Internet Visual Resources in Undergraduate Endodontic Education: A Pilot Assessment of Dental Students' Attitudes and Preferences

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Abstract

Background: : Internet Visual Resources (IVR) — encompassing video tutorials, online demonstrations, and other web-based audiovisual materials — are increasingly used by dental students as a supplement to formal instruction. Despite their growing prevalence, the specific patterns of IVR use in endodontic education, and the factors governing students' selection of such materials, have not yet been systematically characterized. This gap is particularly relevant to endodontics, a specialty in which the operative field is anatomically constrained and procedural visualization is especially challenging.

Aim: The aim of this study was to evaluate fourth-year dental students' attitudes toward IVR in the context of endodontic education and to identify the factors that most significantly influence their choice of such materials.

Methods: Anonymous questionnaires were distributed to 31 fourth-year dental students at the Poznan University of Medical Sciences. The instrument comprised closed-ended Likert-scale items rating the perceived usefulness of IVR for seven specific endodontic procedures, as well as open-ended questions addressing advantages, disadvantages, barriers, and selection criteria. Data were analyzed using the Friedman ANOVA with Dunn's post-hoc test for between-item comparisons.

Results: Twenty-nine students (94%) reported using IVR for endodontic learning. IVR were rated as most beneficial for rotary instrumentation (mean = 4.45 ± 0.77), retreatment (4.29 ± 0.86), and root canal obturation (4.19 ± 0.79), and least beneficial for endodontic anatomy (3.36 ± 1.23). The presence of spoken or written commentary was identified as the most important selection criterion (4.34 ± 0.71), rated significantly higher than material length (3.26 ± 0.93; p = 0.006) and language (3.45 ± 1.03; p = 0.024). Qualitative analysis revealed accessibility and comprehensibility as the principal advantages of IVR, while concerns about content quality, limited procedural coverage at the intermediate level, and access barriers related to language and cost were the most frequently cited disadvantages.

Conclusions: Undergraduate dental students demonstrate a broadly positive attitude toward IVR and integrate them extensively into self-directed endodontic learning, with the greatest perceived benefit attributed to procedural rather than conceptual content. However, the current landscape of available resources does not fully meet students' educational needs. The development of curated, commentary-rich, and freely accessible IVR, integrated within a structured blended learning framework, appears to represent the most effective direction for contemporary undergraduate endodontic education. **(TCM-GMJ August 2026; 11 (3): P35-P38)**

Keywords: Endodontics; Education, Dental; Educational Technology .

Introduction

The ultimate goal of undergraduate dental education is to equip students not only with the theoretical foundations of their discipline, but with the clinical competencies required to manage basic patient scenarios safely, confidently, and in accordance with contemporary standards of care, and in this context, the teaching of endodontics occupies a particularly important position within the curriculum. The knowledge requirements expected of European dental graduates have been formally defined in guidelines published by the European Society of Endodontology in 2013, which delineate both the clinical procedures a graduate should be competent to perform independently and the domains in which adequate theoretical understanding is considered obligatory [1]. Given that every student completing a European dental program is expected to be capable of managing straightforward endodontic cases with a level of confidence commensurate with accepted professional standards, the development and implementation of a clear, well-structured, and clinically relevant endodontic curriculum becomes not merely desirable, but essential to ensuring that future practitioners are prepared to deliver root canal therapy that meets current expectations of quality [2].Dental training typically begins with simulation exercises, commonly referred to as "phantom-head" or "phantom-teeth" classes, in which students perform basic root canal treatment procedures in a simulated environment. Despite observable advances in simulation

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technology [3], the clinical situations students subsequently encounter differ, to a considerable extent, from those experienced in the laboratory. In many instances, students lack sufficient opportunities to familiarize themselves with the correct execution of certain procedures before reaching the level of confidence required to perform them in real patients [4–6]. Furthermore, the rapid advances that have occurred in dentistry over recent decades have made it virtually impossible to incorporate every aspect of endodontic instrumentation, obturation, and advanced treatment techniques into the curriculum. As a result, students increasingly turn to so-called Internet Visual Resources (IVR) - materials available online [7]. In some cases, they are encouraged to do so by faculty, supervisors, or peers. However, due to the inherent characteristics of the internet, identifying high-quality educational material often proves difficult, as numerous factors influence the reliability and pedagogical value of available content.

This may explain why a growing number of dental schools worldwide have begun to incorporate IVR into their curricula across various subjects. However, most published studies concern the use of computer-assisted learning for orthodontic measurement or radiographic diagnosis, with comparatively little attention paid to endodontics.

Because the operative field in endodontics is particularly small, students frequently report that they have not "seen" or "experienced" enough to feel prepared for clinical practice, as demonstrated in prior studies. Moreover, the broad spectrum of modern instruments and techniques means that students entering professional environments are likely to encounter methods not covered during undergraduate training. IVR therefore offer a potentially valuable means of familiarization with contemporary clinical approaches. Given that the development of any educational material should be preceded by a careful needs assessment, such an evaluation appears warranted in the context of undergraduate endodontic education.

Methods

The study group comprised 31 fourth-year dental students at the Poznan University of Medical Sciences. Data were collected during the first semester of the 2015/2016 academic year. The group included 18 females and 13 males, with a mean age of 23.09 years (SD = 0.65). This cohort was selected because fourth-year students typically begin performing endodontic procedures in real clinical settings at this stage of their training.

The study was qualitative in design and employed a structured questionnaire. The instrument consisted of two parts. The first addressed the use of IVR in endodontics and included open-ended questions on the advantages and disadvantages of IVR, the endodontic areas in which IVR could be applied, potential barriers to use, and the criteria students apply when selecting IVR. This section also contained closed-ended Likert-scale items in which students rated the perceived usefulness of IVR for learning the following endodontic procedures: endodontic anatomy, access cavity preparation, root canal preparation with hand instruments, root canal preparation with engine -driven instruments, root canal obturation, endodontic retreatment, and advanced surgical endodontic procedures (e.g., perforation repair, apicoectomy).

The second part of the questionnaire addressed IVR use in a broader dental context. Students were asked whether they had used IVR for other dental specialties, and were invited to specify the types and sources of IVR consulted. No word limit was imposed on any of the responses.

Results and discussion

Almost all students (n = 29; 94%) reported having used IVR for learning. According to the Likert-scale analysis, students rated IVR as most beneficial for learning rotary endodontic instrumentation (mean = 4.45 ± 0.77), followed by retreatment (4.29 ± 0.86), root canal obturation (4.19 ± 0.79), access cavity preparation (4.03 ± 0.91), hand instrumentation (3.97 ± 0.95), and endodontic anatomy (3.36 ± 1.23). The most important factor influencing IVR selection was the presence of spoken or written commentary (4.34 ± 0.71), which was rated significantly higher than material length (3.26 ± 0.93) and language (3.45 ± 1.03) (Dunn's post-hoc test following Friedman ANOVA: $p = 0.006$ and $p = 0.024$, respectively).

Analysis of the open-ended responses allowed identification of several recurring themes. The predominant advantage cited was accessibility: students emphasized the ability to consult IVR at any time, without the constraints of carrying textbooks or waiting for a tutor. One student noted that

"he felt reassured having his mobile phone nearby, knowing that he could consult the internet at any point during a procedure." A further cluster of advantages related to the comprehensibility of IVR materials: students highlighted the ability to observe procedures under appropriate magnification, to control the pace of learning, to pause at any moment without risk to a patient, and to review content repeatedly - possibilities not available when observing a clinician in real time. Participants also noted that IVR allowed them to familiarize themselves with each step of a procedure without feeling judged by teachers or peers.

Despite the generally positive tone, students also identified certain disadvantages. The issue raised in almost all surveys (29 of 31) was the difficulty of evaluating the quality and authority of available content, with many students expressing uncertainty about the reliability of what they had viewed. This was compounded by the inability to ask questions about the material. Additional concerns included the cost of premium resources requiring paid membership, and the limited availability of materials covering intermediate-level procedures - students noted that most IVR addressed either very basic tasks (e.g., cavity preparation, matrix placement) or advanced procedures they were unlikely to be required to perform (e.g., complicated apicoectomy cases). It should be noted, however, that the sections addressing

disadvantages were generally less detailed than those describing advantages. Identified barriers to IVR use included language proficiency and cost: approximately half of the students reported that their language skills were insufficient to follow the commentary accurately, and the majority indicated that subscription costs could represent a significant impediment.

Although the Internet has become an indispensable feature of contemporary life, its potential for educational purposes remains insufficiently exploited. The general consensus in recent literature is that students are broadly enthusiastic about e-learning strategies, while it is primarily faculty who express reservations about computer-assisted learning in the dental classroom [8,9].

The majority of software resources used in dental education are concentrated in areas amenable to computer-based analysis - principally radiography, orthodontic diagnostics, and radiographic case analysis [10–13]. Evidence relating specifically to endodontic education appears scarce, particularly in more recent literature. Published studies in this area have largely focused on purpose-designed tools such as interactive dental atlases [14] or diagnostic training software. However, the findings of the present study suggest that students do not regard these areas as the highest priority and would benefit more from materials addressing other aspects of clinical practice. As has been noted in the literature, the development of bespoke educational software for a single course can require substantial financial investment, representing a barrier for many universities worldwide [13]. By contrast, the use of freely accessible IVR - such as those utilized by students in the present study - may represent a more practical alternative. The use of Facebook as a learning management system (LMS) in dental education has also been investigated [15]. While social media platforms occupy an important place in the lives of younger students and may help mitigate cost-related barriers, their use must be carefully managed: students tend to treat them primarily as content repositories rather than as environments for higher-order learning tasks [11,16], and their application for knowledge integration requires greater motivation and instructional design.

The issue of quality assurance arose not only in the present study but has been documented in numerous prior investigations [8,10,12]. As the volume of online content continues to grow steadily, students risk becoming overwhelmed by the variety of available resources. Questions such as "How can I be certain that this method reflects current practice?" recur repeatedly. For this reason, while Schönwetter et al. [17] have proposed e-learning as a potential solution to the global shortage of teaching personnel, e-learning alone may be insufficient. Both students and teachers report a need for bidirectional feedback [8]. Bains et al. [10] concluded that e-learning used as the sole educational modality is less effective than blended or face-to-face learning. This underscores the importance of incorporating online communication within the broader framework of dental e-learning research, as advocated by Marei and Al-Khalifa [18]. This need was also evident in the outcomes of the present study, in which commentary was rated as significantly more important than other features of IVR.

The effect of e-learning on the acquisition of knowledge and skills, relative to live instruction, remains equivocal [19]. Nevertheless, a prevailing view in the literature suggests that computer-assisted learning (CAL) techniques are particularly beneficial for skill development, i.e. the performative dimension of education, rather than for the acquisition of declarative knowledge [19]. Following the use of online resources, students have in several studies reported increased confidence in areas such as caries diagnosis [20] and endodontic pathology assessment [13]. This tendency was also apparent in the present study: students attributed greater benefit to IVR for procedural competencies (e.g., rotary instrument use, root canal obturation) than for conceptual understanding (e.g., tooth anatomy).

E-learning techniques thus appear to be well suited to contemporary educational approaches, in which learning is student-centered and faculty assume the role of facilitators rather than didactic instructors. As it is widely accepted that educators cannot transmit every piece of published knowledge, the goal of undergraduate training is to provide students with a solid foundation and the self-confidence required to enter professional life. IVR enable students to identify and address their own knowledge gaps, thereby guiding their individual learning trajectories. This is how the educational process becomes truly individualized. Nevertheless, the authors recognize the need to develop a structured framework - beginning with a formal needs assessment - in order to guide the creation of appropriate educational resources.

Conclusion

The findings of this pilot study demonstrate that undergraduate dental students at the Poznan University of Medical Sciences display a predominantly positive attitude toward the use of Internet Visual Resources in endodontic education, with the vast majority already integrating IVR into their self-directed learning practice. Procedural competencies, particularly rotary instrumentation, retreatment, and root canal obturation, were consistently identified as the areas in which IVR offer the greatest perceived benefit, a pattern consistent with the broader literature on computer-assisted skill acquisition. The presence of explanatory commentary, whether spoken or written, emerged as the factor most significantly influencing resource selection, underscoring the importance of didactic scaffolding in online educational content.

At the same time, students identified substantial shortcomings in the currently available landscape of endodontic IVR, including concerns regarding content quality and authority, limited coverage of intermediate-level clinical procedures, and access barriers related to language and cost. These findings suggest that the

spontaneous, unstructured use of IVR, while widespread, cannot substitute for a systematically designed educational framework. Future efforts should therefore focus on the development of curated, quality-assured IVR that align with established undergraduate endodontic curricula, incorporate bidirectional communication mechanisms, and are accessible across language and economic contexts. The integration of such resources into a blended learning model, combining self-directed online study with faculty-guided feedback, appears to represent the most promising direction for contemporary endodontic education.

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