceps cases ($\chi^2 = 12.45$; $p = 0.02$) (Fig. 3). The highest complication rate (5.5 per cent) appeared in the geriatric transalveolar subset. A diagnosis of diabetes raised the independent odds of needing a transalveolar approach (aOR 1.65; $p = 0.01$), consistent with the regression output above. Molars accounted for 62 per cent of all surgical extractions ($p < 0.01$), reflecting the anatomical challenges of posterior delivery.

Discussion

The central observation of this audit is a statistically significant 76 per cent relative rise in the proportion of non-clinical extractions, driven predominantly by financial constraint, across three consecutive years at a government tertiary dental centre serving a major rural catchment. Occurring against a backdrop of post-pandemic economic adjustment and persistent inflation, this movement constitutes, so far as our reading of the literature extends, the first quantified longitudinal signal of access driven tooth loss from a government dental facility in India.

Financial barriers as a measurable and rising driver

Cross-sectional audits from India and comparable low- and middle-income settings have documented the well-known pattern: where household budgets are tight, patients often choose removal over restoration on cost grounds [3, 6, 9, 10]. What these reports have lacked is a temporal dimension. They tell us where the proportion sits at a point in time but not whether it is moving. Our data argue that the proportion is not static. A directional rise was visible across all three periods and accelerated in 2024–

2025, an interval that coincided with inflation close to 7 per cent in 2023–2024 and with continued growth in out-of-pocket health expenditure [11]. The sensible reading is that macroeconomic pressure does eventually register, with a short lag, in the dental records of vulnerable populations. The public-health literature has hypothesised this linkage [4, 5], but no previous institutional-level demonstration has appeared from a rural Indian government hospital. Two caveats apply. Our data establish temporal association, not causation. The ecological move from national inflation indicators to individual decisions made in the dental chair still requires prospective validation against household-level economic data.

The paediatric burden: parental cost constraints and child oral health

The most arresting age-specific finding is the non-clinical extraction share in children, which reached 24.4 per cent. That figure sits almost two-and-a-half times above the adult share and carries an adjusted odds ratio of 2.89 ($p < 0.001$). A child does not typically decline restorative treatment on financial grounds. A parent does. The most plausible reading, therefore, is that the paediatric signal reflects parental cost constraints at the point when the clinician offers a pulpotomy or a stainless-steel crown. This reading sits comfortably within the conceptual framework Fisher-Owens and colleagues proposed [20], in which family-level socioeconomic context sits at the centre of paediatric oral-health determinants. The downstream consequences of premature primary-tooth loss (space loss, subsequent malocclusion, and disrupted permanent eruption) make this a compounding rather than self-limiting problem [21], and one that targeted financial subsidies could realistically interrupt.

The diabetes periodontitis surgical complexity axis

The independent rise in both periodontitis-driven removal (aOR 1.92) and surgical technique (aOR 1.65) among diabetic patients is consistent with the bidirectional diabetes–periodontitis relationship described in the consensus literature [22, 23]. What our data add is the clinical-service consequence. In a rural government tertiary setting, this biological interaction translates directly into measurable transalveolar workload and into a higher complication rate (5.5 per cent in geriatric surgical cases versus 1.5 per cent in paediatric forceps cases). The overall transalveolar share in this cohort, at 31.6 per cent, is worth flagging. It sits well above the 15 to 20 per cent that urban Indian dental centres have reported [1, 19] and above the 20 to 25 per cent reported from rural international series [9, 10]. The most likely explanation is the late-presentation profile of a government-hospital catchment. Geographic distance, cost, and limited health literacy push presentation toward the end of the disease course, by which point conservative removal is no longer feasible. As India’s diabetic population continues to expand, rural dental services will face a workload that, at present, they are not well equipped to absorb.

What this study adds beyond existing extraction epidemiology

What separates the present work from the broader body of extraction audits is the combination of a temporal axis with a policy-oriented framing. Descriptive studies showing that caries and periodontitis

dominate extraction lists in low-resource settings are already abundant [1–4, 9, 10]. Evidence on whether the non-clinical proportion is moving, in which direction, and with what demographic specificity has not previously been available. By answering these three questions, the audit converts a descriptive observation into a policy-actionable finding. Access-driven tooth loss is rising. It falls hardest on children. Its movement tracks the post-pandemic economic environment.

Policy implications

Three interventions follow from these data. First, basic restorative dentistry (composite restorations, pulp therapy, and stainless-steel crowns) belongs inside the benefits package of national insurance programmes such as Ayushman Bharat. Such inclusion would directly address the cost barrier that now drives roughly 12 to 15 per cent of all extractions in our series, and the cost per averted extraction is modest when set against the long-term burden of edentulism. Second, mobile dental outreach to underserved rural districts should expand, both to close the geographic gap and to allow restorable pathology to be intercepted before it progresses. Third, school-based oral-health screening deserves programmatic investment, because catching caries at the classroom level is the most direct way to reduce the share of children whose restorable teeth are lost because a parent cannot cover the cost of restoration.

Limitations

Six specific limitations apply. First, we coded non-clinical reasons from the treating clinician’s note, and documentation of financial constraint in a busy outpatient department is uneven. The resulting ascertainment bias pushes toward under-counting, so the 76 per cent rise we report is best read as a conservative estimate. Second, this is a single-centre study from one government tertiary hospital, and the patient profile may not generalise to primary care or private practice settings. Third, the retrospective design does not support a causal claim about the link between macroeconomic conditions and individual extraction decisions. Fourth, we did not capture household income at the patient level; financial-barrier status was inferred from the chart rather than measured directly. Fifth, three years are sufficient to detect a directional trend but not to separate a secular trend from cyclical economic variation. Sixth, the non-clinical category combines three sub-reasons (60 per cent financial, 25 per cent refusal, 15 per cent anxiety) with different aetiologies and different policy answers; future work should unpack them separately using validated instruments. Multicentre prospective work that pairs extraction coding with standardised socioeconomic questionnaires and qualitative decision-making assessments will be needed to confirm and extend these findings.

Conclusion

Caries and periodontitis remain the two clinical drivers that dominate extraction practice at our government tertiary facility. Non clinical extractions, and financial constraint in particular, have climbed appreciably over three years, from 8.7 per cent of the cohort in 2022–2023 to 15.3 per cent in 2024–2025. Children bore the largest share of the burden: almost one paediatric extraction in four was non-

clinical. Within the geriatric cohort, the diabetes–periodontitis axis produced greater transalveolar workload and a higher complication rate. Taken together, the data give quantitative backing to three policy steps: bringing basic restorative dentistry into the national insurance benefit package, scaling up mobile dental outreach in underserved rural districts, and establishing school-based prevention to interrupt preventable paediatric tooth loss at the earliest modifiable point.

References

1. Lee JH, Nam SK, Kim JH. Reasons for tooth extraction in a Korean population: a retrospective study of contributing factors. J Oral Maxillofac Surg. 2020;78(4):512–518.
2. Chrysanthakopoulos NA. Reasons for extraction of permanent teeth in Greece: a five-year follow-up study. Int Dent J. 2011;61(1):19–24.
3. Aida J, Kondo K, Yamamoto T, et al. Socioeconomic factors and tooth loss in Japan: results from the JAGES study. Community Dent Oral Epidemiol. 2019;47(3):241–247.
4. Peres MA, Macpherson LMD, Weyant RJ, et al. Oral diseases: a global public health challenge. Lancet. 2019;394(10194):249–260.
5. World Health Organization. Oral health: key facts. Geneva: WHO; 2024.
6. Bernabé E, Masood M, Vujicic M. The impact of out-of-pocket payments for dental care on household finances in low and middle income countries. BMC Public Health. 2017;17(1):109.
7. Dental Council of India. Registered dentists: state-wise data. New Delhi: DCI; 2024.
8. Gambhir RS, Gupta T. Need for oral health policy in India. Ann Med Health Sci Res. 2016;6(1):50–55.
9. Varenne B, Msellati P, Monier L, et al. Reasons for tooth extraction in rural West Africa. Community Dent Health. 2012;29(3):224–228.
10. Patel S, Naidoo P, Davies T. Socioeconomic determinants of tooth extraction in South Africa: a cross-sectional study. Int J Dent. 2020;2020:7381913.
11. Reserve Bank of India. Annual Report 2023–24: monetary policy, inflation and the economy. Mumbai: RBI; 2024.
12. Watt RG, Steele JG, Treasure ET, et al. Adult dental health survey 2019: implications for tooth loss trends. Br Dent J. 2020;228(3):187–192.
13. Government of Rajasthan. Rajasthan State Water Policy 2023: addressing arid zone challenges. Jaipur: Department of Water Resources; 2023.
14. World Health Organization. Density of dentistry personnel (per 10,000 population). Geneva: WHO Global Health Workforce Statistics; 2024.
15. von Elm E, Altman DG, Egger M, et al. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement. Lancet. 2007;370(9596):1453–1457.
16. World Medical Association. Declaration of Helsinki: ethical principles for medical research involving human subjects. JAMA. 2013;310(20):2191–2194.

17. Roberts C, McNamee R. Assessing the reliability of clinical records for retrospective studies. Community Dent Oral Epidemiol. 2006;34(3):149–156.
18. World Health Organization. Ageing and health: key facts. Geneva: WHO; 2024.
19. Hupp JR, Ellis E, Tucker MR. Contemporary Oral and Maxillofacial Surgery. 7th ed. St. Louis: Elsevier; 2019.
20. Fisher-Owens SA, Gansky SA, Platt LJ, et al. Influences on children's oral health: a conceptual model. Pediatrics. 2007;120(3):e510–e520.
21. Proffit WR, Fields HW, Larson BE. Contemporary Orthodontics. 6th ed. St. Louis: Elsevier; 2018.
22. Preshaw PM, Bissett SM. Periodontitis and diabetes: a two-way relationship. Diabetologia. 2016;59(1):21–31.
23. Chapple ILC, Genco R. Diabetes and periodontal diseases: consensus report of the Joint EFP/AAP Workshop. J Clin Periodontol. 2013;40(Suppl 14):S106–S112.
24. Glendor U. Epidemiology of traumatic dental injuries: a 12-year review of the literature. Dent Traumatol. 2008;24(6):603–611.
25. Armfield JM. The avoidance and treatment of dental anxiety: a review. Aust Dent J. 2010;55(4):365–371.

Tables

Table 1. Demographic and clinical profile of the audit cohort (n = 1,100).

Characteristic	n (%) or mean ± SD
Total patients enrolled	1,100 (100.0)
Paediatric (< 18 years)	201 (18.3)
Adult (18–64 years)	686 (62.4)
Geriatric (≥ 65 years)	213 (19.3)
Male	573 (52.1)
Female	527 (47.9)
Molars extracted	540 (49.1)
Premolars extracted	328 (29.8)
Anteriors extracted	232 (21.1)
Forceps (simple) extraction	752 (68.4)
Mean duration (minutes)†	7.4 ± 2.1
Transalveolar (surgical) extraction	348 (31.6)
Mean duration (minutes)†	18.6 ± 5.3
Patients with one or more comorbidity	245 (22.3)
Diabetes mellitus	133 (12.1)
Hypertension	94 (8.5)

† Procedure duration was recorded from outpatient time stamps in 843 cases (76.6% of total).

Table 2. Indication distribution across the three study periods.

Indication	Period 1 n (%)	Period 2 n (%)	Period 3 n (%)	p (trend)
Dental caries	173 (47.1)	165 (45.0)	154 (42.1)	0.07
Periodontitis	109 (29.7)	111 (30.2)	117 (32.0)	0.03*
Trauma	46 (12.5)	42 (11.4)	41 (11.2)	0.52
Non-clinical	32 (8.7)	47 (12.8)	56 (15.3)	0.01*
Orthodontic	1 (0.3)	2 (0.5)	3 (0.8)	0.31
Other†	6 (1.6)	0 (0.0)	15 (4.1)	—
Total	367	367	366	

** Statistically significant (p < 0.05). The periodontitis trend refers to the geriatric subgroup.*

† Other: failed prosthetic abutments (n = 12), medication-related bone complications (n = 6), pre-radiotherapy clearance (n = 3).

Table 3. Indication distribution stratified by age group.

Indication	Paed. n (%)	Adult n (%)	Ger. n (%)	Overall n (%)
Dental caries	110 (54.7)	304 (44.3)	69 (32.4)	483 (43.9)
Periodontitis	13 (6.5)	231 (33.7)	85 (39.9)	329 (29.9)
Trauma	28 (13.9)	78 (11.4)	20 (9.4)	126 (11.5)
Non-clinical	49 (24.4)	71 (10.3)	15 (7.0)	135 (12.3)
Orthodontic	1 (0.5)	2 (0.3)	2 (0.9)	5 (0.5)
Other	0 (0.0)	0 (0.0)	22 (10.3)	22 (2.0)
Total	201	686	213	1,100

Percentages are column-wise within each age stratum. Counts were verified against the raw dataset and totals confirmed.

Table 4. Multivariable logistic regression: adjusted odds ratios for age and comorbidity predictors.

Outcome	Predictor	aOR (95% CI)	p-value
Non-clinical indication	Paediatric vs adult	2.89 (1.84–4.53)	< 0.001
Trauma	Paediatric vs adult	1.76 (1.05–2.94)	0.03
Periodontitis	Geriatric vs adult	2.81 (1.89–4.18)	< 0.001
Periodontitis	DM vs non-DM	1.92 (1.23–2.99)	0.004
Surgical extraction	DM vs non-DM	1.65 (1.12–2.43)	0.01

Models were adjusted for tooth type, sex, extraction technique, comorbidity, and extraction year.

DM = diabetes mellitus. Model c-statistics: non-clinical model 0.74; surgical model 0.71. Hosmer–Lemeshow: p = 0.68 and p = 0.55 respectively.

Figures

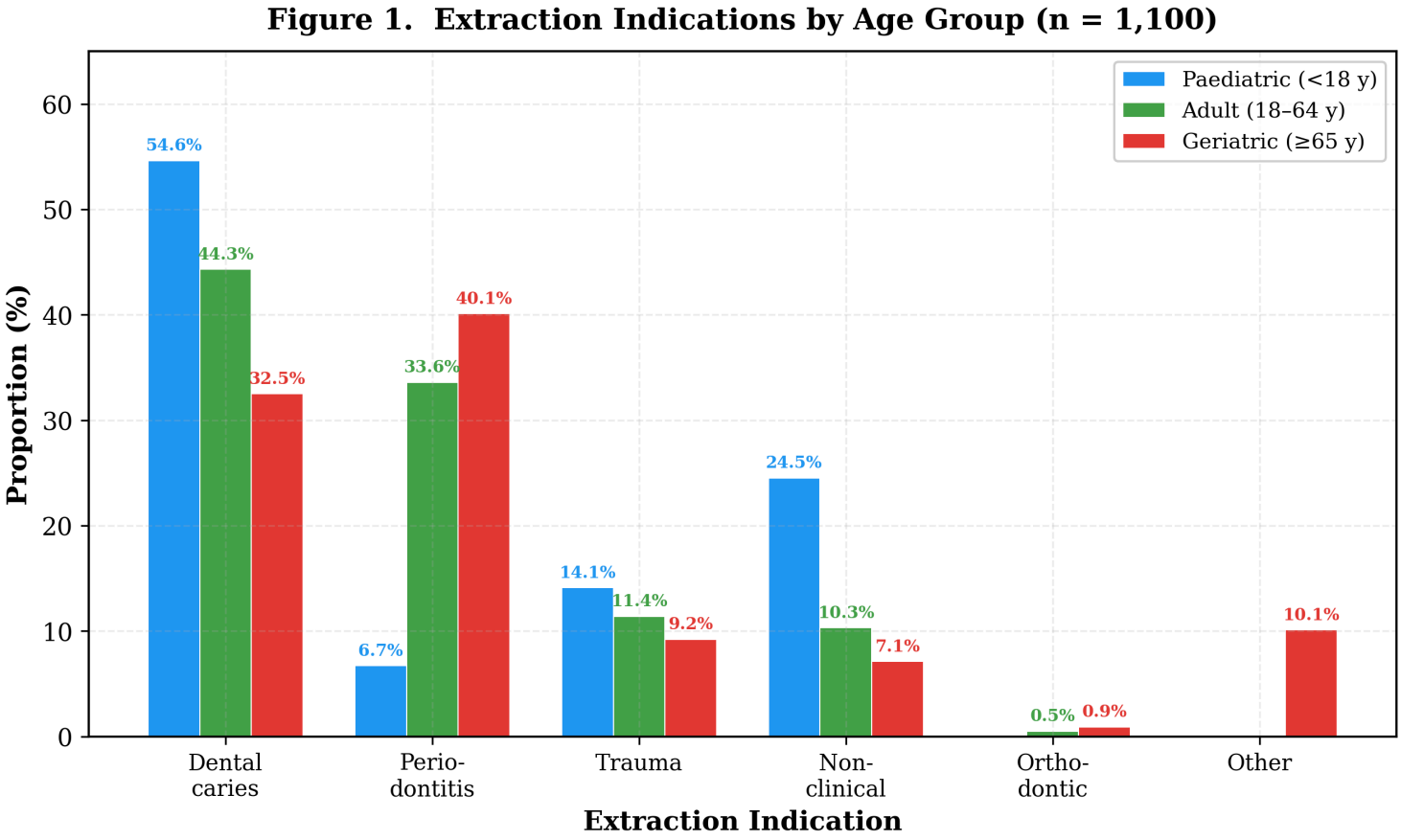


Figure 1

See image above for figure legend