

Dentoalveolar surgery education in Chinese undergraduate dental schools: a national survey of curriculum structure, simulation training and assessment

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Abstract

Background

Dentoalveolar surgery is an essential component of undergraduate dental education and plays an important role in developing students' competence in tooth extraction, local anesthesia, complication management, and basic oral surgical decision-making. However, evidence regarding the current implementation of dentoalveolar surgery education in Chinese undergraduate dental institutions remains limited. This study aimed to investigate the current status of dentoalveolar surgery teaching in undergraduate dental programs across China and to identify common features and areas requiring improvement.

Methods

A questionnaire-based cross-sectional survey was conducted among 49 Chinese institutions offering undergraduate programs in stomatology/dentistry during the 2021–2023 academic years. The survey collected information on undergraduate enrolment, curriculum models, course timing, theoretical and practical teaching content, allocation of teaching hours, digital teaching tools, teaching methods, and assessment strategies. Descriptive statistical analyses were performed to summarise the curriculum characteristics and inter-institutional variations.

Results

Most institutions taught dentoalveolar surgery as a chapter within oral and maxillofacial surgery rather than as an independent course. The course was most commonly offered in the fourth academic year. Teaching content was mainly centred on tooth extraction, local anesthesia, extraction of mandibular impacted third molars, and healing and complications after tooth extraction. In most institutions, both theoretical and practical teaching hours were concentrated within 10–20 hours, although considerable variation was observed. Practical teaching was relatively emphasised in many institutions, particularly for local anesthesia and routine tooth extraction. Videos and animations were widely used as digital teaching resources, whereas virtual interactive programs were less frequently adopted. Problem-based learning was the most commonly used teaching method, followed by case-based learning and flipped classroom teaching. Assessment remained largely theory-oriented, while practical skills assessment, phantom head model assessment, and case-based assessment were less consistently implemented.

Conclusions

Undergraduate dentoalveolar surgery education in China has established a relatively complete curriculum framework, with tooth extraction and local anesthesia as core teaching components and

increasing use of practical and digital teaching methods. However, challenges remain, including limited course independence, substantial variation in teaching hours and content coverage, insufficient training in complex tooth extraction procedures, limited use of highly interactive digital tools, and assessment systems that remain heavily focused on theoretical knowledge. Future curriculum development should be guided by clinical competence, with greater standardisation of teaching objectives, strengthened practical training, deeper integration of digital and case-based learning, and more comprehensive assessment strategies.

1. Introduction

Oral surgery is an essential component of dental education and serves as a key discipline linking basic oral sciences, clinical dentistry, and the development of clinical competence. As an important part of oral surgery, dentoalveolar surgery encompasses several core knowledge and skill domains, including the principles of tooth extraction, local anesthesia, the use of extraction instruments, dentoalveolar surgical procedures, extraction of impacted teeth, and the prevention and management of extraction-related complications[1]. These topics represent fundamental clinical skills that dental students are expected to acquire and constitute essential competencies for clinical clerkship and future independent dental practice[2]. Therefore, dentoalveolar surgery plays a critical role in undergraduate dental education.

Tooth extraction is one of the most common and fundamental clinical procedures in oral surgery. The quality of teaching in this area directly affects students' mastery of basic diagnostic and therapeutic procedures in oral surgery, aseptic principles, local anatomy, intraoperative risk control, and the management of postoperative complications[3]. Local anesthesia, as a prerequisite for dentoalveolar surgical procedures, requires students not only to understand anaesthetic agents, injection techniques, and clinical indications, but also to acquire sound knowledge of relevant anatomical structures and standardised operative procedures[4]. In addition, the identification and use of extraction instruments, routine tooth extraction, surgical tooth extraction, root removal, and impacted tooth extraction further highlight the close integration of theoretical knowledge and practical skills in dentoalveolar surgery education[5]. Through systematic training, students can develop basic clinical reasoning, improve procedural standardisation, and enhance their awareness of risk prevention and management.

In recent years, advances in medical education have led to substantial changes in the teaching of oral surgery[2]. Traditional teacher-centred, lecture-based teaching is gradually being replaced by student-centred and competency-oriented approaches. Digital teaching resources, online courses, virtual simulation technologies, instructional videos, and massive open online courses have increasingly been incorporated into oral surgery education, providing students with more intuitive, flexible, and repeatable learning opportunities[6]. Furthermore, the implementation of teaching strategies such as problem-based learning and case-based learning may help improve students' self-directed learning, clinical reasoning, and comprehensive decision-making abilities.

In addition to reforms in theoretical teaching, the role of practical training in oral surgery education has become increasingly important. Dentoalveolar surgery is highly procedure-oriented and involves inherent clinical risks; therefore, classroom-based teaching alone is insufficient to meet the requirements for developing students' clinical competence. Consequently, many institutions have strengthened practical teaching through surgical video observation, identification and use of extraction instruments, training on phantom head models, clinical observation, and simulation-based practice[7]. Increasing the number of practical teaching hours and diversifying practical teaching formats may help students become familiar with basic operative procedures before entering real clinical settings, thereby improving their manual skills and clinical adaptability[8].

However, differences may still exist among dental schools in China in terms of dentoalveolar surgery curriculum design, coverage of teaching content, allocation of theoretical and practical teaching hours, teaching methods, and assessment strategies. Because training programs, faculty resources, clinical resources, and teaching conditions vary across institutions, systematic multicentre evidence regarding the implementation of dentoalveolar surgery education remains limited[9]. Clarifying the current status of teaching in this field may help identify common features and existing deficiencies in curriculum development, providing a basis for further optimising oral surgery education, promoting teaching standardisation, and improving the quality of dental training.

Accordingly, the present study conducted a systematic survey of 49 dental schools across China to investigate the current status of dentoalveolar surgery education. The survey focused on teaching content, teaching methods, and assessment strategies used in both theoretical and practical teaching. By collating, comparing, and analysing the survey data, this study summarised the shared characteristics of current curriculum arrangements as well as differences among institutions. The findings are discussed with the aim of providing evidence to support curriculum optimisation and quality improvement in dentoalveolar surgery education.

2. Methods

2.1 Study participants

This study targeted Chinese institutions offering undergraduate programs in stomatology/dentistry. A questionnaire-based survey was conducted to investigate undergraduate enrolment in stomatology/dentistry and the arrangement of relevant courses at 49 institutions during the 2021–2023 academic years. The survey mainly covered undergraduate enrolment size, curriculum design, theoretical and practical teaching content, allocation of teaching hours, and assessment methods. This study was conducted in accordance with the relevant guidelines and regulations of the School of Stomatology, Fourth Military Medical University, and with the principles of the Declaration of Helsinki. Informed consent to participate was obtained from all participants prior to their participation in the survey.

2.2 Study design and questionnaire

A self-designed questionnaire was used to collect data. The questionnaire focused on the design and implementation of oral surgery-related courses in undergraduate stomatology/dental education. The questionnaire used in this study is available as Supplementary File 1. The main survey domains were as follows:

- (1) Basic institutional information: including institution type, geographical location, and the establishment of undergraduate stomatology/dental programs.
- (2) Enrolment information: including the number of undergraduate stomatology/dental students admitted between 2021 and 2023 and the overall student scale at each institution.
- (3) Curriculum arrangement: including the timing of oral surgery-related courses, course type, and the allocation of theoretical and practical teaching hours.
- (4) Teaching content: including whether topics such as tooth extraction, local anesthesia, extraction instruments, impacted tooth extraction, and dentoalveolar surgical procedures were included in theoretical and practical teaching.
- (5) Teaching and assessment methods: including teaching approaches such as video demonstration, model-based training, clinical observation, and hands-on practice, as well as summative assessment methods such as written examinations, practical skill assessments, and case analysis.

2.3 Data collection

The survey covered teaching activities conducted during the 2021–2023 academic years. The questionnaires were completed by teachers or teaching administrators who were familiar with undergraduate stomatology/dental education at their respective institutions. After collection, all questionnaires were reviewed and checked for completeness and logical consistency. Questionnaires with substantial missing information or obvious logical inconsistencies were excluded. Ultimately, valid questionnaires from 49 institutions were included in the statistical analysis.

2.4 Statistical analysis

Descriptive statistical methods were used to analyse the survey results. Categorical variables are presented as the number and percentage of institutions and were used to describe enrolment status, curriculum arrangements, coverage of teaching content, allocation of teaching hours, and assessment methods. Data collation and statistical analyses were performed using SPSS software.

3. Results

A total of 49 Chinese institutions offering undergraduate stomatology programs were included in this study. From 2021 to 2023, the enrolment scale of these institutions remained generally stable, with an annual total enrolment of approximately 4,000 students. The median annual enrolment per institution

ranged from 64 to 70 students, although substantial inter-institutional variation was observed, with enrolment ranging from approximately 20 to 240 students per institution.

3.1 Teaching model

Most institutions taught dentoalveolar surgery as a chapter within the course of oral and maxillofacial surgery, rather than as an independent course. Specifically, 47 institutions (95.92%) adopted this integrated teaching model, whereas only 2 institutions (4.08%) offered dentoalveolar surgery as a separate course. This pattern differs from the practice in some countries, such as the United States and Germany, where dentoalveolar surgery is often provided as an independent course. The integrated model may facilitate linkage with related topics, such as infection, trauma, anesthesia, and complication management, thereby improving the coherence and systematic structure of the knowledge framework. However, this model may also reduce the independence and practical depth of dentoalveolar surgery teaching, potentially resulting in insufficient training in key skills such as complex tooth extraction and alveolar ridge trimming, and may limit the timely incorporation of emerging advances into teaching.

The starting time of the course was highly concentrated in the fourth academic year. Thirty-seven institutions (75.51%) offered the course in the fourth year, 11 institutions (22.45%) offered it in the third year, and only 1 institution (2.04%) arranged the course in the first semester of the fifth year. This distribution indicates that most institutions place the theoretical component of dentoalveolar surgery in the final year of preclinical theoretical teaching, which may facilitate transition to clinical internship. In contrast, institutions that offer the course in the third year may place greater emphasis on early theoretical preparation and basic skills training.

Regarding teaching format, offline teaching remained predominant. Thirty-five institutions (71.43%) mainly adopted face-to-face teaching, whereas 14 institutions (28.57%) used a blended online–offline teaching model. The dominance of offline teaching is consistent with the characteristics of dentoalveolar surgery, which requires direct demonstration, real-time interaction, and manual skills training. Meanwhile, the adoption of blended teaching by nearly one-third of the institutions suggests that digital teaching resources have been increasingly introduced into this field.

There was considerable variation in the total number of theoretical teaching hours among institutions, ranging from 4 to 36 hours. Twenty institutions allocated ≤ 10 hours, 25 allocated 10–20 hours, and 4 allocated > 20 hours to theoretical teaching (Fig. 1). For practical teaching, 16 institutions allocated ≤ 10 hours, 27 allocated 10–20 hours, and 6 allocated > 20 hours. The ratio of theoretical to practical teaching hours ranged from 0.31 to 2.77. Twenty-two institutions had a ratio < 1 , 11 had a ratio of 1, and 16 had a ratio > 1 .

3.2 Theoretical courses

Among the 49 institutions, the theoretical teaching of oral surgery mainly focused on routine tooth extraction and related basic knowledge, although the allocation of teaching hours varied across modules

(Fig. 2). Routine tooth extraction, an overview of tooth extraction, and healing and complications after tooth extraction were commonly included; for each of these topics, 34 institutions (69.39%) allocated 1 teaching hour, whereas relatively fewer institutions allocated 2 hours or ≥ 3 hours.

The extraction of mandibular impacted third molars was widely covered, with only 1 institution (2.04%) not including this topic. Thirty institutions (61.22%) allocated 1 hour, 12 institutions (24.49%) allocated 2 hours, and 6 institutions (12.24%) allocated ≥ 3 hours. Relatively more teaching time was devoted to local anesthesia: institutions allocating 2 hours and ≥ 3 hours each accounted for 34.69%, indicating the considerable emphasis placed on this topic in theoretical teaching.

By contrast, surgical tooth extraction, dentoalveolar surgical procedures, root removal, and extraction instruments were most commonly allocated 1 teaching hour, and some institutions did not include these topics. The coverage of impacted tooth extraction in other regions and “other” teaching content was relatively limited, with 30.61% and 75.51% of institutions, respectively, allocating no teaching hours to these topics (Fig. 2).

With respect to digital teaching tools, videos were the most widely used format, adopted by 47 institutions (95.92%), followed by animations, used by 39 institutions (79.59%). The use of virtual interactive programs was relatively limited, with only 12 institutions (24.49%) reporting their application. Two institutions used other teaching platforms, such as the Chaoxing Learning Platform. Overall, digital teaching in dentoalveolar surgery remains dominated by conventional digital media, particularly videos and animations, whereas immersive or highly interactive tools, such as virtual interactive programs, have limited coverage.

The application of teaching methods showed a diversified pattern. Problem-based learning (PBL) was the most frequently used method, adopted by 35 institutions (71.43%), which is consistent with the goal of cultivating problem-oriented clinical thinking. Case-based learning (CBL) was used by 21 institutions (42.86%), and flipped classroom teaching was used by 17 institutions (34.69%). These findings suggest that case-driven teaching and restructuring of the teaching process are gradually receiving greater attention, although there remains room for wider implementation. Reading reports were used by 14 institutions (28.57%), mainly as an auxiliary approach to promote literature integration and reflective learning.

3.3 Practical courses

Overall, the allocation of practical teaching hours differed substantially across teaching topics. Local anesthesia received the greatest investment of practical teaching time. Only 1 institution (2.04%) did not provide practical teaching related to local anesthesia, whereas 57.14% of institutions allocated ≥ 3 hours to this topic, indicating its central role in the practical teaching system.

Routine tooth extraction and extraction of mandibular impacted third molars also received considerable attention. Routine tooth extraction was most commonly allocated 1–2 hours. For mandibular impacted third molar extraction, 20.41% of institutions allocated 2 hours and another 20.41% allocated ≥ 3 hours,

suggesting that some institutions strengthened practical training for this type of complex extraction. Extraction instruments, surgical tooth extraction, and root removal were most frequently allocated 1 hour, with proportions ranging from 51.02% to 65.31%. In contrast, practical teaching coverage was lower for healing and complications after tooth extraction, impacted tooth extraction in other regions, and dentoalveolar surgical procedures, with 40.82%–57.14% of institutions allocating no practical teaching hours to these topics.

Practical teaching of local anesthesia generally followed a progressive structure consisting of instrument training, practice on phantom head models, and peer-to-peer local anesthesia practice. In terms of instrument training, all 47 institutions (95.92%) that provided this practical course included the use of conventional 5-mL syringes, reflecting their importance as basic instruments. In contrast, the use of cartridge syringes and single-tooth anesthesia systems was less common, reported by 22 institutions (44.90%) and 17 institutions (34.69%), respectively. This indicates that the introduction of newer instruments into existing curricula remains limited.

For model-based training, 38 institutions used phantom head models for local anesthesia practice. Among them, 36 institutions (73.47%) provided training in local infiltration anesthesia, and 37 institutions (75.51%) provided training in nerve block anesthesia. In addition, 37 institutions included peer-to-peer local anesthesia practice. Overall, 30 institutions (61.22%) had established a complete teaching pathway comprising instrument training, phantom head model practice, and peer-to-peer local anesthesia practice, suggesting that most institutions have developed a systematic, stepwise framework for practical skills training.

The practical teaching methods used for tooth extraction were also investigated across the 49 institutions. All institutions (100%, 49/49) used tooth extraction videos as a basic teaching method. This was followed by identification and use of extraction instruments (97.96%, 48/49) and clinical observation (89.80%, 44/49), indicating that most institutions emphasised the integration of theoretical knowledge and practical exposure and provided students with a transition from cognitive learning to clinical observation. Practice on phantom head models was also widely used (87.76%, 43/49), forming, together with clinical observation, a core skills-training pathway from simulated environments to real clinical settings (Fig. 3).

Regarding the content of phantom head model practice, routine tooth extraction was the most commonly included procedure (85.71%, 42/49). However, the coverage of training for complex tooth extraction procedures was substantially lower. Fewer than half of the institutions included practice in mandibular impacted third molar extraction (53.06%, 26/49), root removal (42.86%, 21/49), or impacted tooth extraction in other regions (36.73%, 18/49). Only 1 institution (2.04%) reported specialised practice in maxillary first molar extraction. These findings suggest that, although there is broad consensus regarding practical training in basic skills and routine tooth extraction, simulation-based and hands-on training for high-risk and technically demanding complex extractions remains relatively insufficient (Fig. 4).

3.4 Assessment

Both formative and summative assessments were used during and after teaching to evaluate students' learning outcomes. At present, the most common forms of formative assessment were in-class quizzes and practical skill assessments, each adopted by 37 institutions (75.51%). This indicates that most institutions placed comparable emphasis on real-time classroom evaluation and practical competence. Post-class assignments were also commonly used (71.43%, 35/49) to consolidate key teaching points and promote knowledge transfer, while also allowing the learning process to be tracked.

More than half of the institutions (51.02%, 25/49) incorporated pre-class preparation into their assessment system, reflecting attention to students' learning initiative and process management. However, reading reports, which are intended to cultivate literature reading and summarisation skills, were used by only a small proportion of institutions (18.37%, 9/49). Notably, 2 institutions (4.08%) did not use any form of formative assessment. Overall, the current formative assessment system for tooth extraction courses is centred on in-class quizzes, practical skill assessments, and post-class assignments. Although assessment formats are becoming increasingly diversified, evaluation of higher-order academic abilities, such as those reflected in reading reports, remains relatively limited (Fig. 5).

Among the 49 institutions, summative assessment in oral surgery courses was dominated by theoretical examinations and supplemented by various practical and competency-based evaluation methods. Differences were observed among institutions in the combination and emphasis of assessment approaches. Theoretical examinations were the most common form of summative assessment, used by 47 institutions (95.92%), indicating that evaluation of theoretical knowledge remains the core component of the current undergraduate oral surgery assessment system. Compared with theoretical examinations, practice-related assessments were used less frequently (59.18%). Assessment using phantom head models was conducted in 24 institutions (48.98%). (Fig. 6)

4. Discussion

This study provides a national overview of undergraduate dentoalveolar surgery education in 49 Chinese institutions offering dental or stomatology programs. Overall, the findings indicate that dentoalveolar surgery education in China has established a relatively complete basic framework, usually embedded within oral and maxillofacial surgery, with tooth extraction and local anesthesia as the core teaching components. Most institutions combined theoretical and practical teaching, and the total teaching hours for both components were commonly concentrated within 10–20 hours. This suggests that extraction-related education is generally delivered with a moderate time allocation. However, considerable inter-institutional variation was observed in curriculum structure, teaching hours, practical training content, digital teaching methods and assessment strategies, indicating that a relatively unified and competency-oriented teaching model has not yet been fully established[2].

A notable finding of this study is that dentoalveolar surgery was taught mainly as a chapter within oral and maxillofacial surgery rather than as an independent course. This integrated model has educational advantages, as it allows dentoalveolar surgery to be taught in continuity with related topics such as oral and maxillofacial infection, trauma, anesthesia and complication management. Such an arrangement is consistent with the overall logic of oral and maxillofacial surgery education. Nevertheless, dentoalveolar surgery is highly procedural and clinically risk-sensitive. Competence in tooth extraction, local anesthesia, impacted tooth management and basic dentoalveolar surgical procedures requires not only theoretical understanding of anatomy, imaging and surgical principles, but also repeated practice and structured feedback. If dentoalveolar surgery is taught only as a limited component of a broader course, teaching hours may be insufficient and complex skill training may be weakened[10]. Therefore, while maintaining its integration within oral and maxillofacial surgery, the dentoalveolar surgery module should be strengthened by defining explicit learning objectives, skill requirements and competency standards for undergraduate students.

The timing of dentoalveolar surgery teaching also deserves attention. Most institutions offered the course in the fourth academic year, when students had usually completed relevant basic and clinical foundation courses. This arrangement provides students with the necessary knowledge base before clinical internship. However, dentoalveolar surgical competence cannot be developed through short-term intensive teaching alone. It requires early exposure, repeated simulation, clinical observation and staged feedback. A survey by Brand et al. involving 23 European dental schools showed substantial variation in the starting time of practical teaching for tooth extraction, ranging from the second to the sixth year. Importantly, students' overall evaluation of tooth extraction teaching was higher when practical teaching began earlier[1]. This suggests that dentoalveolar surgical training should not be concentrated excessively in the senior years. Instead, a longitudinal pathway could be developed, in which early-year students are introduced to instrument recognition, local anesthesia principles, tooth extraction videos and simple case discussions, while senior students receive more advanced phantom head training, virtual simulation, clinical observation and comprehensive case-based learning.

Theoretical teaching content was relatively consistent across institutions for core topics. Most institutions included local anesthesia, an overview of tooth extraction, routine tooth extraction, mandibular impacted third molar extraction, wound healing and post-extraction complications. This reflects the central role of extraction-related knowledge, pain control and complication management in undergraduate oral surgery education. Local anesthesia received particular emphasis, with many institutions allocating three or more teaching hours to this topic. This is appropriate because local anesthesia is essential for safe and effective tooth extraction and is closely related to patient comfort, pain management and complication prevention[11]. In contrast, more complex topics, including surgical extraction, root removal, dentoalveolar surgical procedures and extraction of impacted teeth in regions other than the mandibular third molar, showed greater variation in coverage and teaching hours. This may reflect limited undergraduate teaching time, different curriculum priorities and the clinical risks associated with complex procedures. However, even if undergraduate students are not expected to independently perform complex dentoalveolar surgery, they should understand indications,

contraindications, risk assessment, imaging interpretation, complication recognition and referral principles. Therefore, theoretical teaching should not be limited to routine extraction procedures, but should include complex case analysis, surgical planning and risk prevention.

Practical teaching is central to dentoalveolar surgery education. In this study, practical teaching hours were often comparable to or greater than theoretical hours, suggesting that many institutions have recognised the importance of practice-oriented training. Local anesthesia received the greatest allocation of practical teaching time, and many institutions had established a progressive training structure involving instrument training, phantom head model practice and peer-to-peer local anesthesia practice[12]. This progression is consistent with the general process of clinical skill acquisition, moving from cognitive understanding to simulation and then to supervised procedural experience. For tooth extraction training, all institutions used extraction videos, and most provided instrument identification, instrument use, clinical observation and phantom head practice. These findings indicate that Chinese institutions have developed a strong consensus regarding basic practical training in routine extraction.

However, practical training in complex extraction procedures remains relatively limited. Model-based practice for mandibular impacted third molar extraction, root removal and extraction of other impacted teeth was less commonly provided. This may be due to the high clinical risk of these procedures, limited availability of suitable teaching models, insufficient clinical case resources and restrictions on the scope of undergraduate clinical practice[13]. Previous studies have shown that students may feel confident in simple tooth extraction and retained root removal, but lack confidence in surgical extraction and related procedures[14]. Al-Dajani also reported lower confidence in surgical extraction or root sectioning than in simple extraction[15], and other studies have similarly highlighted insufficient self-confidence in surgical extraction skills[16]. Durham et al. suggested that students may feel intimidated because surgical extraction is one of the more invasive procedures encountered in dental clinical training. These findings are consistent with the present study and suggest that insufficient practical exposure may contribute to low confidence in complex dentoalveolar procedures. From a competency-based perspective, undergraduate students may not need to independently perform complex impacted tooth surgery, but they should acquire basic principles, risk judgement, complication prevention and referral awareness through simulation, virtual training and case-based reasoning.

Digital teaching methods were widely used, but their level of interactivity remains limited[17]. Videos and animations were the most common digital tools, which is understandable because dentoalveolar surgery involves spatial anatomy and dynamic procedural techniques that are difficult to demonstrate fully through traditional lectures. Videos and animations can help students visualise instrument use, elevator fulcrum selection, tooth sectioning, bone removal and local anaesthetic injection pathways. However, these resources are mainly passive learning tools and do not provide real-time feedback. In contrast, virtual reality, augmented reality, three-dimensional reconstruction and interactive simulators are increasingly used in dental education internationally. These technologies can provide safe, repeatable and feedback-rich training before students treat real patients. The findings of this study suggest that digital dentoalveolar surgery teaching in China remains largely at the conventional multimedia stage.

Future curriculum development should integrate virtual simulation, digital case libraries and three-dimensional imaging reconstruction, particularly for local anesthesia, impacted tooth extraction planning and complication management.

Teaching methods in dentoalveolar surgery education are also changing. This study found that problem-based learning was widely adopted, while case-based learning and flipped classroom teaching were also used in some institutions. This indicates a shift from teacher-centred lecture-based instruction towards student-centred and clinically oriented learning. Dentoalveolar surgery is well suited to PBL and CBL because it requires students to integrate anatomy, imaging, pharmacology, surgical principles and complication management. For example, teaching can be organised around questions such as whether a mandibular impacted third molar should be extracted, how post-extraction bleeding should be managed or why local anesthesia may fail. However, effective PBL and CBL require more than classroom discussion. They depend on standardised case libraries, clear learning objectives, progressively structured questions and trained facilitators. In the future, PBL, CBL, flipped classroom teaching, virtual simulation and formative assessment should be integrated to support the coordinated development of knowledge, skills and clinical decision-making.

Assessment remains an important area for improvement. Although many institutions used formative assessment, including in-class quizzes, practical skill assessment and post-class assignments, summative assessment was still dominated by theoretical examinations. Practical operation assessment, phantom head model assessment and case analysis were less consistently implemented. This assessment pattern may not fully reflect the competency requirements of dentoalveolar surgery, which include theoretical knowledge, operative standardisation, clinical judgement, risk control and patient safety awareness. A single written examination cannot adequately evaluate students' readiness for clinical practice[18]. International medical and dental education commonly uses objective structured clinical examinations, simulation-based assessment, case analysis and workplace-based assessment to evaluate clinical competence. Therefore, future assessment systems should combine theoretical examinations with local anesthesia skill tests, extraction instrument use assessments, phantom head procedures, case-based analysis and scenario-based complication management. A more comprehensive assessment system would better align teaching with competency-based education.

In summary, undergraduate dentoalveolar surgery education in China has developed a solid foundation, with broad coverage of core content and increasing use of practical and digital teaching methods. Nevertheless, important gaps remain. These include insufficient course independence, variation in theoretical and practical teaching hours, limited training in complex extraction procedures, relatively low use of interactive digital tools, and assessment systems that remain heavily theory-oriented. Given that most undergraduate dental students in China are expected to become general dental practitioners, essential procedures such as tooth extraction and local anaesthesia should be regarded as core competencies that must be fully mastered before graduation.

However, current curricular arrangements remain insufficient, as dentoalveolar surgery is still largely embedded within oral and maxillofacial surgery courses, with greater emphasis placed on maxillofacial surgery content. Therefore, we call for an increase in the teaching hours allocated to dentoalveolar surgery in undergraduate dental curricula in China, so as to ensure that students can acquire a more comprehensive understanding of relevant knowledge and clinical skills and be better prepared for their future professional practice. Future curriculum reform should define core undergraduate competencies in dentoalveolar surgery, optimise the balance between theoretical and practical teaching, strengthen simulation-based and case-based training for complex procedures, and develop a continuous training pathway integrating video demonstration, instrument training, model-based practice, virtual simulation and clinical observation. Competency-oriented assessment should also be strengthened to ensure that students are adequately prepared for safe clinical practice.

This study has several limitations. First, as a cross-sectional survey, it mainly reflects curriculum design and teaching arrangements at the institutional level, rather than the actual learning outcomes of students. Second, student feedback, teacher interviews and objective performance data were not included. Third, the implementation standards for practical operation, clinical observation and phantom head training may differ among institutions, which may influence the comparability of teaching practices. Future studies should combine institutional surveys with student questionnaires, teacher interviews, operative performance scores and clinical competence assessments. Longitudinal and multidimensional research is needed to evaluate the actual effectiveness of different teaching models and to provide stronger evidence for curriculum optimisation.

5. Conclusion

In conclusion, dentoalveolar surgery education in 49 Chinese undergraduate dental institutions has established a relatively complete curriculum framework. Teaching content is centred on tooth extraction, local anesthesia, and related basic knowledge, and practical teaching and digital teaching methods are widely used. However, several issues remain, including insufficient course independence, limited coverage of complex tooth extraction training, inadequate use of highly interactive digital tools, and an assessment system that remains heavily theory-oriented. In the future, undergraduate dentoalveolar surgery education should be guided by clinical competence, with further optimisation of teaching content, strengthening of practical training, deeper integration of PBL/CBL with digital teaching, and establishment of a more comprehensive assessment system. These measures may promote the standardisation and high-quality development of undergraduate dentoalveolar surgery education in China.

Declarations

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Author Contributions

YZ: Conceptualization, data curation, formal analysis, investigation, resources, writing—original draft, writing—review and editing. **WC:** data curation, formal analysis, investigation, methodology, validation, writing—original draft, writing—review and editing. **KJH:** Design of the study communication and coordination, review. **JZM:** Data collection and statistical analysis. **FH:** software, writing—review, and editing. **YW:** Conceptualization, formal analysis, methodology, software, writing—review and editing. **JW:** Data curation. **WYZ:** Data curation. **ZWZ:** Data verification, manuscript revision, and statistical analysis. **YMW:** Conceptualization, data curation, formal analysis, visualization, writing—original draft, writing—review, and editing. **YX:** Conceptualization, data curation, formal analysis, investigation, methodology, project administration, resources, communication and coordination, writing—original draft, writing—review, and editing.

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Ethics approval and consent to participate

Ethics approval was waived by the Ethics Committee of the School of Stomatology, Fourth Military Medical University. This study did not involve patients, clinical interventions, invasive procedures, human tissue, or personally identifiable human data, and was limited to a survey of undergraduate dentoalveolar surgery curriculum arrangements in dental schools. The requirement for ethics approval for this study was waived by the ethics committee.

This study was conducted in accordance with the relevant guidelines and regulations of the School of Stomatology, Fourth Military Medical University, and with the principles of the Declaration of Helsinki.

Conflict of Interest

The authors declare that the research was conducted without any commercial or financial relationships that could potentially create a conflict of interest.

Consent for publication

Not applicable.

Availability of data and materials

Data used within this manuscript are available from the corresponding author on reasonable request.

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Figures

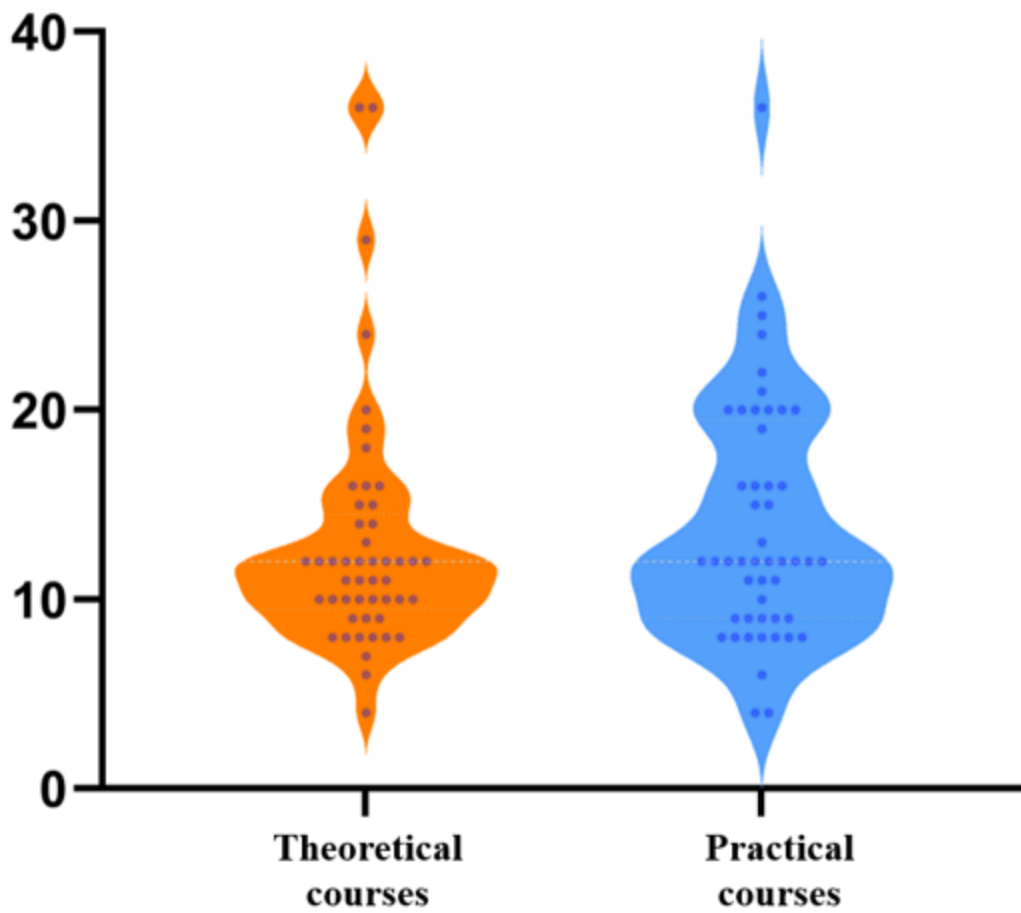


Figure 1

Statistical chart of teaching hours for theoretical and practical courses in oral surgery

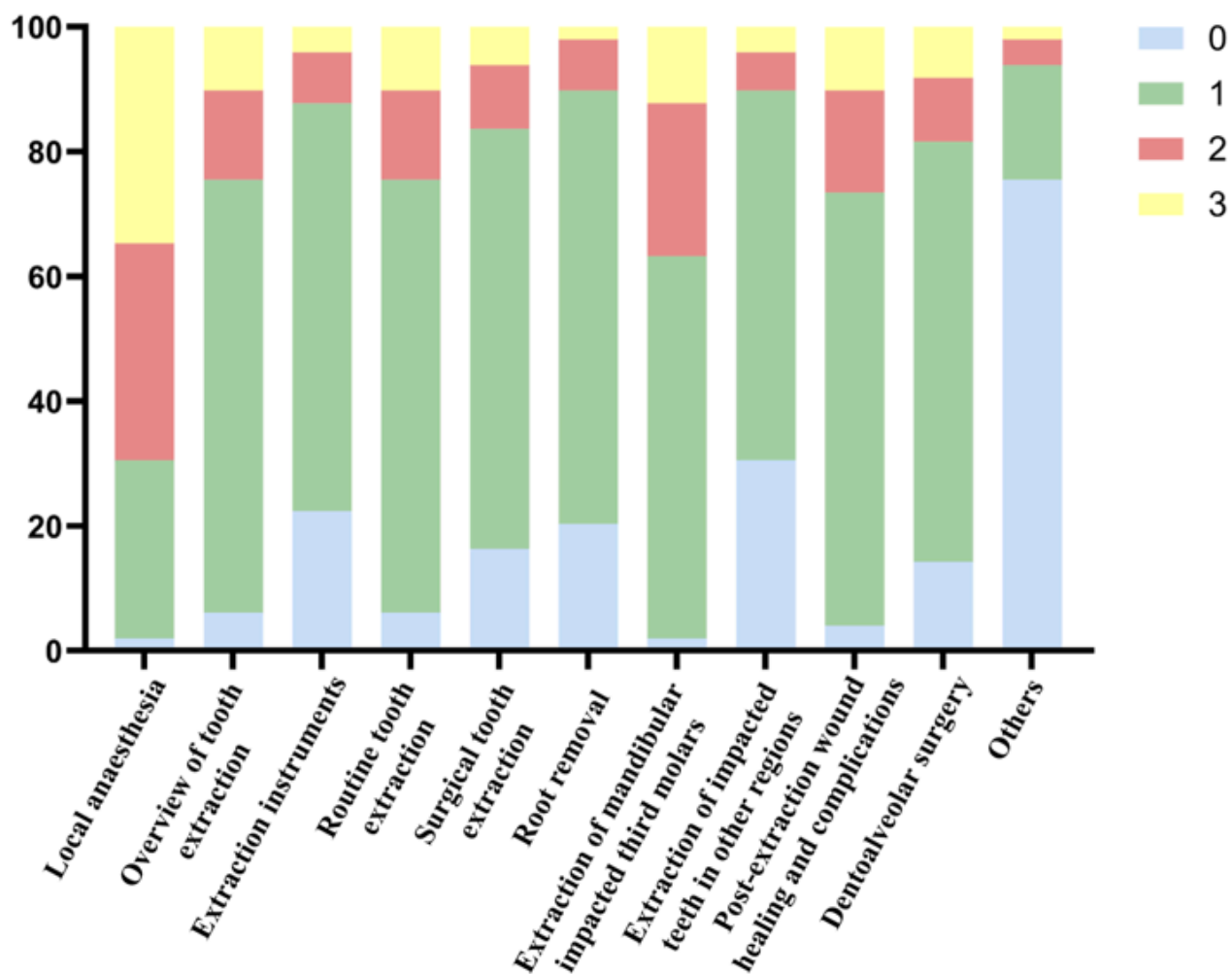


Figure 2

Percentage distribution of teaching hours for theoretical courses in oral surgery (%)

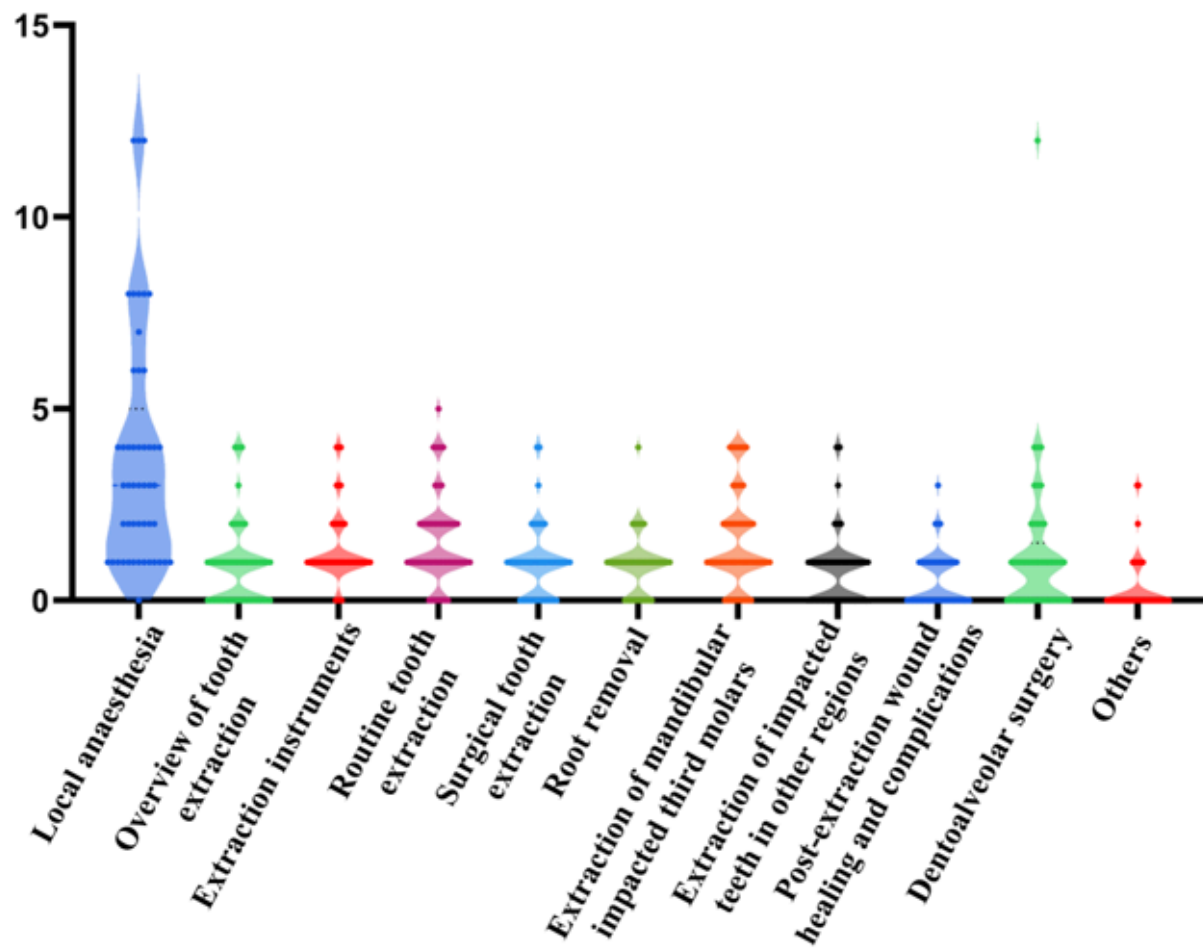


Figure 3

Distribution of teaching hours for practical courses

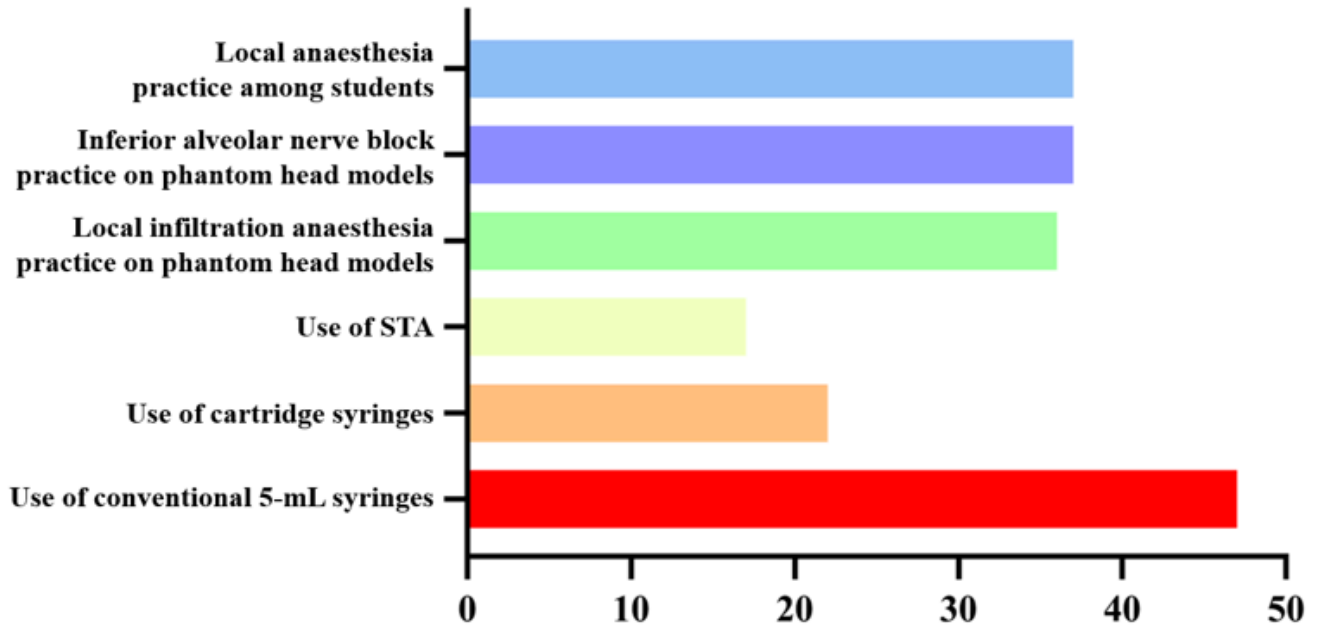


Figure 4

Availability of practical course content on local anesthesia across institutions

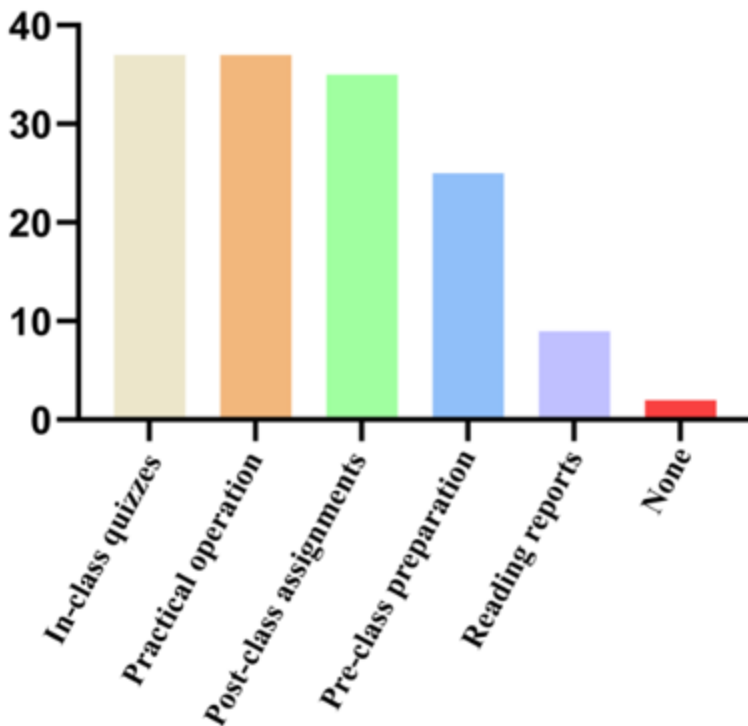


Figure 5

Assessment methods used in courses across institutions

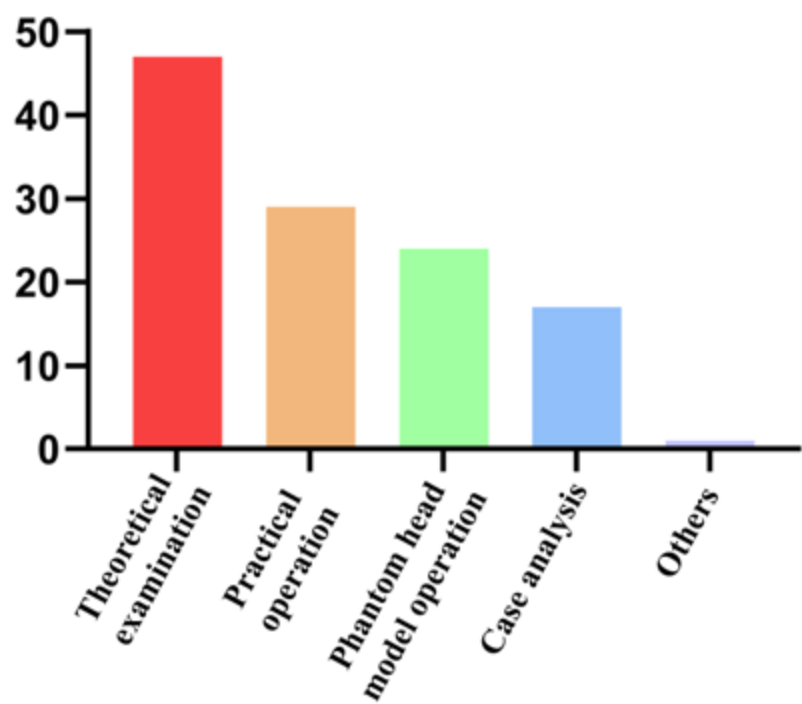


Figure 6

Summative assessment methods across institutions

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