Remediation Strategies in Dental Education: A Scoping Review

Strategi Remediasi di Kedokteran Gigi: Scoping Review

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ABSTRACT
While systematic reviews of remedial interventions for medical students have been published, no such review exists for dental students. This scoping review aimed to identify the reasons, methods, and impact of remediation in dental education. Following the Arksey & O'Malley framework for scoping reviews, a literature search was conducted using keywords including 'remedial', 'remediation', and 'dental students' across Google Scholar and PubMed. English-language studies published until January 2025, focusing on dental students and dental hygiene students, were included. Thematic analysis was performed on the selected articles, and from an initial yield of 1,790 articles, screening and full-text review identified 11 relevant studies. Remediation strategies varied widely, encompassing seminars and tutorials, problem-based learning, plenary discussions, lectures, web-based learning, summer courses, guided independent learning, self-reflection, individual consultations, and discrimination training. However, the available literature provides limited insight into the implementation of remedial programs in dental education. Key gaps include the comparative effectiveness of remediation methods, the influence of students' factors on assessment outcomes, and remediation's short- and long-term effects. Further research is needed to establish evidence-based guidelines for optimizing remediation strategies in dental education.
Keywords: Dental students, remediation strategies, remedial teaching, underperforming students

ABSTRAK
Meskipun tinjauan sistematis intervensi remedial untuk mahasiswa kedokteran telah dipublikasikan, tinjauan serupa belum tersedia untuk mahasiswa kedokteran gigi. Scoping review ini bertujuan untuk mengidentifikasi alasan, metode, dan dampak remedial dalam pendidikan kedokteran gigi. Mengikuti kerangka kerja Arksey & O'Malley untuk scoping review, penelusuran literatur dilakukan menggunakan kata kunci seperti 'remedial', 'remediasi', dan 'mahasiswa kedokteran gigi' di Google Scholar dan PubMed. Studi berbahasa Inggris yang dipublikasikan hingga Januari 2025, dengan fokus pada mahasiswa kedokteran gigi (*dental students* dan *dental hygiene students*) juga disertakan. Analisis tematik dilakukan terhadap artikel-artikel terpilih, dan dari hasil awal 1.790 artikel, penyaringan dan tinjauan teks lengkap mengidentifikasi 11 studi relevan. Strategi remedial sangat bervariasi, meliputi seminar/tutorial, *problem-based learning*, diskusi pleno, kuliah pakar, pembelajaran berbasis web, kursus musim panas, pembelajaran mandiri, refleksi diri, konsultasi individu, dan pelatihan diskriminasi. Namun, literatur yang tersedia memberikan wawasan terbatas tentang implementasi program remedial dalam pendidikan kedokteran gigi. Kesenjangan utama meliputi efektivitas komparatif metode remedial, pengaruh faktor mahasiswa terhadap hasil asesmen, dan dampak jangka pendek dan jangka panjang program remedial. Penelitian lebih lanjut diperlukan untuk menetapkan pedoman berbasis bukti guna mengoptimalkan strategi remediasi dalam pendidikan kedokteran gigi.
Kata Kunci: Mahasiswa kedokteran gigi, strategi remediasi, pengajaran remedial, mahasiswa berprestasi rendah

INTRODUCTION

Remediation is an act of teaching and reassessing the abilities of students who previously received poor grades or failed an exam.[1] Remediation aims to improve student's level of competence, be it cognitive or psychomotor abilities, as their previous failure meant that they had not reached the required competence standard.[2] Therefore, remediation should focus on providing instruction and support for students to improve their abilities and knowledge. However, oftentimes, medical education only aims to provide students with the opportunity to pass a retake.[3]

The remediation phenomenon in medical education has been researched thoroughly with the publication of a systematic review of remediation for medical students in 2013.[4] The synthesis of the results of that review showed that remediation for medical students was developed based on several factors, such as the availability and willingness of lecturers, the severity of students' difficulties, and the needs of students.

Without appropriate remedial methods, dental students may graduate with unaddressed competencies, potentially compromising patient care. Poor performance also has an impact on the decline in students' mental health and can even cause students to be absent from campus or drop out of the program.[5] In contrast, with the right remediation program, students can improve their cognitive, affective, and psychomotor abilities, especially if those are tailored to their needs. To do this, the decision must be evidence-based, one of which is by providing a scoping review of remediation for dental students as a basis for making such policy.

Despite the critical role of remediation in ensuring clinical competence, no prior scoping or systematic reviews have comprehensively examined remediation strategies specific to dental education. Therefore, this scoping review was conducted to determine the reasons, methods, and effects of remediation for dental students. The results of this study are expected to be used to determine gaps in research on remediation in dentistry, provide an overview of remedial procedures in dentistry, and become a basis for decision-making for remedial programs in dental institutions.

SCOPING REVIEW

This scoping review was done through 5 stages according to Arksey & O'Malley's framework.[6]

Stage 1: Identifying the research question. In this study, remediation can be a reassessment or a reassessment accompanied by previous teaching. There is no limitation in determining the remedial method. The remedial effect is the impact of the remedial method on the cognitive, affective, or psychomotor abilities of students that are measured and reported objectively. Dental students are students of undergraduate, professional, dental hygienist, clinical, and pre-clinical dental education programs who are studying at dental educational institutions.

Stage 2: Identifying relevant studies. The literature search was conducted through electronic data centres and searches from bibliographies (prospective and retrospective) for both published literature. The keywords used were 'remedial', 'remedial teaching', 'remediation', 'dental students', and 'dentistry', which were combined using Boolean Operators and MeSH. The databases used were Google Scholar and PubMed.

Stage 3: Study selection. The inclusion and exclusion criteria are as follows. Inclusion criteria are English language literature, study participants are undergraduate dental students or dental hygienist students requiring academic or clinical remediation, using any structured strategy, program, or educational intervention designed to address academic or clinical deficiencies, survey about remediation efforts, and reporting any outcomes related to remediation effectiveness. The exclusion criteria are if the full text of the article is not available. There is no limitation on the year of research that can be used for this scoping review, considering that research on remedial in the field of dentistry is still very limited.

Stage 4: Charting the data. The articles obtained were read and summarised in tables. The collected data were the author's name, year of publication, location, study design, population, and key findings.

Stage 5: Collating, summarizing and reporting the results. The results of the fourth stage were synthesized using the thematic review method to obtain an overview of the available literature on remedial for dental

students. Gaps in the literature will be determined from the least studied research areas.

RESULTS

A literature search conducted on the Google Scholar and PubMed databases in November 2024 – January 2025 yielded 1,790 articles. Of these, screening was carried out based on the title and abstract and 1,370 articles were obtained. Furthermore, a full article search was conducted, and 58 articles were obtained. Only 11 articles were included in this scoping review. The article collection process can be seen in Figure 1.

Data were then summarised into tables consisting of the author's name, year of publication, location, study design, and population (Table 1). Of the 11 articles, most of them are mixed-method studies and quantitative descriptive studies utilizing surveys as the data collection method. The studies were mostly conducted in the United States (n=7).

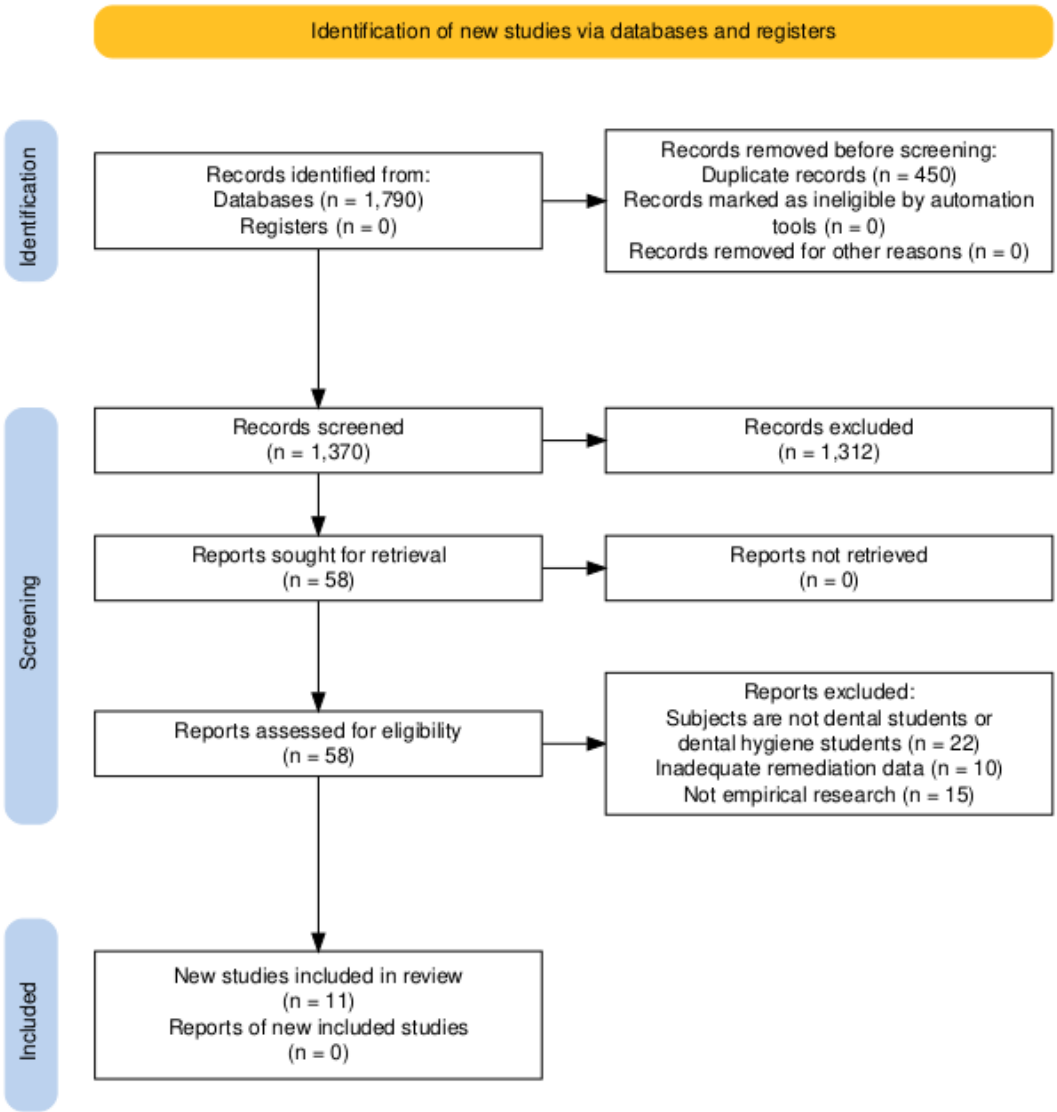

Figure 1. Article collection process. Haddaway, N. R., Page, M. J., Pritchard, C. C., & McGuinness, L. A. (2022). PRISMA2020: An R package and Shiny app for producing PRISMA 2020-compliant flow diagrams, with interactivity for optimized digital transparency and Open Synthesis Campbell Systematic Reviews, 18, e1230.

Table 1. Study Characteristics

No	Title	Author (s)	Year	Country	Study Design
1	Diverse and participative learning methodologies: a remedial teaching intervention for low marks dental students in Chile	Alcota et al.	2011	Chile	This study employed an intervention design with a pre-post approach, utilizing Kolb's experiential learning theory as its foundational framework. The research focused on assessing the academic performance of low-achieving students before and after the intervention while also comparing their outcomes with those of peers who did not receive the intervention.
2	An "XL" endodontics intervention for dental students required to repeat the course: changing frustration to improved grades and attitudes	Alcota et al.	2015	Chile	This study adopted a quasi-experimental intervention design, utilizing a non-randomized approach with pre-post comparisons and historical controls. The research examined the academic performance of students who participated in the intervention between 2010 and 2012. Their outcomes were then compared with those of a historical control group from 2007 to 2009, who had not received the intervention.
3	Scripting success: A cursive supplemental approach to remediation for fine motor skills and ergonomic enhancement in dental hygiene students	Brandt	2024	USA	The study employed an explanatory sequential mixed methods design, combining quantitative and qualitative approaches. The quantitative phase involved a retrospective quasi-experimental comparison of ergonomics and fine motor skills scores between the control (2022 cohort) and treatment (2024 cohort) groups. The qualitative phase included reflective journals from students and semi-structured interviews with faculty to explore perceptions of the intervention.
4	Factors facilitating academic success in dental students after initial failure: A qualitative study	Dadpe et al.	2018	India	This qualitative study employed the Appreciative Inquiry (AI) approach, which emphasizes strengths and success factors rather than deficits or problems. Instead of focusing on the causes of academic failure, the research aimed to identify the key factors that facilitate academic success among students who initially struggled but later improved their performance.
5	Destigmatizing remediation: A reflection-based approach	Eapen et al.	2023	USA	This study introduced an innovative intervention that employed a reflection-based remediation approach, aiming to reduce the stigma often associated with academic remediation.
6	A scholastic appeals process for dental hygiene student remediation and retention	Freudenthal & Bowen	2009	USA	This retrospective cohort study analyzed the academic records of dental hygiene students who either required remediation or withdrew from the program over a nine-year period (1999–2008). The primary focus was to evaluate the effectiveness of the scholastic appeals process in facilitating individualized remediation for struggling students.
7	Long-term outcomes for remedial students	Guenzel et al.	1992	USA	This study utilized a quasi-experimental design to compare the effectiveness of two remediation approaches: an innovative experimental method (discrimination training + self-evaluation) versus a

					traditional remediation model (verbal feedback + model access).
8	Student retention practices in associate degree, entry-level dental hygiene programs	Holt	2005	USA	This descriptive survey study explored retention strategies in dental hygiene programs, employing a mixed-methods approach to capture comprehensive insights. The quantitative component utilized forced-choice questions to systematically assess structured retention initiatives, while the qualitative component gathered open-ended responses to uncover nuanced perspectives.
9	Use of instructional videos in remediation to enhance dental hygiene students' restorative skills	Lu, Cristina	2017	USA	The study employed a mixed-method design with a counterbalanced experimental approach. Senior dental hygiene students were randomly assigned to two groups: Group 1 watched a step-by-step instructional video followed by a self-evaluation video (A-B), while Group 2 watched the videos in reverse order (B-A). Quantitative data were collected from timed-carving (TC) scores, and qualitative data were gathered via open-ended questionnaires.
10	The effects of an interactive software application on the self-assessment ability of dental students	Mattheos et al.	2004	Sweden	This randomized controlled trial (RCT) evaluated the effectiveness of two digital approaches for teaching self-assessment skills to dental students: an interactive Internet-based software (LEO) versus a static web page. Participants were randomly assigned to either the experimental group (using the dynamic LEO platform) or the control group (using passive web-based content). The study measured differences in skill acquisition, engagement, and long-term retention of self-assessment competencies.
11	Factors associated with clinical skill remediation in dental hygiene education programs	Wood et al.	2014	USA	The study employed a cross-sectional survey design to examine clinical skill remediation practices in dental hygiene programs across the U.S. A modified version of a 1995 survey by Branson et al. was used to collect data.

Types of Remediation Strategies

The remediation strategies across the studies include active, tailored approaches such as small-group seminars, case-based learning[7], and early clinical exposure through simulations and real patient interactions[8], alongside advanced technical training[9,10]. Conceptual and metacognitive methods involve self-made study aids, reflection-based assignments with structured rubrics, and mistake analysis for improved learning.[10,11] Structured academic support features individualized contracts, one-on-one faculty guidance, and additional clinical practice[12], while psychological and peer support incorporates meditation, counselling, and peer mentoring.[13] Technology-enhanced strategies, like interactive feedback software, were also utilized.[10]

Targeted Domains of Deficiency

The targeted domains of deficiency across the studies include cognitive (theoretical gaps, anatomical misidentifications, poor conceptual understanding), clinical (slow performance, weak psychomotor skills, difficulty applying theory), metacognitive (poor self-assessment,

problem-solving weaknesses), behavioural (professionalism lapses, ethical breaches), and psychological (exam anxiety, low self-efficacy, external stressors like personal or family pressures).[7-17]

Identification and Referral Processes

Remediation identification combines academic thresholds (e.g., failing grades), faculty observations of clinical/professional gaps, and early predictive testing.[7,11,15,16] Referrals range from mandatory to voluntary, with some programs using committees for individualized plans.[7,12,13] Interventions prioritize timeliness, particularly for clinical deficiencies.[16]

Evaluation of Effectiveness

The effectiveness of remediation programs is evaluated through both quantitative and qualitative measures, with most studies reporting improved outcomes. Key metrics include academic performance improvements, such as grade increases[7, 8] and board pass rates[12], clinical skill development[9], and reduced remediation needs[15]. Subjective measures like student confidence and stress levels[11] complement these findings, though some studies lack control groups or long-term tracking. While most programs demonstrate success, limitations like short evaluation periods and external factors may affect generalizability.

Barriers and Enablers

Remediation programs face several barriers, including systemic challenges like resource limitations[8,12,16] and time constraints[11], alongside psychological factors such as stigma[14] and late identification of deficiencies[13]. Conversely, key enablers include student-centred approaches like tailored learning[8] and metacognitive training[11], structured support systems[14], and well-designed technological tools[8-10]. Successful remediation hinges on addressing these logistical and attitudinal hurdles while implementing personalized, evidence-based strategies supported by institutional commitment.

DISCUSSION

Although a literature search yielded thousands of results on remediation in dentistry, only a few articles fully discussed the implementation of remediation. The search results also showed research on remediation in other health profession education fields, such as general medicine, nursing, pharmacy, and so on. While there have been systematic reviews of remediation in general medicine, as far as the researcher knows, this study is the first scoping review in dentistry.

One condition that can trigger this event is failure to fail, which is the failure of lecturers to assess students' abilities validly.[18] Many clinical educators feel unprepared and/or unwilling to report student performance that does not meet standards. This condition means that remediation is not carried out, and incompetent students can be graduated as professional health workers. Therefore, there are not many remediation processes reported in the literature.

The type of remediation provided can be adjusted to the needs of students. If an assessment of student needs is not carried out, dental education institutions can provide various types of remediation that can be chosen by students. The main function of remediation is to provide clarification of material concepts that have not been understood, explanations of deficiencies or errors made by students, and feedback on the competency standards that must be achieved. Regardless of the chosen type of remediation, it must be able to meet these criteria. Based on the literature obtained, there has been no research comparing the effectiveness between types of remediation. Further research can examine this.

Assessment for the remedial outcome can be carried out in the long term or short term. Although the focus of remediation is often on students' passing the module or course being tested, some of the literature used in this study shows long-term remedial impact. Students who experience learning difficulties need to be detected and corrected early in the education program so that these difficulties do not get worse over time.[19] Research shows that remediation is usually successful in the long term; remediated learners are often indistinguishable from their non-remediated peers at the end of the educational program.[20,21] Further research could be conducted to elucidate the short- and long-term impacts of remediation.

So far, the most successful strategies have three things in common: organized feedback systems, early identification of students who are at risk, and active learning techniques like case-based and problem-based learning. These methods not only raise students' academic achievement but also their confidence and metacognitive abilities. However, there are still issues with implementation, especially in relation to institutional support and teacher readiness.

The present results are significant in at least one major respect, which is that institutional commitment is necessary for successful remediation. From resource allocation to faculty training, guaranteeing that all students fulfil the high standards required of dental professionals requires full support, which requires a comprehensive support system that addresses multiple levels of the educational ecosystem. By addressing these gaps, dental education can develop more evidence-based, equitable approaches to supporting struggling students.

CONCLUSION

Remedial in dentistry has various remedial determinant assessments, remedial types, and remedial outcome assessments. The available literature has not been able to provide a sufficient picture for the application of remedial in dental education institutions. Further research is needed on the effectiveness of remedial types, the relationship between students' personal conditions and assessment results and remedial needs, and the short-term and long-term impacts of remedial.

CONFLICT OF INTEREST

The author declares no potential conflict of interest.

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