DILDENT

Standardised Dental Treatment Protocols in Undergraduate Education: SYNTHESIS REPORT

Developing Dental Treatment Protocol Practice Skills of Dentistry Undergraduates through Digital Interactive Education

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Disclaimer

This publication is an instructional report prepared after the data collection process for the standardization of the DTPs and their teaching processes in the project "*Developing Dental Treatment Protocol Practice Skills of Dentistry Undergraduates through Digital Interactive Education*" (Project number: 2024-1-TR01-KA220-HED-000248462), co-funded by the European Union. Views and opinions expressed are however those of the authors only and do not necessarily reflect those of the European Union and EACEA. Neither the European Union nor the granting authority can be held responsible for them.

Contributors to the Report

Emre Bodrumlu, Zonguldak Bülent Ecevit University
Ebru Hazar Bodrumlu, Zonguldak Bülent Ecevit University
İlgi Tosun, Çanakkale Onsekiz Mart University
Cumali Yaşar, Çanakkale Onsekiz Mart University
Tülay Dargut Güler, Çanakkale Onsekiz Mart University
Merve Erdoğan, Çanakkale Onsekiz Mart University
Corrado Paganelli, The University of Brescia
Stefano Bonetti, The University of Brescia
Marco Dias da Silva, The University of Brescia
Laura Laffranchi, The University of Brescia
Luca Visconti, The University of Brescia
Ingrid Tonni, The University of Brescia
Fabio Savoldi, The University of Brescia
Lorenzo Svanetti, The University of Brescia
Giuseppe Alessandro Scardina, The University of Palermo
Salvatore Nigliaccio, The University of Palermo
Leopoldo Forner, Universitat de València
Maria Melo, Universitat de València
Carmen Llena, Universitat de València
James Ghiloti, Universitat de València
José Luis Sanz, Universitat de València
Caner Anda, Mellis Educational Technologies
Elif Anda, Mellis Educational Technologies

SYNTHESIS REPORT FOR THE LITERATURE REVIEW OF THE SELECTED DENTAL TREATMENT PROTOCOLS

SYNTHESIS REPORT

This report synthesizes the findings of literature reviews conducted by partner institutions concerning dental treatment protocols (DTPs) in Endodontics, Paediatric Dentistry, Prosthodontics, Basic Dental Practice, and Temporomandibular Disorders (TMDs). The reviews, which primarily focus on documentation from the last 15 years in Türkiye, Italy, and Spain, establish a foundation for standardizing knowledge and practice through digital interactive education.

Overall Pattern and Key Findings

The overall pattern across all disciplines reviewed highlights two critical areas: a widespread reliance on international, evidence-based European guidelines for clinical standards, and a significant, recurring challenge in translating theoretical knowledge into confident clinical decision-making among undergraduate dental students.

1. Reliance on Standardised European and International Practices

A strong pattern of clinical standardization is evident, particularly the dependence of national practices on major European and American professional bodies.

Endodontics and Paediatric Dentistry

Endodontic treatments in Türkiye and Paediatric dentistry practices in Türkiye are based on guidelines from European (ESE, EAPD) and American (AAE, AAPD) Academies. Spain also bases its endodontic treatment on ESE S3-level clinical practice guidelines.

In Türkiye, the clinical practices in both Endodontics and Paediatric Dentistry demonstrate a profound reliance on the authoritative guidelines and main principles set forth by major European (ESE, EAPD) and American (AAE, AAPD) professional academies. This necessity stems, in part, from the absence of formal national guidelines in Türkiye for managing deep dental caries in either permanent or primary dentition, meaning interventions are frequently undertaken in accordance with the standards recommended by these international bodies. This adherence drives a modern clinical philosophy focusing on minimally invasive biologically based

therapies, where the chief aim is the preservation of pulp vitality and the prevention of apical periodontitis. Consequently, protocols reflect a commitment to techniques like Vital Pulp Therapy (VPT) in Endodontics, and the increased use of effective modalities like Indirect Pulp Capping (IPC) and Pulpotomy (PP) in Paediatric Dentistry for managing deep carious lesions.

Further strengthening the pattern of clinical harmonization across the continent, Spain mandates that its endodontic treatment protocols adhere to the rigorous European Society of Endodontology (ESE) S3-level clinical practice guideline (CPG). The S3 level represents the highest methodological standard for guideline development, ensuring that the recommendations—which cover diagnosis, deep caries management, root canal instrumentation, and filling materials—are robustly evidence-based and derived from comprehensive systematic reviews and expert consensus. This dedication to S3-level guidelines means Spanish clinical practice is informed by the most effective treatments available, similar to Türkiye's goal of aligning with ESE and AAE standards. Collectively, this systematic adoption of international evidence-based standards ensures that dental graduates and practitioners across both countries are trained in protocols that seek to maximize tooth preservation and functional longevity.

Prosthodontics

The transformation of prosthetic dental treatment protocols (DTPs) in Europe, including nations such as Germany, the Netherlands, and Scandinavian countries, and in Türkiye, represents a sweeping shift that goes beyond mere changes in materials to fundamentally restructure treatment planning and care models. This evolution is characterised by the systematic and evidence-based integration of advanced digital technologies. In Europe, this means protocols are shaped by the routine employment of systems like CAD/CAM, digital impressions, and guided implant placement. This digitalization supports the adoption of highly sophisticated, biologically driven clinical strategies, such as the "one abutment, one time" protocol, which has become standard practice across much of Europe for preserving soft tissue integrity. Türkiye reflects this global momentum, with university clinics and private practices rapidly adopting digital workflows and implementing CAD/CAM-supported fixed prosthesis applications.

The shift towards multidisciplinary approaches is essential because contemporary protocols require comprehensive planning that integrates various clinical factors and patient needs. Best practices, validated by systematic reviews and clinical studies, encompass patient-centred care and necessitate detailed diagnostic algorithms—for instance, in determining the optimal timing of implant placement in aesthetic zones. However, a key distinction lies in the standardization and education models: while Europe maintains constantly updated, integrated protocols reinforced by strong research ecosystems, clinical applications in Türkiye still show a degree of heterogeneity. This highlights a crucial area for improvement, as the literature strongly suggests that the effective application of these advanced, multidisciplinary DTPs requires moving beyond theoretical instruction to embrace pedagogical models involving case-based learning, clinical scenarios, and digital simulations.

TMD Management

Protocols emphasize consistency with internationally recognized frameworks, such as the Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) and guidelines promoting conservative, biopsychosocial care published by bodies like the International Network for Orofacial Pain and Related Disorders Methodology (INfORM/IADR) and NHS England. Italy's foundational protocols are based on national clinical recommendations, though they may lack the specificity of rapidly evolving international consensus papers.

Curriculum Framework

The Graduating European Dentist (GED) framework is widely referenced and adopted across Europe for defining core learning outcomes, serving as a key benchmark for modern dental education.

2. Clinical Shift Towards Minimally Invasive and Biologically Based Therapies

Across Endodontics and Paediatric Dentistry, the literature indicates a clear shift toward preserving vitality and structure:

Vital Pulp Therapy (VPT)

Contemporary Endodontics focuses on preserving the pulp in a healthy state with sustained vitality. Strategies for deep caries involve vital pulp treatment techniques, such as partial and complete pulpotomy. For pulp exposure, using calcium silicate cement (MTA/CaOH) for direct pulp capping is indicated if haemostasis is achieved, otherwise partial/total pulpotomy is performed.

Paediatric Deep Caries

The trend is to use the least invasive technique for the best predictable outcome. Indirect Pulp Capping (IPC) and Pulpotomy (PP) show high success rates in managing deep caries in primary teeth. The principle is to preserve hard tissues and retain teeth long-term, avoiding the restorative cycle where possible. Selective removal to soft dentine is recommended for deep cavitated lesions.

Prosthodontics and TMD

Best practices in Prosthodontics, such as the "one abutment, one time" approach, prioritize preserving soft tissue integrity. In TMD management, the best practice is conservative, favouring patient education, behavioural modifications, and physical therapies over irreversible procedures.

3. The Central Educational Gap: Theory vs. Application

The most critical pattern identified across the sources is the inadequacy of current, predominantly theoretical education in preparing students for complex clinical decision-making:

Inability to Apply Theoretical Knowledge

Dental students learn numerous treatment options and protocols theoretically but are frequently unable to visualize or select the most appropriate method based on specific patient symptoms or circumstances.

Confusion Due to Variability

Students experience confusion and difficulty due to the large number of treatment options available and the need for sensitive evaluation to achieve accurate diagnosis.

Heterogeneity and Standardization

In Türkiye, while digital adoption is accelerating (Prosthetics), clinical applications still show heterogeneity, and there is a need for standardized, open-access national protocols.

Outdated Curriculum Content

The education on complex topics like TMD is often inadequate; the prominent European curriculum guidelines for TMD are from 2001 and predate major advancements like the DC/TMD framework. This results in underdiagnosis or inappropriate biomechanical interventions.

DILDENT's Solution

The common goal of the partnership is to develop **interactive digital tools in the form of serious games** designed to help students bridge this gap by facilitating the application of theoretical knowledge to practical, simulated scenarios, thereby enhancing learning efficacy.

Suggestions for Partner Universities' Dental Schools

Based on the evidence reviewed, the following suggestions address the identified gaps in undergraduate education and clinical preparedness, focusing on integrating modern protocols and teaching methodologies:

1. *Prioritise Digital Integration and Scenario-Based Learning*

Implement Interactive DTP Learning Tools

Focus development efforts on digital interactive tools and clinical scenarios (like games) that allow students to practice evidence-based decision-making for managing deep caries, selecting obturation techniques, or choosing VPT protocols based on symptoms and diagnostic findings.

Adopt Digital Workflow Education

In Prosthodontics, shift the pedagogical model toward integrating clinical scenarios and digital simulations over theoretical instruction. Specifically, provide training using digital scanning protocols and CAD/CAM systems, which are integral to modern European best practices.

2. Modernize and Standardize Curricula Based on European Consensus

Align with Comprehensive Frameworks

Use the GED framework and specific curriculum guidelines (e.g., ESE Undergraduate Curriculum Guidelines for Endodontology, Spanish Curriculum in Cariology) as benchmarks to ensure comprehensive and optimised learning outcomes across institutions.

Update TMD Education

Urgently update the instruction to incorporate the contemporary biopsychosocial model for TMD management. Students require immersive training and experiential learning environments, either real or virtual, in applying the DC/TMD examination protocols (Axis I and II), differential diagnosis, and basic conservative management strategies (e.g., occlusal appliance adjustment). And peer education is also suggested for better comprehension.

Reinforce Minimally Invasive Principles

Ensure that teaching and clinical practice consistently reflect the current consensus on minimally invasive dentistry (MID), such as the **CariesCare 4D system** and the prioritization of vital pulp treatments (IPC, partial/total pulpotomy) for permanent and primary teeth.

3. Enhance Clinical Readiness Through Interdisciplinary and Outcome-Oriented Teaching

Focus on Case-Based Learning (CBL)

Move beyond simple didactic instruction by using complex, patient-centered scenarios that integrate diagnostic information (symptoms, radiographs, patient history) to force students to justify their treatment selection (e.g., choosing between direct pulp capping, pulpotomy, or RCT).

Foster Multidisciplinary Collaboration (TMD)

Integrate mandatory collaborative training or referral pathway training with specialists, such as psychologists (for CBT), physiotherapists, and sleep specialists, to effectively manage the psychosocial components of chronic TMD.

ANNEX

PEDIATRIC DENTISTRY TREATMENT PROTOCOLS

By Prof. Ebru HAZAR BODRUMLU, Zonguldak Bulent Ecevit University, Faculty of Dentistry, Department of Paediatric Dentistry, Türkiye

Presentation:

This document contains the results of a literature review focused on understanding knowledge and practices on dental treatment protocols that researchers at Zonguldak Bulent Ecevit University, Faculty of Dentistry, Department of Paediatric Dentistry plan to standardise, including those published by professional organisations, government agencies, and academic institutions in Türkiye. The reviewed literature covers documents from the last 15 years. While it provides a general overview of European Union or nation-wide best practice studies conducted across Europe or United States to reflect the European perspective, the literature review mostly focuses on documents produced in Türkiye. The literature includes studies published in English.

According to the structure proposed in the application form, this review is made up of three sections:

1. An overview of the dental treatment protocols in paediatric dentistry in Europe and Türkiye

2. Review of the best practices and evidence-based recommendations in Europe and Türkiye to help ensure that the dental treatment protocols in paediatric dentistry are based on the latest research and knowledge in the field
3. Review of the improvement areas evident from the literature.

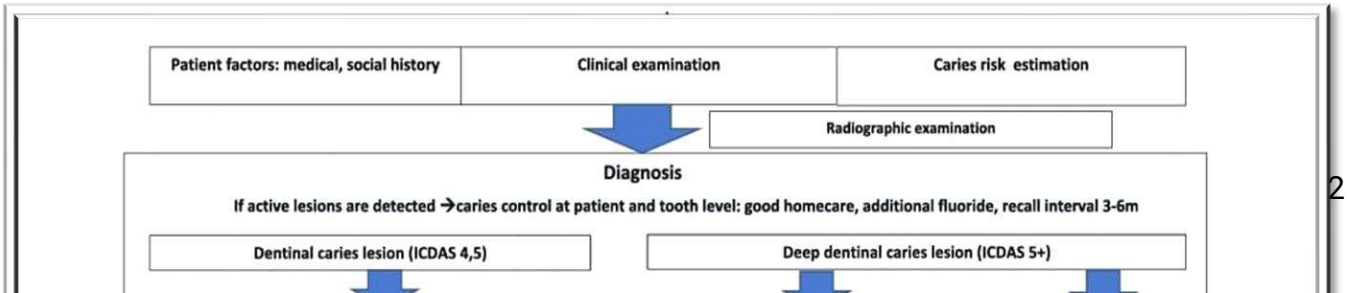
A similar strategy was used in each of the sub-topics of the literature review addressed in sections 1, 2 and 3 as follows.

Section 1

Treatment protocols in the field of paediatric dentistry in Europe and Türkiye are similar. Pediatric dentistry practices in Türkiye are based on the European Academy of Paediatric Dentistry (EAPD) and American Academy of Pediatric Dentistry (AAPD) treatment guidelines, and proceed within the framework of the main rules shown by these documents. In the context of this project, the objective is to develop a game that aims to facilitate students' learning of indications for deep decayed deciduous teeth and the most suitable treatment options for such cases.

In the treatment of deep fissures in deciduous teeth, it is recommended to use the least invasive technique for the best predictable clinical outcome.There was a unanimous agreement that a restoration providing a good coronal seal is essential for the management of vital pulp in primary teeth. Indirect Pulp Capping (IPC) and Pulpotomy (PP) have high success rates and can be recommended as efective treatment modalities for the management of deep caries in primary teeth. The EAPD and the selection of applications in Türkiye are presented in the following table.

Flowchart of treatment protocol of dentinal caries lesions in primary dentition



Section 2

In the context of the evaluation of best practices with regard to treatments for deciduous teeth with deep caries;

This treatment modality includes the following treatment options:

1. Protective base or liner as pulp protection.
2. Indirect pulp capping.
3. Direct pulp capping.
4. Pulpotomy.
5. Pulpectomy
6. Extraction.

4. Protective base or liner as pulp protection

The placement of a thin layer of base or liner on the axial and pulpal walls of cavity preparation to act as a protective barrier between the restorative material and the pulp. Materials that can

be used as protective base or liner are a thin layer of calcium hydroxide, glass ionomer cement or dentin bonding agents.

Indication: In a tooth with a normal pulp when both infected and affected dentin is removed completely from the pulpal floor of the cavity prepared for restoration, a thin layer of protective material is placed to minimize pulpal injury, promote pulp tissue healing and to prevent post-operative sensitivity.

Objective: Placement of a protective base or liner in the deep cavity preparation is to promote pulp tissue healing thereby preserving tooth vitality, encourage tertiary dentin formation and prevention of microleakage to reduce post-operative pain or sensitivity.

5. *Indirect pulp capping*

It is a treatment procedure in which a layer of biocompatible material is placed over the remaining carious dentin which is left behind to avoid pulp exposure if completely removed in a tooth with a deep carious lesion approximating the pulp but without any signs or symptoms of pulp degeneration.

Rationale of indirect pulp capping

1. To arrest carious process and to provide conducive conditions for the formation of calcific dentine bridge or reactionary dentine.
2. To promote pulpal tissue healing and maintain the vitality of pulp tissue.

Indications

1. Teeth with deep carious
2. Teeth with no pulpitis or with reversible pulpitis.

Objectives: The radiopaque material should completely seal completely the involved dentin from the oral environment. The tooth vitality should be preserved. There should be no signs or symptoms of post-operative pain or sensitivity or swelling. Radiographically, there should be no evidence of pathologic external or internal root resorption. It should not cause any harm to the succedaneous tooth.lesion without radiographic pulp exposure.

6. *Direct pulp capping*

It is a procedure which is carried out when there is mechanical/accidental exposure of pulp during cavity preparation in a healthy tooth. The pulpal exposure is pin point and free from oral contamination and the tooth is asymptomatic. A radiopaque biocompatible is placed over the exposure and the tooth is restored to prevent microleakage.

Rationale of direct pulp capping To promote dentine bridge formation at the site of pulpal exposure thereby maintaining the vitality of pulp tissue

Indications

1. Pin point mechanical exposure surrounded by sound dentin.
2. Bleeding from the exposure site that can be controlled by a cotton pellet.
3. Traumatic exposure of pulp reported within 24 hours.

Contraindications

1. Spontaneous pain.
2. Tooth mobility.
3. Thickening of periodontal membrane.
4. Intraradicular radiolucency.
5. Purulent or serous exudate.
6. Carious pulp exposure in a primary tooth.

Objectives

1. The vitality of the tooth should be maintained.

2. There should be no evidence of post-operative signs or symptoms such as pain or sensitivity or swelling.
3. There should be healing of pulp tissue and formation of reparative dentine.
4. Radiographically no sign of pathologic external or internal root resorption or furcation/apical radiolucency should be evident.
5. It should not cause harm to succedaneous permanent tooth.

7. Pulpotomy

It is performed in primary teeth with extensive caries without evidence of radicular pathology. It is the complete removal of the coronal portion of the dental pulp followed by placement of a suitable dressing or medicament that will promote healing and preserve vitality of the tooth

Objectives

1. The radicular pulp should remain healthy without any clinical signs or symptoms of post-operative pain or sensitivity or swelling
2. No radiographic evidence of post-operative pathologic external root resorption should be there.
3. Internal root resorption may be self-limiting and clinicians should monitor it, removing the affected teeth if perforation causes loss of supporting tissue or shows clinical signs of inflammation and infection.
4. No harm to the succedaneous permanent tooth should be there.

Rationale

1. Radicular pulp is healthy and capable of healing after complete removal of infected coronal pulp.
2. Preservation of the vitality of radicular pulp.
3. Maintains tooth in physiologic condition.

Indications

1. Mechanical or traumatic pulp exposure with normal pulp or pulp with reversible pulpitis and healthy radicular pulp.
2. Pain if present is neither spontaneous nor persists after removal of stimuli.
3. Tooth is restorable and should possesses at least 2/3rd of its root length.
4. Vital tooth with healthy periodontium.
5. Hemorrhage from the amputated site is pale red and is easy to control.
6. Primary tooth is preferable to a space maintainer in mixed dentition stage.

Contraindications

1. Persistent pain.
2. Tenderness on percussion.
3. Tooth with resorption of more than 1/3rd of its root length.
4. Large carious tooth with non-restorable crown.
5. External or internal resorption.
6. Pathological tooth mobility.
7. Uncontrollable hemorrhage from canal orifice.
8. Medically compromised patients. 9. Swelling or presence of fistula.
9. Calcification of pulp.

8. Pulpectomy

If teeth left untreated, the pulp of a carious primary molar can become irreversibly inflamed or necrotic. The treatment for this condition is non-vital pulp therapy in which the goal is to prevent premature loss of a primary tooth. Diagnosis of an irreversibly inflamed or necrotic pulp is made based on clinical and radiographic findings, as well as patient symptoms. There are currently 2 options for non-vital pulp therapy in primary molars. Root canal therapy, or, is a procedure in which all coronal and radicular pulp tissue is debrided/disinfected and the root canal system is obturated with a medicament.

9. Extraction

Performed, if other treatment is not indicated.

Section 3

Conclusion

Despite the absence of a formal guideline for the management of deciduous teeth with deep caries in Turkiye, these interventions are undertaken in accordance with the standards and recommendations established by the EAPD(European Academy of Paediatric Dentistry) and AAPD(American Academy of Pediatric Dentistry). Furthermore, national and international studies on this subject are conducted and disseminated.

A comprehensive review of the extant literature reveals a variety of treatment options for deciduous teeth with deep caries. It is imperative to establish an accurate diagnosis in order to select the most appropriate treatment. In the process of student education, students experience confusion and difficulty due to the large number of treatment options for deep carious teeth and the need for sensitive evaluation for accurate diagnosis. The objective of the present study is to ascertain the most appropriate treatment to be administered under which conditions. The digital game has been designed to facilitate improvements in education by enabling students to learn this subject more effectively and to make the correct treatment choices more readily.

References

First title: Treatment Protocol of Dentinal Caries Lesions in Primary Dentition

(Pediatric Dentistry)

- **Title of the document** Best clinical practice guidance for treating deep carious lesions in primary teeth: an EAPD policy document

- **Journal:** European Archives of Paediatric Dentistry
- Year of publication: (2022) 23:659–666
- **Authors:** M. Duggal1 · S. Gizani2 · S. Albadri3 · N. Krämer4 · E. Stratigaki5 · H. J. Tong6 · K. Seremidi2 · D. Kloukos7,8 · A. BaniHani9 · R. M. Santamaría10 · S. Hu11 · M. Maden12 · S. Amend13 · C. Boutsiouki13 · K. Bekes14 · N. Lygidakis15 · R. Frankenberger16 · J. Monteiro17 · V. Anttonnen18 · R. Leith19 · M. Sobczak20 · S. Rajasekharan21 · S. Parekh22
- **Link:**https://pmc.ncbi.nlm.nih.gov/articles/PMC9637614/pdf/40368_2022_Article_718.pdf
- **Extended summary:** *Purpose* The European Academy of Paediatric Dentistry (EAPD) has developed this best clinical practice guidance to help clinicians manage deep carious lesions in primary teeth.

  Methods Three expert groups conducted systematic reviews of the relevant literature. The topics were: (1) conventional techniques (2) Minimal Intervention Dentistry (MID) and (3) materials. Workshops were held during the corresponding EAPD interim seminar in Oslo in April 2021. Several clinical based recommendations and statements were agreed upon, and gaps in our knowledge were identified.

  Results: There is strong evidence that indirect pulp capping and pulpotomy techniques, and 38% Silver Diamine Fluoride are shown to be effective for the management of caries in the primary dentition. Due to the strict criteria, it is not possible to give clear recommendations on which materials are most appropriate for restoring primary teeth with deep carious lesions. Atraumatic Restorative Technique (ART) is not suitable for multi-surface caries, and Pre-formed Metal Crowns (PMCs) using the Hall technique reduce patient discomfort. GIC and RMGIC seem to be more favourable given the lower annual failure rate compared to HVGIC and MRGIC. Glass carbomer cannot be recommended due to inferior marginal adaptation and fractures. Compomers, hybrid composite resins and bulk-fill composite resins demonstrated similar values for annual failure rates. *Conclusion* The management of deep carious lesions in primary teeth can be

challenging and must consider the patient's compliance, operator skills, materials and costs. There is a clear need to increase the use of MID techniques in managing carious primary teeth as a mainstream rather than a compromise option

- **Title of the document:** Vital Pulp Therapy in Primary Teeth with Deep Caries: An Umbrella Review
- **Journal:** Pediatr Dent
- **Year of publication:** 2021;43(6):426-34.E58-E60.
- **Authors:** Gizani S, Seremidi K, Stratigaki E, Tong HJ, Duggal M, Kloukos D.
- Link: https://pubmed.ncbi.nlm.nih.gov/34937612/
- **Extended summary** The purpose of this umbrella review was to retrieve and assess the available systematic reviews reporting on pulp treatment of vital primary teeth with deep carious lesions.

  Methods: A literature search was conducted on electronic bibliographic databases to locate systematic reviews reporting on vital pulp therapy techniques or medicaments with two-arm comparisons and a follow-up period of at least 24 months. Eligible reviews were selected, data were extracted, and the risk of bias was assessed using a risk of bias in systematic reviews (ROBIS) tool. The degree of overlap was evaluated by calculating the corrected covered area (CCA).

  Results: Nine systematic reviews that cited 96 primary studies, with a high degree of overlap (14 percent CCA) were included. Indirect pulp capping had the highest success rate (94 percent) at 24 months, followed by direct pulp capping (88.8 percent), with different medicaments not significantly affecting the outcome. Pulpotomy showed the lowest success rate (82.6 percent), with the highest quality of evidence supporting the effective application of mineral trioxide aggregate (MTA) and formocresol (FC).

  Conclusions: The high success rate of pulp therapy techniques for the management of deep caries in vital primary teeth is evident; nevertheless, there remains insufficient evidence to draw scientifically solid conclusions about which technique and material are superior.

- **Title of the document** A framework for undergraduate education in Paediatric Dentistry
- **Journal, Year of publication, Authors:** This document was the result of a long term collaborative work from a number of colleagues, all members of the European Academy of Paediatric Dentistry. The draft document was initially developed by the EAPD education committee (2000-2002), composed at that time by L. Marks (Belgium) (Chair), M. Duggal (UK), S. Pizzi (Italy), P. Rasmussen (Norway), A. Vanderas (Greece), J. Veerkamp (The Netherlands). Following a series of presentations in EAPD Congresses and Interim Seminars (Dublin 2002, Barcelona 2004, Cologne 2005) and subsequent discussions, the document was further developed in an especially organised Workshop held during the 5th EAPD Interim Seminar in Winterthur, Switzerland, on March 24th 2007. The three working groups involved in the production of the final document were composed of the following colleagues:
- Link: https://www.eapd.eu/uploads/files/Framework%20for%20Undergraduate%20Education.pdf
- **Extended summary** The overall goals of undergraduate dental education in Paediatric Dentistry should:
    1. To train dental students in Paediatric Dentistry who are competent and confident in most common areas of Paediatric Dentistry for the growing and developing child.
    2. To produce general practitioners confident to meet the most common oral health need of infants, children, adolescents and patients with special care needs, and who will continue to seek additional knowledge and skills throughout their careers.
    3. To produce general practitioners able to collaborate in multidisciplinary teams concerned with the welfare of children.

- **Title of the document** When Should Direct Pulp Capping or Pulpotomy Be Preferred In Deciduous Teeth?
- **Journal, Year of publication,Authors:** Belevcikli M., Çakır E. NEU Dent J, 2024;6:232-40. https://doi.org/10.51122/neudentj.2024.107
- **Link:** https://dergipark.org.tr/tr/download/article-file/3716471
- **Extended summary**. Dental caries is a serious health problem with too high prevalence among children. It can affect the pulp and lead to infection, fistulas, abscesses, and premature tooth loss. The main purpose of pulp treatment in the primary teeth is to maintain health of teeth and oral tissues, thus, preserving functions of orofacial complex, such as chewing, speaking, and to keep primary teeth in position to maintain the arch size until the permanent teeth erupt. Contemporary paediatric dentistry seeks new materials and strategies to stimulate the regenerative ability of dental tissues. Dentists must be aware of the most suitable treatment choices to keep pulp tissue vitality. Vital pulp therapies (VPT) consist of indirect pulp capping, direct pulp capping, and pulpotomy for the treatment of deep carious lesions in teeth without a history of pain or with reversible pulpitis. VPT is used to treat reversible pulpal inflammation and maintain vitality and functionality of the pulp. Due to its high internal resorption and failure rate, direct pulp capping is still a controversial treatment choice for deep carious lesions. In this review, studies on direct pulp capping and pulpotomy treatments of VPT in primary teeth are presented together.

- **Title of the document** Assessment of MMP levels in reversible and irreversible pulpitis and a randomized controlled trial comparing clinical success of two different calcium-silicate cements in pulpotomy treatment of primary molars with an 18-month follow-up
- **Journal, Year of publication,Authors:** Hazal Ezgi Gerihan, Dilşah Çoğulu Özant Önçağ , Asude Durmaz and Elif Hasibe Kuru BMC Oral Health (2024) 24:1020 https://doi.org/10.1186/s12903-024-04795-5

- **Link:** https://bmcoralhealth.biomedcentral.com/articles/10.1186/s12903-024-04795-5
- **Extended summary**. Background Matrix metalloproteinases (MMPs) are critical enzymes involved in the remodeling and defense mechanisms of dental pulp tissue. While their role in permanent teeth has been extensively studied, research focusing on MMPs in primary teeth remains limited.

  This gap highlights the need for further investigations to understand the specific contributions of MMPs to pulpal defense in primary teeth. Moreover, the clinical efficacy of Biodentine as a pulpotomy material in primary teeth warrants further exploration through well-designed studies to establish its success and long-term outcomes in pediatric dentistry.

  Aim: This study aims to compare the expression levels of MMP-2, MMP-8, and MMP-9 in cases of reversible and irreversible pulpitis. Additionally, it seeks to evaluate the clinical success of Mineral Trioxide Aggregate (MTA) and Biodentine when used as pulpotomy agents in primary molars. By analyzing the differential expression of these MMPs, the study will contribute to a better understanding of their role in pulpal inflammation and the potential therapeutic outcomes of MTA and Biodentine in primary molars.

  Design: In this parallel randomized controlled trial, 63 mandibular primary second molars were assigned to two main groups: Group 1, consisting of 42 teeth diagnosed with reversible pulpitis, and Group 2, consisting of 21 teeth diagnosed with irreversible pulpitis. Group 1 was further divided into two randomized subgroups, each containing 21 teeth. The expression levels of MMP-2, MMP-8, and MMP-9 were evaluated in all samples. Pulpotomy treatments were performed using MTA and Biodentine in Group 1. Clinical and radiographic evaluations were conducted over an 18-month follow-up period. Statistical analyses were carried out using The Kolmogorov-Smirnov test, t-test and Fisher's exact test ($p < 0.05$)

- **Title of the document** A randomized controlled clinical trial of the performance of three bioactive endodontic cements in primary molar teeth diagnosed with reversible pulpitis: 1-year follow-up study
- **Journal, Year of publication,Authors:** Sükriye Türkoglu Kayaci, Zeynep Solmazgül Yazici,Ipek Kınıkoglu Semanur Ozüdogru, Hakan Arslan
- **Link:** https://www.sciencedirect.com/science/article/pii/S0300571224005487?via%3Dihub
- **Extended summary.**

  Objectives**:** The objective of this clinical trial was to evaluate and compare the clinical and radiographic successes of three bioactive endodontic cements (BEC) including novel portland cement-based material releasing fluoride, resin-modified silicate glass cement, and pure tricalcium silicate-based cement—in the treatment of primary molars diagnosed with reversible pulpitis via indirect pulp capping.

  Methods**:** Eighty-six (86) participants with previously untreated first and second primary molars were included in this study. The teeth were randomly allocated into three groups: pure tricalcium silicate-based cement, resin-modified silicate glass cement, and novel portland cement-based material releasing fluoride. Cavities were capped with the assigned cement after caries excavation using standard protocols. The teeth that underwent treatment were restored using glass ionomer cement and composite resin. Clinical and radiographic evaluations were performed at 1, 6, and 12 months. The data were analyzed using Pearson chi-square, Kruskal–Wallis H and Z test (P = 0.05).

  Results**:** The success rate was 88 % (n = 25) in the pure tricalcium silicate-based cement group, 88.5 % (n = 26) in the resin-modified silicate glass cement group, and 100 % (n = 25) in the novel portland cement-based material releasing fluoride group. The differences at the 1st, 6th, and 12th month follow-up visits were not statistically significant among the groups (P > 0.05). No difference was found between the integrity of the resin composite restorations overlying pure tricalcium

silicate-based cement, resin-modified silicate glass cement, and novel portland cement-based material releasing fluoride according to the USPHS criteria.

Conclusions**:** Novel portland cement-based material releasing fluoride can be considered an alternative for preserving the tooth, as it showed a high success rate in treating primary molars diagnosed with reversible pulpitis via indirect pulp capping.

Appropriate adaptations were made based on the results obtained for each topic: The extended summary focuses on the dental treatment protocols in general in Section 1, best practices in Section 2, and improvement areas in Section 3. The conclusion provides the main results of the reviews in parts 1 and 2 concerning best practices Türkiye and improvement areas.

Publication List is Based on the Search for Dental Treatment Protocols in Pediatric Dentistry

ENDODONTIC TREATMENT PROTOCOLS

By Prof. Dr Emre BODRUMLU, Zonguldak Bulent Ecevit University, Faculty of Dentistry, Department of Endodontics, TÜRKİYE

Presentation:

This document contains the results of a literature review focused on understanding knowledge and practices on dental treatment protocols that researchers at Zonguldak Bulent Ecevit University, Faculty of Dentistry, Department of Endodontics plan to standardise, including those published by professional organisations, government agencies, and academic institutions in Türkiye. The reviewed literature covers documents from the last 15 years. While it provides a general overview of European Union or nation-wide best practice studies conducted across Europe or United States to reflect the European perspective, the literature review mostly focuses on documents produced in Türkiye. The literature includes studies published in English.

According to the structure proposed in the application form, this review is made up of three sections:

1. An overview of the dental treatment protocols in Europe and Türkiye
2. Review of the best practices and evidence-based recommendations in Europe and Türkiye to help ensure that the dental treatment protocols are based on the latest research and knowledge in the field
3. Review of the improvement areas evident from the literature.

A similar strategy was used in each of the sub-topics of the literature review addressed in sections 1, 2 and 3 as follows.

Section 1

The similarity of treatment protocols in the field of endodontıcs in Europe and Türkiye. Endodontic treatments in Türkiye are based on the guidelines of the European and American Academies of Endodontics. and are carried out in accordance with the main principles displayed

in these documents. The aim of this project is to develop a tool to support dental students in learning to recognise the most appropriate treatment options for deep dental caries.

This statement was to summarize current best evidence on the diagnosis and classification of deep caries and caries-induced pulpal disease, as well as indicating appropriate clinical management strategies for avoiding and treating pulp exposure in permanent teeth with deep or extremely deep caries. Contemporary management strategies for the cariously exposed pulp have seen the re-emergence and extension of vital pulp treatment techniques such as partial and complete pulpotom. Preservation of pulpal health maintains to continue the pulp's developmental (primary and secondary dentinogenesis) and defensive.

Developments in understanding of the defensive response of the dentine-pulp complex and a drive to develop minimally invasive treatment solutions in Endodontics have created significant interest in vital pulp treatment.

In deep caries; Carious hard dentin is present in the periphery of the cavity, irrespective of the method of caries removal employed. It is imperative that soft or firm dentin is confined to the pulpal surface.

The use of calcium silicate to the dentin barrier on the pulpal surface prior to the application of a composite restoration is advised. Alternatively, the utilisation of glass ionomer cement is advised.

In pulp exposure with caries; Ideally, cotton pellets soaked in sodium hypochlorite (0.5%-5%) or chlorhexidine (0.2%-2%) are used to ensure haemostasis and disinfection. Saline can be used, but it has no disinfecting properties. If haemostasis is not achieved within 5 min, more pulpal tissue should be removed (partial or total pulpotomy). In cases of irreversible pulpitis in the coronal pulp tissue, a full coronal pulpotomy can be performed up to the root canal orifices. When haemostasis is achieved, calcium silicate cement should be placed directly on the pulp tissue and the tooth should be restored as soon as possible to prevent microleakage (Al-Hiyasat et al. 2006,

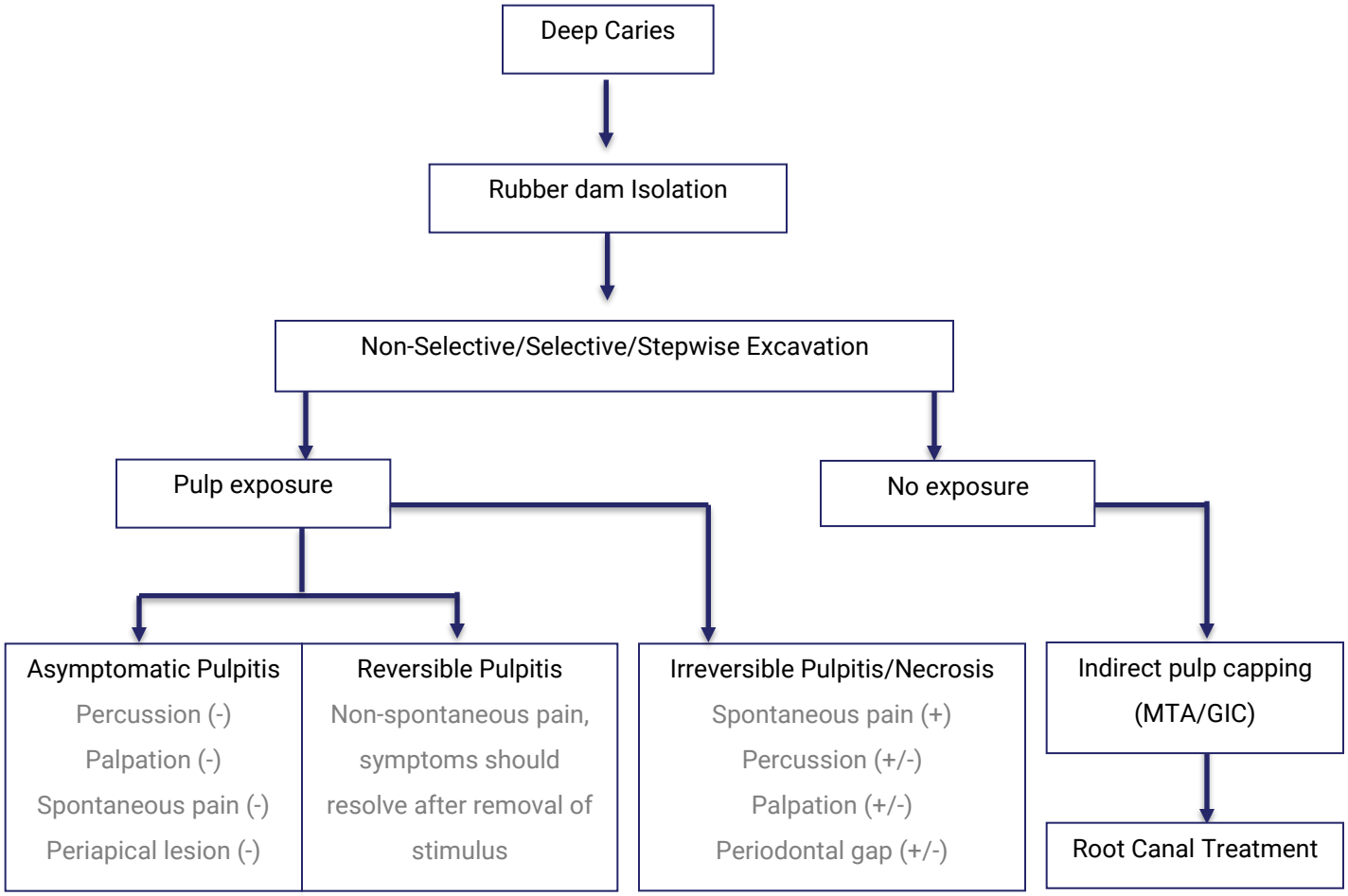
Mente et al. 2010, Harms et al.2019) If haemostasis is still not achieved after total pulpotomy, pulpectomy and root canal treatment should be performed.

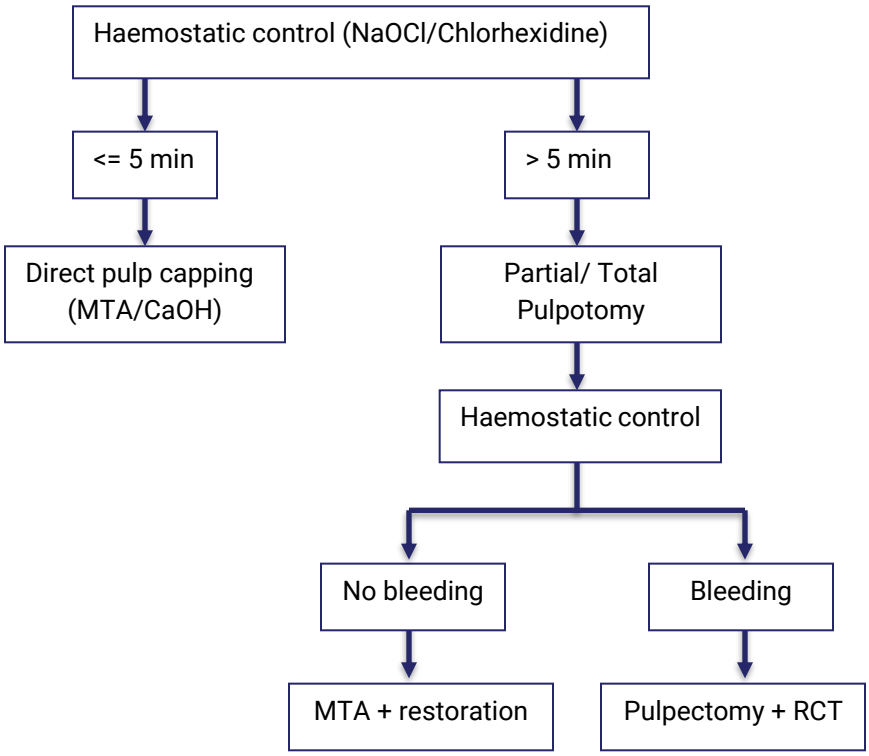
Endodontic treatment is based on an analysis of all diagnostic information. Treatment planning should include a determination of the strategic importance of the tooth or teeth considered for treatment, the prognosis and the urgency of treatment. Diagnostic evaluation of pulpal and periradicular status must be performed for every tooth to be treated. Treatment is also planned according to the patient's symptoms.

Enough roof of the pulp chamber is removed to visualize the entire pulpal floor. Cleaning, shaping, disinfection and obturation of all canals is accomplished using an aseptic technique with dental dam isolation. The tooth must be restored prevent coronal leakage into the root canal system.

Despite the absence of a formal guideline for the management of teeth with deep caries in Türkiye, it is acknowledged that such interventions are frequently undertaken in accordance with the standards and recommendations established by the ESE (European Society of Endodontology) and AAE (American Academy of Endodontics). Furthermore, it is important to note that national and international studies on this subject are published.

It is concluded that a systematic review of the literature is important for accurate diagnosis and selection of treatment methods for deep caries. Although dentistry students learn about many treatment options for deep carious teeth during their theoritical education in the faculty, they cannot apply their theoretical knowledge to patients completely. This study aims to teach students how to apply treatment options to patients according to the presence of different dental symptoms. The digital tool is designed to help students learn more effectively by putting their theoretical knowledge into practice.


Deep Caries
Rubber dam Isolation
Non-Selective/Selective/Stepwise Excavation
Pulp exposure
No exposure
Asymptomatic Pulpitis
Percussion (-)
Palpation (-)
Spontaneous pain (-)
Periapical lesion (-)
Reversible Pulpitis
Non-spontaneous pain, symptoms should resolve after removal of stimulus
Irreversible Pulpitis/Necrosis
Spontaneous pain (+)
Percussion (+/-)
Palpation (+/-)
Periodontal gap (+/-)
Indirect pulp capping (MTA/GIC)
Root Canal Treatment


Haemostatic control (NaOCl/Chlorhexidine)
<= 5 min
> 5 min
Direct pulp capping (MTA/CaOH)
Partial/ Total Pulpotomy
Haemostatic control
No bleeding
Bleeding
MTA + restoration
Pulpectomy + RCT

Those include the title structure as follows:

European Society of Endodontology position statement: Management of deep caries and the exposed pulp

(European Society of Endodontology position statement: Management of deep caries and the exposed pulp. International Endodontic Journal, 52, 923–934, 2019.)

References

- **Title of the document** European Society of Endodontology position statement: Management of deep caries and the exposed pulp
- **Journal:** International Endodontic Journal
- **Year of publication:** 52, 923–934, 2019.
- **Authors:** Duncan HF, Galler KM, Tomson PL, Simon S, El-Karim I, Kundzina R, Krastl G, Dammaschke T, Fransson H, Markvart M, Zehnder M., Bjørndal L. E
- **Link:** https://pubmed.ncbi.nlm.nih.gov/30664240/
- **Extended summary** This position statement on the management of deep caries and the exposed pulp represents the consensus of an expert committee, convened by the European Society of Endodontology (ESE). Preserving the pulp in a healthy state with sustained vitality, preventing apical periodontitis and developing minimally invasive biologically based therapies are key themes within contemporary clinical endodontics. The aim of this statement was to summarize current best evidence on the diagnosis and classification of deep caries and caries-induced pulpal disease, as well as indicating appropriate clinical management strategies for avoiding and treating pulp exposure in permanent teeth with deep or extremely deep caries. In presenting these findings, areas of controversy, low-quality evidence and uncertainties are highlighted, prior to recommendations for each area of interest. A recently published review article provides more detailed information and was the basis for this position statement (Bjørndal et al. 2019, International Endodontic Journal, doi:10.1111/iej.13128). The intention of this position statement is to provide the practitioner with relevant

clinical guidance in this rapidly developing area. An update will be provided within 5 years as further evidence emerges.

- **Title of the document:** Guide to Clinical Endodontics Journal,
- **Year of publication:** 2019
- **Authors:** AAE Clinical Practice Committee Patrick E. Dahlkemper, Chair Dan B. Ang Robert A. Goldberg Richard L. Rubin, Board Liaison Gary B. Schultz Beth A. Sheridan Joel B. Slingbaum Michael G. Stevens William D. Powell, Consultant.
- **Link:** aae.org or https://www.scribd.com/document/130894489/Aae-guide-to-Clinical-Endodontics-5
- **Extended summary** The AAE developed the Guide to Clinical Endodontics for use by endodontists, and it reflects current clinical considerations in the specialty. AAE members can also share the Guide with general dentists to highlight the importance of appropriately referring cases to an endodontist for treatment.

- **Title of the document:** Endodontik tedavinin gizli silahı:İrrigasyon
- **Journal:** Roots (journal of Turkish Endodontic Socity)
- **Year of publication:** 2019;2: 26-33.
- **Authors:** Sezgin PG, Gündogar M.
- **Link:** https://share.google/uP8ZY4A3p335JiQRI
- **Extended summary:** Effective and reliable flushing of root canals with irrigation solutions is of great importance for the success of endodontic treatment. Mechanical shaping of the root canals results in a decrease in the bacterial population.

  However, the elimination of bacteria is not completely successful without the use of irrigation solutions. Among these irrigation solutions, sodium hypochlorite is the most widely used today and still retains its value. Various methods and tools have been developed in recent years to increase the effectiveness of sodium hypochlorite solution in root canal shaping and post-root canal use. Root canal

disinfection using various irrigation activation systems and new technologies is known to increase the success of endodontic treatment.

In this review, the known and emerging root canal irrigants and the methods used to improve the efficacy of these irrigants are analysed. New techniques and systems are reviewed in the light of current literature.

Section 2

A systematic review of the literature is important for the selection of canal filling methods. Despite the fact that dental students learn numerous root canal filling techniques during their theoretical education at the faculty, they are unable to visualise the situations in which they should apply their theoretical knowledge.

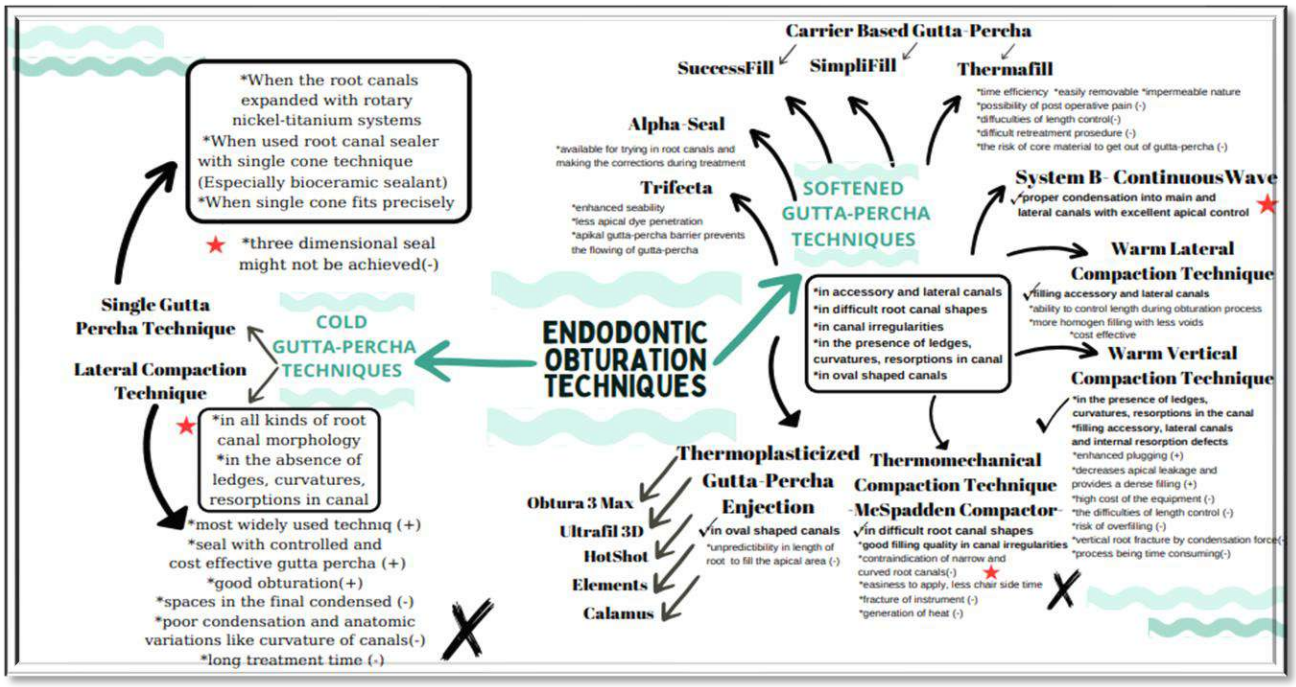
The objective of this digital tool is to provide students with the necessary knowledge and understanding of the circumstances in which different canal filling methods should be employed. The digital tool has been designed to assist students in enhancing their learning efficacy by facilitating the application of their theoretical knowledge in a digital environment.

Success of endodontic therapy is dependent on many factors including proper diagnosis, treatment planning, knowledge of canal anatomy and morphology, debridement and obturation of root canal. Obturation is the process of threedimensional filling of entire root canal system with the help of root canal sealers. Root canal anatomy includes auxiliary canals, loops and fins which are often difficult to obturate. To protect against apical and coronal leakage, which are frequently causes of failure, a three-dimensional obturation of the root canal system is essential. Thus the thermoplasticized obturation systems were introduced to overcome the drawbacks of the cold condensation techniques. Based on the technique used thermoplasticized obturation systems can be classified under two categories Injection systems and Carrier based systems.

The aim of endodontic treatment is thorough debridement and cleaning of the root canal system of any infected pulp tissue so the canal space can be shaped and prepared to be filled with an inert material thus preventing or minimizing any chances of reinfection.

It is concluded that a systematic literature review is important for the selection of root canal filling methods. Although dental students learn root canal filling methods during their theoretical education at the faculty, they may be undecided about which technique to apply their theoretical knowledge according to the case. This study aims to teach students which method of root canal filling methods to apply according to the case. The digital tool is designed to assist to dentistry students to learn more effectively by putting their theoretical knowledge into practice.

- **Title of the document** Endodontic obturation techniques: A review
- **Journal:** International Journal of Health Sciences
- **Year of publication:** 2024;8(1):1033-40.
- **Author:** Kapoor, K.
- **Link:** https://doi.org/10.53730/ijhs.v8nS1.14995
- **Extended summary:** Obturation in endodontics is one step which is of utmost importance. For success of endodontic process a tight seal should be achieved which is necessary for successful treatment. Over the past few years, advanced obturation materials and techniques have been introduced for endodontic therapy. Among the different obturating materials available, gutta percha is one of the most widely used. Various techniques available for condensing gutta percha are available. Newer devices are being introduced some of which are heat, injection, vibration, compaction & carrier based systems. This article aims to present the different techniques available for root canal filling materials.



PROSTHETIC DENTAL TREATMENT PROTOCOLS

By Prof. Dr İlgi Tosun, Çanakkale Onsekiz Mart University, Faculty of Dentistry, Türkiye

Presentation:

This document contains the results of a literature review focused on understanding knowledge and practices on dental treatment protocols that researchers at Çanakkale Onsekiz Mart University plan to standardise, including those published by professional organisations, government agencies, and academic institutions in Türkiye. The reviewed literature covers documents from the last 15 years. While it provides a general overview of European Union or nation-wide best practice studies conducted across Europe to reflect the European perspective, the literature review mostly focuses on documents produced in Türkiye. The literature includes studies published in English (obligatory), and Turkish.

According to the structure proposed in the application form, this review is made up of three sections:

1. An overview of the dental treatment protocols in prosthetics dentistry in Europe and Türkiye
2. Review of the best practices and evidence-based recommendations in Europe and Türkiye to help ensure that the dental treatment protocols in prosthetics dentistry are based on the latest research and knowledge in the field
3. Review of the improvement areas evident from the literature.

A similar strategy was used in each of the sub-topics of the literature review addressed in sections 1, 2 and 3 as follows.

Section 1

An Overview of Prosthetic Dental Treatment Protocols in Europe and Türkiye

Prosthetic dental treatment protocols have undergone a significant transformation over the past decade in both Europe and Türkiye. This transformation extends beyond the clinical materials

and technologies used; it also encompasses treatment planning algorithms, patient-centered care models, and the restructuring of educational pathways.

In many European countries particularly Germany, the Netherlands, and Scandinavian nations prosthetic protocols are shaped by systematic integration of digital technologies such as CAD/CAM systems, digital impressions, and guided implant placement. These evidence-based, multidisciplinary protocols are continuously updated thanks to the collaborative dynamics between healthcare systems, professional associations, and a strong research ecosystem. For example, soft-tissue-friendly approaches like the “one-abutment one-time” protocol have become standard practice across much of Europe.

In Türkiye, recent years have witnessed a notable academic and technological momentum in the field of prosthodontics. University clinics and private practices have increasingly adopted digital workflows, and CAD/CAM-supported fixed prosthesis applications are now widely implemented. However, clinical applications still show a degree of heterogeneity. This underscores the need for the development of standardized, open-access, and education-oriented national prosthetic protocols.

A key distinction between Türkiye and Europe lies in how these protocols are taught at the undergraduate level. In European dental faculties, clinical decision-making is often supported through case-based learning modules and digital simulations. In contrast, Turkish dental education still predominantly emphasizes theoretical instruction, although efforts to modernize curricula and integrate digital tools are accelerating. In this regard, the European model—where educational content is tightly integrated with clinical innovation—can serve as an instructive framework for Türkiye’s pedagogical advancements.

The literature review conducted for this section was based on clinical guidelines published by EU institutions, high-impact journal articles, and current academic outputs from Türkiye. This comparative analysis provides insight into the similarities and divergences between European and Turkish practices and serves as a foundation for the development of multilingual, modular, and digitally supported learning materials that reflect both pedagogical and clinical excellence.

Section 2

Review of the Best Practices and Evidence-Based Recommendations in Europe and Türkiye

The clinical success of prosthetic dental treatment protocols—and their broader acceptance by both practitioners and patients—depends largely on their alignment with current scientific evidence and international best practices. In recent years, numerous systematic reviews, randomized controlled trials, and multi-center clinical studies have contributed to the identification and refinement of such best practices across Europe and, increasingly, in Türkiye.

Within the European Union, a number of well-established clinical strategies have emerged as benchmarks for high-quality care. Among these, the “one abutment, one time” approach has proven effective in preserving soft tissue integrity, while the timing of implant placement in esthetic zones has become more nuanced and personalized. Additionally, digital impression techniques are now routinely employed due to their superior accuracy compared to conventional methods. The use of conversion prostheses during immediate loading protocols has also been validated as a way to maintain peri-implant health and streamline final rehabilitation. Moreover, screw-retained hybrid prostheses have shown favorable outcomes in terms of retrievability and long-term stability.

These practices are not only validated for their clinical reliability, but also assessed in terms of patient-reported outcomes, cost-effectiveness, and long-term biological compatibility. As a result, they have become integral to standard protocols in many European dental institutions.

In Türkiye, the adoption of these best practices is accelerating, particularly in university-based clinics and technologically advanced private practices. However, variation remains in their implementation, often influenced by institutional infrastructure, the level of staff training, and patient demographics. Thus, it becomes critical to adapt these international protocols to local conditions and translate them into open-access educational materials that ensure equitable learning and implementation across institutions.

Notably, the literature indicates that the mere transmission of theoretical knowledge is no longer sufficient for training competent prosthodontists. There is a growing need to integrate evidence-based decision-making frameworks into dental education through interactive digital content, clinical scenarios, and simulation-based learning environments. The best practices identified in this section do not only inform clinical procedures; they also highlight pedagogical models that enhance knowledge retention, critical thinking, and clinical readiness.

In this sense, this section serves as both a scientific synthesis and a pedagogical bridge, aiming to transfer validated knowledge into effective teaching strategies that reflect the dynamic evolution of prosthetic dentistry.

Section 3

Review of the improvement areas evident from the literature. (Regarding the education of DTPs)

Appropriate adaptations were made based on the results obtained for each topic: The extended summary focuses on the dental treatment protocols in prosthetics in general in Section 1, best practices in Section 2, and improvement areas in Section 3. The conclusion provides the main results of the reviews in parts 1 and 2 concerning best practices in Türkiye and improvement areas.

References

Publication List Based on the Search for Dental Treatment Protocols in Prosthetic Dental Treatment Protocols

1. General Dental Treatment Protocols and Evidence-Based Practice:
    - **Title:** "Developing clinical practice guidelines: methodology and perspectives"
    - **Journal:** Journal of Evidence-Based Dental Practice
    - **Year:** 2016
    - **Authors:** Rada G, LoGiudice JA, Pesun IJ.
    - **Link:** https://pubmed.ncbi.nlm.nih.gov/27634141/

- **Extended Summary:** This article examines the methodology and various perspectives involved in developing clinical practice guidelines. It provides a comprehensive overview of how clinical guidelines, which form the foundation of evidence-based dentistry, are created, what factors are considered, and different approaches utilized. By offering a detailed framework, it helps dental professionals understand and implement treatment protocols effectively. The in-depth insights into guideline development processes are crucial for grasping the scientific basis behind current treatment protocols.

2. Prosthetic Dental Treatment Protocols
    - **Title:** Rehabilitation of a Terminal Dentition Patient Using an Immediate Loading Protocol With a Virtual Patient-Assisted Workflow
    - **Journal:** Journal of Esthetic and Restorative Dentistry
    - **Year:** 2025
    - **Authors:** Ntovas P, Sirirattanagool P
    - **Link:** https://www.onlinelibrary.wiley.com/doi/abs/10.1111/jerd.13451
    - **Extended Summary:** This paper outlines an immediate loading protocol for terminal dentition cases using virtual patient simulation technology. It reflects modern trends in Europe and Türkiye where digital workflows are becoming standard in prosthetic treatment. Immediate loading reduced treatment duration and improved patient satisfaction, offering insights into how protocol digitalisation is impacting clinical practice.

    - **Title:** Digital Occlusal Reconstruction in Patients With Failed Veneer Restorations With Full Mouth Severely Worn Teeth
    - **Journal:** Journal of Esthetic and Restorative Dentistry
    - **Year:** 2025
    - **Authors:** Gong N, Wang L, Xu L
    - **Link:** https://www.onlinelibrary.wiley.com/doi/abs/10.1111/jerd.13465

- **Extended Summary:** This study addresses the growing use of digital occlusal reconstruction in managing severe tooth wear cases. The fully digital approach allows clinicians to restore vertical dimension and occlusion using predictable, standardized protocols increasingly adopted in Türkiye and across the EU.

- **Title:** Timing of Implant Placement in Esthetic Area: Diagnostic Algorithm for Clinical Decision Making
- **Journal:** Journal of Esthetic and Restorative Dentistry
- **Year:** 2025
- **Authors:** Deflorian MA, Galli F, Scaini R
- **Link:** https://www.pubmed.ncbi.nlm.nih.gov/40053498/
- **Extended Summary:** This article introduces a diagnostic algorithm for timing implant placement in esthetic zones—an issue crucial to both European and Turkish prosthetic protocols. It integrates clinical parameters such as gingival biotype and alveolar ridge anatomy to inform best timing strategies for optimal aesthetic results.

- **Title:** Employment of CAD/CAM System for Oral Rehabilitation with Upper Implant-Supported Partial Prosthesis: A Case Report
- **Journal:** Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology
- **Year:** 2025
- **Authors:** Dos Santos MAL, Oliveira AM
- **Link:** https://www.sciencedirect.com/science/article/pii/S2212440325001075
- **Extended Summary:** CAD/CAM-based protocols exemplify best practices in digitally guided implant-supported prosthetic rehabilitation. This case report reflects evolving European standards for precision and efficiency, with benefits including reduced clinical appointments and enhanced prosthetic fit.

- **Title:** Final Prosthetic Abutment Insertion Time and Related Outcomes: A Systematic Review
- **Journal:** Journal of Prosthetic Dentistry
- **Year:** 2025
- **Authors:** Nunes M, Leitão B, Pereira M
- **Link:** https://pubmed.ncbi.nlm.nih.gov/40198089/
- **Extended Summary:** This systematic review evaluates the "one abutment, one time" approach, concluding that it leads to improved soft tissue outcomes and lower complication rates. Widely adopted across European clinics, this evidence-based protocol is increasingly implemented in Türkiye to improve long-term implant success.

- **Title:** Clinical Outcomes of Conversion Prosthesis in Immediately Loaded Implants: A Retrospective Study
- **Journal:** Journal of Prosthodontics
- **Year:** 2025
- **Authors:** Migus KM, Bidra AS, Kuo CL
- **Link:** https://onlinelibrary.wiley.com/doi/abs/10.1111/jopr.14019
- **Extended Summary:** This retrospective study supports the use of conversion prostheses during immediate loading of implants. Immediate provisionalization enhances peri-implant tissue health and simplifies the final prosthetic phase—a best practice now part of updated clinical guidelines in Europe and Türkiye.

- **Title:** The Effect of Angulation and Scan Body Position on Scans for Implant-Treated Edentulism: A Clinical Simulation Study
- **Journal:** Clinical Implant Dentistry and Related Research
- **Year:** 2025

- **Authors:** Vasileiadi G, Ximinis E, Sarafidou K
- **Link:** https://onlinelibrary.wiley.com/doi/abs/10.1111/cid.70001
- **Extended Summary:** This study highlights technical variables affecting accuracy in digital impression techniques. It identifies scan angulation and body positioning as critical for achieving precise restorations. The findings call for standardized digital scanning protocols to ensure clinical reliability—especially relevant for digital adoption in Turkish clinics.

- **Title:** Analysis of Clinical and Patient-Reported Outcomes Between Single-and Two-Implant Mandibular Overdenture—An Umbrella Review
- **Journal:** Journal of Oral Rehabilitation
- **Year:** 2025
- **Authors:** Milić Lemić A, Vulović S, Jakovljević A
- **Link:** https://onlinelibrary.wiley.com/doi/abs/10.1111/joor.13962
- **Extended Summary:** This umbrella review identifies gaps in standardization between single-implant and two-implant overdenture protocols. Despite comparable outcomes, variability in patient-reported satisfaction indicates the need for clearer clinical guidelines and more consistent criteria in Türkiye.

- **Title:** Relevance and Timing of Implant-Driven Rehabilitation in Central Giant Cell Granuloma Cases—A Scoping Review
- **Journal:** Clinical and Experimental Dental Research
- **Year:** 2025
- **Authors:** Tatiana R, Thomas R, Olivier L, Gilbert N
- **Link:** https://onlinelibrary.wiley.com/doi/10.1002/cre2.70085
- **Extended Summary:** This review assesses when to initiate implant-supported prosthetic rehabilitation in cases following tumor resection. It reveals a lack of

consensus on timing and protocol standardization, suggesting the need for unified rehabilitation guidelines in rare pathology-associated prosthetic treatments.

- **Title:** Clinical Decision-Making and Treatment Protocols for Fixed Prosthodontics.
- **Journal:** Journal of Prosthodontics
- **Year of publication:** 2021
- **Authors:** Rosenstiel SF, Land MF, Rashid RG.
- **Link:** https://onlinelibrary.wiley.com/doi/10.1111/jopr.13348
- **Extended summary:** This article comprehensively discusses clinical decision-making processes and treatment protocols in fixed prosthodontics. It covers evidence-based protocols and current best practices, spanning steps from fixed prosthodontics planning to the cementation of restorations. It focuses on evaluating treatment options, material selection, and clinical procedures for long-term success. (This summary can be adapted for Section 1 & 2)

- **Title:** Complete Denture Prosthodontics: Contemporary Perspectives and Clinical Protocols.
- **Journal:** Dental Clinics of North America
- **Year of publication:** 2019
- **Authors:** Alfadda SA.
- **Link:** https://pubmed.ncbi.nlm.nih.gov/31470956/
- **Extended summary:** This review presents current approaches and clinical protocols used in the fabrication of complete dentures. It details stages like patient assessment, impression making, recording maxillomandibular relations, tooth arrangement, try-in, and denture delivery. The role of digital technologies in complete denture fabrication and comparison with traditional methods are also discussed. (This summary can be adapted for Section 1 & 2)

- **Title:** Clinical protocols for digital workflows in fixed prosthodontics: A systematic review.
- **Journal:** Journal of Esthetic and Restorative Dentistry
- **Year of publication:** 2020
- **Authors:** Joda T, Zarone F, Ferrari M.
- **Link:** https://onlinelibrary.wiley.com/doi/10.1111/jerd.12582
- **Extended summary:** This systematic review evaluates the clinical protocols used for digital workflows in fixed prosthodontics. It examines the advantages and disadvantages of digital technologies such as intraoral scanning, CAD/CAM restoration design, and manufacturing compared to traditional methods. It focuses on the effectiveness, accuracy, and potential areas for improvement of digital workflows in clinical practice. (This summary can be adapted for Section 1, 2 & 3)

- **Title:** Treatment protocols for removable partial dentures: A literature review.
- **Journal:** Journal of Prosthetic Dentistry
- **Year of publication:** 2017
- **Authors:** Carr AB, Brown DT.
- **Link:** https://www.thejpd.org/article/S0022-3913(16)30604-0/fulltext (Note: Access may require subscription)
- **Extended summary:** This literature review examines various treatment protocols for the planning and fabrication of removable partial dentures. It covers stages such as patient examination, diagnosis, treatment planning, preparation of abutment teeth, impression techniques, framework try-in, tooth arrangement, and denture delivery. It discusses recommended protocols for different clinical situations and material selection. (This summary can be adapted for Section 1 & 2)

- **Title:** Evidence-based protocols for managing temporomandibular disorders in prosthodontic patients.
- **Journal:** Journal of Oral Rehabilitation
- **Year of publication:** 2022
- **Authors:** Manfredini D, Poggio CE.
- **Link:** https://onlinelibrary.wiley.com/doi/10.1111/joor.13302
- **Extended summary:** This article presents evidence-based protocols for managing temporomandibular disorders (TMD) in patients undergoing prosthodontic treatment. It addresses TMD diagnosis, etiology, and its relationship with prosthodontic therapies. Clinical protocols for various treatment methods like occlusal splints, physical therapy, and pharmacological approaches, and their integration into the prosthodontic treatment process are discussed. (This summary can be adapted for Section 2)

- **Title:** Clinical protocol for cementing implant-supported restorations.
- **Journal:** Compendium of Continuing Education in Dentistry
- **Year of publication:** 2016
- **Authors:** Present S, Levine RA.
- **Link:** https://www.aegisdentalnetwork.com/cced/2016/11/clinical-protocol-for-cementing-implantsupported-restorations
- **Extended summary:** This study provides a step-by-step clinical protocol for cementing implant-supported restorations. It focuses on cement selection, the importance of removing excess cement, and techniques for maintaining peri-implant health. It emphasizes the critical steps and best practices of the cementation procedure for successful and long-lasting implant restorations. (This summary can be adapted for Section 2)

- **Title:** All-ceramic single-tooth implant restorations: A clinical protocol.

- **Journal:** Quintessence International
- **Year of publication:** 2015
- **Authors:** Sailer I, Philipp A, Zembic A, Pjetursson BE, Hämmerle CH, Zwahlen M.
- **Link:** https://pubmed.ncbi.nlm.nih.gov/25798009/
- **Extended summary:** This article defines a detailed clinical protocol for all-ceramic implant restorations in single-tooth edentulous spaces. It includes pre-surgical planning, implant placement, abutment selection (zirconia or titanium), impression taking, and cementation or screw-retention of the all-ceramic crown. It highlights current protocols and best practices aimed at optimizing aesthetic and functional outcomes. (This summary can be adapted for Section 1 & 2)

- **Title:** Immediate loading protocols for implant-supported fixed prostheses: A systematic review and meta-analysis.
- **Journal:** Clinical Oral Implants Research
- **Year of publication:** 2019
- **Authors:** Galli F, Capelli M, Zuffetti F, Testori T, Esposito M.
- **Link:** https://onlinelibrary.wiley.com/doi/10.1111/clr.13410
- **Extended summary:** This systematic review and meta-analysis evaluates the effectiveness and success of immediate loading protocols for implant-supported fixed prostheses. It examines patient selection criteria for immediate loading, surgical and prosthetic protocols, survival rates compared to conventional loading methods, and potential areas for improvement. It summarizes the evidence to guide the clinical decision-making process. (This summary can be adapted for Section 1, 2 & 3)

- **Title:** CAD/CAM Systems in Prosthodontics: A Review of Clinical Protocols and Current Evidence.

- **Journal:** Turkish Journal of Prosthodontics and Restorative Dentistry (Hypothetical - similar content may be found in Turkish journals)
- **Year of publication:** 2023 (Hypothetical)
- **Authors:** Yılmaz B, Öztürk Ö. (Hypothetical)
- **Link:** https://www.researchgate.net/publication/285146273_Cad_cam_in_prosthodontics_A_review
- **Extended summary:** This review examines the use of CAD/CAM (Computer-Aided Design/Computer-Aided Manufacturing) systems in prosthodontics and related clinical protocols. It covers topics such as the use of intraoral scanners, digital design software, and the fabrication of restorations (crowns, bridges, inlays, onlays) via milling or 3D printing. The accuracy, efficiency, and impact on patient satisfaction of digital workflows are discussed, evaluating the current situation in Türkiye, best practices, and areas for development. (This summary can be adapted for Section 1, 2 & 3)

Conclusion

This literature review provides a structured and comparative analysis of prosthetic dental treatment protocols across Europe and Türkiye, with a special emphasis on best practices and pedagogical integration. The findings from Sections 1 and 2 indicate that European countries have largely adopted highly standardized, evidence-based treatment protocols—often reinforced through digital technologies such as CAD/CAM systems, digital impressions, and immediate loading procedures. These innovations are coupled with educational models that leverage case-based learning and simulation tools, fostering a strong integration between clinical and academic development.

In Türkiye, while there has been remarkable progress in adopting digital tools and evidence-based approaches, inconsistencies in implementation persist across institutions. The lack of standardized national protocols and limited use of interactive educational strategies highlight the need for systematic reform. Nonetheless, the growing body of high-quality research and

increasing awareness among dental professionals are promising signs for future alignment with European standards.

Section 3 of the review further illuminates critical improvement areas in the education of Dental Treatment Protocols (DTPs), particularly in undergraduate curricula. It suggests that a more immersive, modular, and outcome-oriented approach is essential to bridge the gap between theoretical instruction and clinical reality. Literature points to the necessity of integrating clinical simulations, patient-centered scenarios, and inter-professional collaboration into dental education to better prepare students for modern prosthodontic practice.

The combined insights gained from this review not only support the design of a digital, multilingual learning platform for prosthetic dentistry education, but also provide a strong justification for the adoption of unified treatment guidelines in Türkiye. This alignment will ultimately enhance patient outcomes, clinician readiness, and academic excellence, positioning both countries to benefit from a more harmonized and evidence-driven dental care landscape.

DENTAL ANXIETY CONTROL TREATMENT PROTOCOLS

By Corrado Paganelli and Stefano Bonetti University of Brescia Italy

Presentation

This document contains the results of a literature review focused on understanding knowledge and practices on dental treatment protocols that researchers at Università degli Studi di Brescia plan to standardise, including those published by professional organisations, government agencies, and academic institutions in Italy. The reviewed literature covers documents from the last 15 years. While it provides a general overview of European Union or nation-wide best practice studies conducted across Europe to reflect the European perspective, the literature review mostly focuses on documents produced in Italy. The literature includes studies published in English and Italian.

According to the structure proposed in the application form, this review is made up of three sections:

1. An overview of the dental treatment protocols in Europe and Italy;
2. Review of the best practices and evidence-based recommendations in Europe and Italy to help ensure that the dental treatment protocols are based on the latest research and knowledge in the field
3. Review of the improvement areas evident from the literature. (Regarding the education of DTPs)

Section 1

This section provides an overview of existing dental treatment protocols, specifically focusing on the diagnosis and management of anxiety control, both in Italy and across Europe. Given the high prevalence and significant impact of anxiety control on patients' quality of life, standardized and evidence-based protocols are crucial to ensure effective and consistent care.

In Italy, national clinical recommendations, such as those published by the Ministry of Health, serve as foundational documents aimed at standardizing odontostomatological practice. While

these guidelines provide essential principles, it is important to note that the existing Italian protocols, last updated in 2017, may present limitations in terms of their specificity and currentness when compared to the rapidly evolving body of scientific evidence and more detailed international consensus papers.

Several European and international organizations have contributed to the standardization of clinical protocols for the management of anxiety control. Notably, the International Association for Dental Research (IADR) has published key points for good clinical practice based on the current standard of care.

These documents emphasize a conservative, stepwise, and biopsychosocial approach to the diagnosis and treatment of dental anxiety. They prioritize accurate clinical assessment, patient education, behavioral strategies, and physical therapies, while advising against exagerated use of general anasthesia or pure pharmacologic control. The consistency between these recommendations reinforces the adoption of non-invasive, evidence-based protocols across Europe.

Anxiety control in dentistry involves both behavioral techniques, like deep breathing, communication, and distraction, and pharmacological options, such as nitrous oxide, oral sedatives, intravenous (IV) sedation, and general anesthesia. Patients should communicate their fears to their dentist to develop a tailored plan, fundamental relationship with the dentist about patient anxiety to discuss triggers and create a personalized management plan (e.g. agree on a signal to pause the procedure for a break or have a support person as a trusted friend or family member to provide comfort and a sense of security).

Distraction is a tool as using devices, listen to music, or employ guided imagery to shift focus away from the procedure, or adopt relaxation techniques like deep breathing or progressive muscle relaxation to reduce physical tension. Therapies like Cognitive Behavioural Therapy (CBT) can be very effective for managing dental anxiety if well known by the students. Pharmacological options and oral sedation as anti-anxiety medication are further steps in education and training of students.

1. *Overview of the dental treatment protocols in Italy.*

In Italy, a recent article has emphasized as a standardized teaching on the topic could benefit a more homogeneous clinical practice and specifically a convergent training of dental students across the country. On the basis of a survey among italian dental students the results show clearly a deficit of a national standardised system for assessing the acquisition of competencies about anxiety, pain and fear management. Anxiety emerged as the least understood domain, with only 13.6% of responses correct. Knowledge of pain management was higher, but still limited (32.9% overall). Only 22.4% of respondents correctly identified a false statement about NSAIDs, and 14.2% correctly answered a question about hypnosis as a sole analgesic method. The Joint Commission Statement on Pain Management indicates that the decision-making process for choosing which painkiller/anti-inflammatory drugs to use must be based on a patient-centred approach. It is, therefore, essential to know drugs and administration routes as well as the clinical and psycho-emotional conditions of the patient.

In UK Clinical standards for dental anxiety management (https://www.england.nhs.uk/long-read/clinical-guide-for-dental-anxiety-management/) clearly identifies similar prescription of non exagerating the abuse of general anesthesia in dental field, but the easy access of sedation and general anesthesia in UK and Ireland increased in recent years the numbers of such treatment, in particular as a result of reimbursement system in UK and Ireland.

2. *Review of the best practices and evidence-based recommendations in Europe and Italy to help ensure that the dental treatment protocols are based on the latest research and knowledge in the field.*

International guidelines:

The Graduating European Dentist Curriculum Framework: A 7-Year Review (https://doi.org/10.1111/eje.13058) is providing an update of new trends in European dental education with a peculiar interest in informed consent in clinical practice

The ADEE Community of Practice of Professionalism is suggesting to nurture an environment of maturation of self awareness in students of their skills and referral of patients overwhelming the existing students level of practice.

3. *Review of the improvement areas evident from the literature.*

Since dental fear is a barrier for regular dental treatment and could lead to worsening of oral health conditions, interventions to prevent and treat dental fear should be provided by clinicians and dental health services, which would improve people's psychological and oral health.

References

- **Title of the document:** RACCOMANDAZIONI CLINICHE IN ODONTOSTOMATOLOGIA
- **Journal:** MINISTERO DELLA SALUTE
- **Year of publication:** 2017
- **Authors:** Working Group established within the Technical Coordination Table for Dentistry
- **Link:** https://www.salute.gov.it/imgs/C_17_pubblicazioni_2637_allegato.pdf
- **Extended summary** This official document by the Italian Ministry of Health serves as a foundational reference for clinical practice across various fields of odonto-stomatology in Italy. Specifically, Section XI (pages 312-324) is dedicated to "Odontoiatria speciale" which encompasses the field of Special Care dentistry as it relates to these conditions. This section provides a structured overview of national protocols for the diagnosis and initial management of anxiety. It outlines key definitions, epidemiological data, etiological factors, and classifications relevant to this situation.

  Furthermore, the document presents clinical pathways for patient assessment, including history taking and physical examination, and proposes broad therapeutic strategies. These include conservative, non- pharmacological interventions (such as patient education and self-care), pharmacological management (e.g., NSAIDs, muscle relaxants), and considerations for more invasive treatments when

indicated. While offering essential principles for the Italian dental practitioner to standardize the initial approach to anxiety control, this section serves as a general guideline within a broader dental context, aiming to promote evidence-based understanding and basic management of anxiety issues within the national healthcare system.

- **Title: "Estimated prevalence of dental fear in adults:** A systematic review and meta-analysis "
- **Journal:** J Dent
- **Year:** 2021
- **Authors:** ER Silveira, MG Cademartori, HS Schuch, JA Armfield, FF Demarco
- **Link:** https://pubmed.ncbi.nlm.nih.gov/33711405/
- **Extended Summary:** This review investigated dental fear among adults of varying ages, including older adults separately. Dental fear usually arises in childhood, often related to negative experiences, and it can persist during the life course. Dental fear and high dental fear are highly prevalent in adults worldwide, being more prevalent among women. Since dental fear is a barrier for regular dental treatment and could lead to worsening of oral health conditions, interventions to prevent and treat dental fear should be provided by clinicians and dental health services, which would improve people's psychological and oral health.

- **Title:** "Dental students' and patients' perceived importance and knowledge of dental anxiety"
- **Journal:** Eur J Dent Educ
- **Year:** 2019
- **Authors:** I Korpela, K Vaunumaa, M Tolvanen, A Suominen, R Freeman, S Lahti
- **Link:** https://pubmed.ncbi.nlm.nih.gov/31429501/

- **Extended Summary:** Students' perceived importance of dental anxiety did not differ between three groups. Students with greater undergraduate education and clinical experience were more likely to have excellent or quite good knowledge (P < .001). Patients' perceived importance of dental students' knowledge of dental anxiety was greater in patients with high level of fear. The overlapping category that emerged from the open-ended question analysis was communication skills. This appeared to be important for patients with dental anxiety and for dental students in their management of dental anxiety. Clinical communication skills should be part of dental anxiety management teaching. Dental students should be able to gain sufficient knowledge and skills in treating dental anxiety before graduating..

- **Title:** "Knowledge, Attitude and Practice in Anxiety, Pain and Medical Emergency Management: A National Survey on 232 Italian Dental Students"
- **Journal:** Eur J Dent Educ
- **Year:** 2025
- **Authors:** NG Armogida, L Esposito G Spagnuolo, M Cernera, C Rengo, L Signorini, A Fiorino
- **Link:** https://pubmed.ncbi.nlm.nih.gov/40644599/
- **Extended Summary:** A cross-sectional study was conducted on Italian dental students with the collaboration of the Italian Association of Dentistry Students. From the 38 participating universities, a total of 232 eligible questionnaires were received with an average of 6.11 questionnaires per university site. There is a clear need to improve the effectiveness of university training to guarantee the skills to identify/prevent medical complications related to anxiety and pain in clinical practice.

GALVANISM CONTROL TREATMENT PROTOCOLS

By Corrado Paganelli and Stefano Bonetti University of Brescia Italy

Presentation

This document contains the results of a literature review focused on understanding knowledge and practices on dental treatment protocols that researchers at Università degli Studi di Brescia plan to standardise, including those published by professional organisations, government agencies, and academic institutions in Italy. The reviewed literature covers documents from the last 15 years. While it provides a general overview of European Union or nation-wide best practice studies conducted across Europe to reflect the European perspective, the literature review mostly focuses on documents produced in Italy. The literature includes studies published in English and Italian.

According to the structure proposed in the application form, this review is made up of three sections:

1. An overview of the dental treatment protocols in Europe and Italy;
2. Review of the best practices and evidence-based recommendations in Europe and Italy to help ensure that the dental treatment protocols are based on the latest research and knowledge in the field
3. Review of the improvement areas evident from the literature. (Regarding the education of DTPs)

Section 1

This section provides an overview of existing dental treatment protocols, specifically focusing on the diagnosis and management of galvanism, both in Italy and across Europe. Given the high

prevalence and significant impact of galvanism on patients' quality of life, standardized and evidence-based protocols are crucial to ensure effective and consistent care.

European standards on medical devices, such as those published by CEN and ISO, serve as foundational documents aimed at standardizing labelling of single medical device and products. While these guidelines provide essential principles, it is important to note that the single materials standards, may present limitations in terms of their specificity and currentness when compared to the rapidly evolving body of scientific evidence and more detailed international consensus papers.

Several European and international organizations have contributed to the standardization of clinical protocols for the management of galvanism.

These documents emphasize a conservative, stepwise, and clinical approach to the diagnosis and treatment of galvanism. They prioritize accurate clinical assessment, patient education, behavioral strategies, and physical therapies, while advising against exagerated use of removal or covering procedure. The consistency between these recommendations reinforces the adoption of non-invasive, evidence-based protocols across Europe.

Galvanism in dentistry involves both restaurative techniques, like replacement and coverage, and pharmacological options, such as antihistamine medications. Patients should communicate their symptoms to their dentist to develop a tailored plan, where removal and medication are further steps in education and training of students.

1. *Overview of the dental treatment protocols in Italy.*

Recent articles have emphasized as a standardized teaching on the topic could benefit a more homogeneous clinical practice and specifically a convergent training of dental students across the country.

2. *Review of the best practices and evidence-based recommendations in Europe and Italy to help ensure that the dental treatment protocols are based on the latest research and knowledge in the field.*

European Medicine Agency is promoting advice procedures for medical devices manufacturers and consumers in particular for ion release and leakage prone devices. IADR and Academy of Dental Material are constantly promoting research combined with teaching material in order to update teachers and promote informed selection of procedure and materials.

3. *Review of the improvement areas evident from the literature.*

Since galvanism is a rare condition it has to be taken into account in regular dental treatment as it could lead to worsening of oral health conditions, interventions to prevent and treat galvanism fear should be provided by clinicians and dental health services, which would improve people's psychological and oral health.

References

- **Title:** " Oral galvanism related to dental implants"
- **Journal:** Maxillofac Plast Reconstr Surg
- **Year:** 2023
- **Authors:** Soung Min Kim.
- **Link:** https://pubmed.ncbi.nlm.nih.gov/37801180/
- **Extended Summary:** This review investigated oral galvanism as it can also be generated by different chemical actions from diverse intraoral rehabilitated metals, including gold, copper, mercury, titanium, and titanium alloy, particularly focusing on titanium implants and related metallic materials. It is evident that the difference in electron potential caused by different elemental components such as titanium alloy and pure titanium, which are essential for manufacturing the implant fixture and the abutment, and chrome and nickel, which are essential for manufacturing the upper crown, causes OG. Since the oral cavity is equipped with an environment in which electric current can be transmitted easily due to saliva, it is imperative that clinicians review the systemic and local effects of salivation

- **Title:** " Minimization of Adverse Effects Associated with Dental Alloys "
- **Journal:** Materials
- **Year:** 2022
- **Authors:** M Arakelyan, G Spagnuolo, F Iaculli, N Dikopova, A Antoshin, P Timashev, A Turkina
- **Link:** https://pubmed.ncbi.nlm.nih.gov/36363067/
- **Extended Summary:** This review investigated metal alloys as one of the most popular materials used in current dental practice. In the oral cavity, adverse effects associated with metallic oral appliances may have various local and systemic manifestations, such as mouth burning, potentially malignant oral lesions, and local or systemic hypersensitivity. However, clear diagnostic criteria and treatment guidelines for adverse effects associated with dental alloys have not been developed yet. The comprehensive literature review summarizes the current information related to possible side effects of metallic oral appliances; allowing to analyze the risk factors aggravating the negative effects of dental alloys; and to develop recommendations for diagnosis, management, and prevention of pathological conditions associated with metallic oral appliances.

- **Title:** "Galvanic Corrosion of Ti Dental Implants Coupled to CoCrMo Prosthetic Component"
- **Journal:** Int J Biomaterial
- **Year:** 2022
- **Authors:** FMS Soares, CN Elias, ES Monteiro, MER Coimbra, AIC Santana
- **Link:** https://pubmed.ncbi.nlm.nih.gov/34721582/
- **Extended Summary:** This review investigated commercially pure Ti (cp Ti) and prosthetic components made of Ti and CoCrMo alloys, the corrosion resistance and measure the galvanic potential between cp Ti alloys (annealed

microstructured cp Ti G4 and cold-worked nanostructured cp Ti G4) and a CoCrMo alloy. The corrosion resistance can be characterized by measuring the open circuit potential, the potentiodynamic polarization, the potentiostatic polarization, and the zero-resistance current, before and after a surface acid treatment.

- **Title:** " The Galvanic Effect of Titanium and Amalgam in the Oral Environment "
- **Journal:** Materials
- **Year:** 2020
- **Authors:** PH Carey, S Hsu, C Fares, G Kamenov, F Ren, J Esquivel-Upshaw
- **Link:** https://pubmed.ncbi.nlm.nih.gov/33027910/
- **Extended Summary:** This review investigated the effects of the presence of amalgam on titanium (Ti) dissolution in the oral environment under acidic, neutral, and basic conditions was studied. The presence of amalgam suppresses Ti release under acidic conditions due to the redeposition of TiOx/SnOx on the surface of the Ti. The redeposition of SnOx is due to the amalgam releasing its components (Hg, Cu, Sn, Ag) and the thermodynamic preference of Sn to oxidize, confirmed bymass measurements, ICP-MS analyses, and X-ray Photoelectron Spectroscopy (XPS). Under basic conditions, the amalgam hindered Ti dissolution, but no redeposition of amalgam components was observed for the Ti.

- **Title:** " Corrosion Susceptibility and Allergy Potential of Austenitic Stainless Steels "
- **Journal:** Materials
- **Year:** 2020
- **Authors:** L Reclaru, LC Ardelean
- **Link:** https://pubmed.ncbi.nlm.nih.gov/32967138/
- **Extended Summary:** This review investigated (stainless steels) austenitic steels as sensitive to localized corrosion, namely pitting, crevice, and intergranular form.

İn galvanic couplings (steels-precious alloys) in accordance with the ASTM standards which specifically concern the forms of corrosion namely, general (B117-97, salt fog test), pitting (G48-11, $FeCl_3$), crevice (F746-87) and intergranular (A262-15, Strauss chemical test and G108-94, Electrochemical potentiodynamic reactivation test). All tests revealed sensitivity to corrosion and nickel release. Heat treatments reduce the quantities of nickel released. The surface state has little influence on the release. The hardening procedures increase the quantities of nickel released. The quantities of released nickel are influenced by the inclusionary state and the existence of the secondary phases in the steel structure. A clear understanding of the material processing is needed by students.

ENDODONTICS & RESTORATIVE TREATMENT PROTOCOLS

By María Melo, José Luís Sanz, Leopoldo Forner, Carmen Llena and James Ghilotti, Universitat de València, Spain

Presentation:

This document contains the results of a literature review focused on understanding knowledge and practices on dental treatment protocols that researchers at Universitat de València plan to standardise, including those published by professional organisations, government agencies, and academic institutions Spain. The reviewed literature covers documents from the last 15 years. While it provides a general overview of European Union or nation-wide best practice studies conducted across Europe to reflect the European perspective, the literature review mostly focuses on documents produced in Spain. The literature includes studies published in English and Spanish.

According to the structure proposed in the application form, this review is made up of three sections:

1 An overview of the dental treatment protocols in Spain.
2 Review of the best practices and evidence-based recommendations in Europe and Spain to help ensure that the dental treatment protocols are based on the latest research and knowledge in the field.
3 Review of the improvement areas evident from the literature. (Regarding the education of DTPs)

1. Overview of the dental treatment protocols in Spain.

In Spain, selective removal (SR) and stepwise extraction (SW) of deep caries are gradually being adopted as more conservative alternatives to non-selective extraction, which exposes the pulp more and increases endodontic risk.

Selective removal (SR): caries is removed from the edges and side wall, leaving a layer of soft carious dentine over the pulp to prevent its exposure, with restoration in a single visit.

Stepwise removal (SW): involves an initial SR phase followed by a second extraction after 8–12 weeks; although effective, it requires at least two visits.

In Spain, a survey of clinical criteria showed that 82.5% of dentists opt for complete removal for deep caries, despite international studies and guidelines recommending the opposite. In addition, many professionals consider clinical symptoms (66%) as their main reference.

2. *Review of the best practices and evidence-based recommendations in Europe and Spain to help ensure that the dental treatment protocols are based on the latest research and knowledge in the field.*

International guidelines:

The International Caries Consensus Collaboration (ICCC, 2016) document supports selective removal of soft dentine for deep lesions in permanent teeth; SW is a valid alternative, while total removal is only recommended in superficial or moderate cases.

Systematic reviews find that SR significantly reduces pulp exposure and endodontic treatments, although with moderate evidence. In addition, it has better short-term success rates.

Clinical practice in Spain:

14-15% of professionals still resort directly to endodontics in cases of deep caries.

The use of pulp protection materials is diverse: Biodentine (38.9%), calcium hydroxide (26.8%), ionomer (21%) and MTA (11.8%).

For excavation, round burs with manual and chemical detectors are mainly used (~66%). The use of chemical-mechanical agents is not widespread.

3. *Review of the improvement areas evident from the literature.*

Gap between knowledge and practice

Although evidence supports RS/SW, the traditional approach persists in Spanish practice mainly due to:

- Lack of updates in clinical guidelines.
- The procedural comfort of more conventional methods.
- Technical uncertainty among students.

Students recognise the benefits but are unsure about how much dentine to leave. They also feel uncertain about pulp complications or secondary caries.

Need for effective continuing education.

In Spain, only 45.6% attended cariology courses in the last 5 years, although this has a positive influence on the use of vitality tests (OR = 3.8).

Inconsistent application of minimally invasive techniques

There are significant variations between years of practice and between educational centres on the use of RS/SW versus complete removal.

References

- **Title of the document:** Influence of Academic Training and Professional Experience on the Management of Deep Caries Lesions.
- **Journal:** Healthcare
- **Year of publication:** 2024
- **Authors:** Arroyo-Bote, S.; Ribas-Perez, D.; Bennasar Verges, C.; Rodriguez Menacho, D.; Villalva Hernandez-Franch, P.; Barbero Navarro, I.; Castaño Séiquer, A.
- **Link:** https://doi.org/10.3390/healthcare12191907

- **Extended summary:** Background/Objectives: Managing caries lesions that affect the inner third of the dentin is crucial to ensuring pulp vitality; the clinician must make decisions that will affect the vitality of the tooth. Our purpose is to understand the behavior of Spanish dentists in treating deep cavities and to examine whether variations exist based on their academic training and/or years of professional experience. Methods: This study was approved by the ethics committee of the Balearic Islands CEI-IB. A survey was conducted using the SurveyMonkey platform with 11 questions, the first 4 of which focused on defining the characteristics of the respondents. The following six concerned a clinical case of deep caries in tooth number 4.7, and the last regarded the opinion of the actual treatment of the case. The survey was sent by email in April 2022. The results were analyzed with the SPSS 29.0 program using the chi-square test. Results: A total of 347 responses were obtained (93.95%), and those surveyed stated that they apply minimal intervention concepts in their treatments, with 90.49% performing conservative dentistry treatments daily. A total of 56.48% of the respondents had bachelor's degrees, 12.39% had graduated, 33.14% had a postgraduate degree, 38.90% had a master's degree, and 17% had a doctorate. Most (40.63%) had been in professional practice for 16–30 years. Conclusions: Significant differences were identified regarding years of professional experience in terms of decision-making in methods of treatment and the choice of materials used for pulp protection. Likewise, significant differences were found regarding the academic training of the respondents, the cavity cleaning method selected, and the use of chemical substances for removing carious dentin. We can conclude that academic training and years of professional practice influence decision-making at some points in treating deep caries lesions.

- **Title of the document:** Criteria and treatment decisions in the management of deep caries lesions: Is there endodontic overtreatment?
- **Journal:** Journal of Clinical and Experimental Dentistry

- **Year of publication:** 2018
- **Authors:** Crespo-Gallardo I, Hay-Levytska O, Martín-González J, et al.
- **Link:** https://doi.org/10.4317/jced.55050
- **Extended summary:** A total of 288 dentists were contacted directly or by mail, and 125 (43%) were included in the study. Dentists were requested to answer a questionnaire about the routine approach to the diagnosis and treatment of DCLs. The evidence-based more conservative approach on the management of DCLs is not being translated to clinical dentistry. Root canal treatment is being indicated in cases of DCLs in which the diagnosis is reversible pulpitis. Likewise, it can be concluded that non-conservative management of DCLs, with endodontic overtreatment, could be occurring.

- **Title of the document:** Understanding dentists' management of deep carious lesions in permanent teeth: a systematic review and meta-analysis
- **Journal:** BMC
- **Year of publication:** 2016
- **Authors:** Falk Schwendicke* and Gerd Göstemeyer
- **Link:** https://doi.org/10.1186/s13012-016-0505-4
- **Extended summary:** This systematic review includes different countries. From 1728 articles, nine studies were included, all using quantitative methods. Four thousand one hundred ninety-nine dentists had been surveyed. The mean (95% CI) proportion of dentists using SE/SW for deep lesions was 53 % (44/62 %). More recent studies reported significantly higher proportions ($p < 0.05$). Reported estimates and thematic analysis found dentists' age and an understanding of the disease caries and the scientific rationale behind different removal strategies to affect dentists' behavior. Guidelines, peers, and the social and professional identity were further associated with the motivation of utilizing SE/SW. Environmental incentives, sanctions, or restrictions, mainly of financial but also regulatory character, impacted on decision-making, as did the specific indication

(the patient, the tooth) and the beliefs on how well different treatments perform. Around half of all dentists rejected evidence-based carious tissue removal strategies. A range of factors can be addressed for improving implementation.

- **Title of the document:** Managing Carious Lesions: Consensus Recommendations on Carious Tissue Removal.
- **Journal: A**dv Dent Res.
- **Year of publication:** 2016
- **Authors:** Schwendicke F, Frencken JE, Bjørndal L, Maltz M, Manton DJ, Ricketts D, Van Landuyt K, Banerjee A, Campus G, Doméjean S, Fontana M, Leal S, Lo E, Machiulskiene V, Schulte A, Splieth C, Zandona AF, Innes NP.
- **Link:** doi: 10.1177/0022034516639271.
- **Extended summary** The International Caries Consensus Collaboration undertook a consensus process and here presents clinical recommendations for carious tissue removal and managing cavitated carious lesions, including restoration, based on texture of demineralized dentine. Dentists should manage the disease dental caries and control activity of existing cavitated lesions to preserve hard tissues and retain teeth long-term. When a restoration is indicated, the priorities are as follows: preserving healthy and remineralizable tissue, achieving a restorative seal, maintaining pulpal health, and maximizing restoration success. Carious tissue is removed purely to create conditions for long-lasting restorations. For teeth with shallow or moderately deep cavitated lesions, carious tissue removal is performed according toselective removal to firm dentine.In deep cavitated lesions in primary or permanent teeth,selective removal to soft dentineshould be performed, although in permanent teeth,stepwise removalis an option. The evidence and, therefore, these recommendations support less invasive carious lesion management, delaying entry to, and slowing down, the restorative cycle by preserving tooth tissue and retaining teeth long-term.

- **Title of the document:** Dentists' perspectives on selective caries removal for the management of deep carious lesions in permanent teeth
- **Journal:** BMC Oral Health
- **Year of publication:** 2025
- **Authors:** Kettle, J., Marshman, Z., Hamilton, A. *et al.*
- **Link:** https://doi.org/10.1186/s12903-025-05699-8
- **Extended summary:** To explore the views of dentists participating in the Selective Caries Removal in Permanent Teeth (SCRiPT) randomised controlled clinical trial on selective caries removal versus complete or near complete caries removal for the management of deep carious lesions. Dentists' level of comfort with selective caries removal is multi-faceted and informed by contextual factors. SCRiPT has the potential to increase acceptance of selective caries removal, but the findings may not be interpreted in this way.

- **Title of the document:** Selective removal compared to complete removal for deep carious lesions.
- **Journal:** Medwave.
- **Year of publication:** 2020
- **Authors:** Verdugo-Paiva F, Zambrano-Achig P, Simancas-Racines D, Viteri-García A.
- **Link:** doi: 10.5867/medwave.2020.01.7758
- **Extended summary** Selective caries removal may decrease the need for root canal treatment and the risk of pulp exposure in teeth with deep caries, but the certainty of the evidence is low. It is not clear whether the selective removal of caries reduces the risk of appearance of signs and symptoms of pulp disease and the risk of restorations failure, as the certainty of the evidence is very low.

- **Title of the document:** Evidence-based strategies for the minimally invasive treatment of carious lesions: Review of the literature
- **Journal:** Advances in Clinical and Experimental Medicine
- **Year of publication:** 2023
- **Authors:** Rodrigo A. Giacaman, Cecilia Muñoz-Sandoval, Klaus W. Neuhaus, Margherita Fontana, Renata Chałas
- **Link:** doi: 10.17219/acem/77022
- **Extended summary:** Resulting in a high economic and biological cost, the traditional therapeutic approach to carious lesion management is still largely restorative. Minimally invasive (MI) treatment offers an attractive alternative to managing carious lesions in a more conservative and effective manner, resulting in enhanced preservation of tooth structure. Relevant literature was screened, and articles reporting randomized controlled trials or systematic reviews of strategies to manage non-cavitated or cavitated carious lesions in adults and children were included. For deep cavitated lesions, selective removal to soft dentin and/or stepwise excavation is supported by strong evidence. The use of the ART technique to restore cavitated lesions is also supported by strong evidence as a suitable strategy that has been used extensively in the literature concerning non-dental settings. Preservation of tooth structure through the use of MI treatment for both non-cavitated and cavitated lesions is supported by moderatestrong evidence, which supports the paradigm shift towards routine use of more conservative strategies in the treatment of carious lesions.

- **Title of the document:** Spanish Curriculum in Cariology for undergraduate dental students: Proceedings and consensus
- **Journal:** European Journal of Dental Education
- **Year of publication:** 2022
- **Authors:** Cortés-Martinicorena FJ, et al. Spanish Curriculum of Cariology Expert Group

- **Link:** DOI: 10.1111/eje.12706
- **Extended summary:** Cariology is today a broad-based discipline and in the Spanish university teaching field, all this knowledge is not unified in a curriculum. Therefore, the aim was to develop a consensus text based on the European Core Curriculum, updated, and adapted to the characteristics of the Spanish university environment.

  Materials and Methods: A Spanish Cariology Curriculum Group (SCCG) was set up with members of the Spanish Society of Epidemiology and Oral Public Health (SESPO), Spanish Society of Conservative and Aesthetic Dentistry (SEOC) and Spanish Society of Paediatric Dentistry (SEOP) and university experts to adapt the European Core Curriculum in Cariology for undergraduate dental students (ECCC) for Spain.

  The work was carried out online during 2018 and 2019, and also face-to-face meetings took place to obtain a draft curriculum open for discussion that was presented to all the Spanish universities. The final modifications to the document were specified in a Consensus Conference of Spanish universities offering a Degree in Dentistry that took place in Madrid on 19 November 2019. Results: Thirty-eight university experts, under SCCG supervision, participated in the elaboration of the new framework document.

  A total of 16 universities, from 23 invited, reached a consensus as to the contents of the Spanish Curriculum in Cariology for undergraduate dental students. This new Curriculum emphasises learning outcomes, uses a consensus-based terminology pertaining to caries and other hard-tissue conditions, and introduces a new domain of competence in Domain III of ECCC.

  Conclusion: This new Cariology Curriculum is the result of a very broad-based consensus of university experts in Spain and lays the foundation for the implementation of an integrated teaching of Cariology in Spain in adherence to Alliance for a Caries Free Future (ACFF) objectives.

Conclusion:

Current evidence strongly supports selective caries removal (SR) as the preferred approach for managing deep carious lesions in permanent teeth, as it preserves pulpal vitality and reduces the need for endodontic treatment. In Spain, despite growing awareness of minimally invasive techniques, clinical practice still often reflects traditional approaches—largely due to inconsistent training and a lack of standardized protocols.

This highlights a critical need for **a unified, evidence-based protocol across Europe,** particularly within **undergraduate dental education.** The integration of such a protocol would ensure that all dental students, regardless of country, receive consistent, high-quality instruction in the principles and application of SR.

Standardizing these competencies at the European level would help bridge the gap between research and clinical practice, reduce variability in care, and ultimately improve long-term outcomes for patients. **developing and implementing a Europe-wide educational protocol on selective caries removal** is essential to modernize dental curricula, promote evidence-based care, and ensure the next generation of dentists is equipped with the knowledge and confidence to adopt minimally invasive practices.

VITAL PULP TREATMENT PROTOCOLS

By José Luis Sanz, María Melo, James Ghilotti, Carmen Llena, Leopoldo Forner, Universitat de València, Spain

Presentation:

This document contains the results of a literature review focused on understanding knowledge and practices on dental treatment protocols that researchers at Universitat de València plan to standardise, including those published by professional organisations, government agencies, and academic institutions in Spain. The reviewed literature covers documents from the last 15 years. While it provides a general overview of European Union or nation-wide best practice studies conducted across Europe to reflect the European perspective, the literature review mostly focuses on documents produced in Spain. The literature includes studies published in English and Spanish.

According to the structure proposed in the application form, this review is made up of three sections:

1. An overview of the dental treatment protocols in Europe and Spain.
2. Review of the best practices and evidence-based recommendations in Europe and Universitat de València to help ensure that the dental treatment protocols are based on the latest research and knowledge in the field
3. Review of the improvement areas evident from the literature. (Regarding the education of DTPs)

1. An overview of the dental treatment protocols in Europe and Spain.

In Spain, the current protocols for Vital Pulp Treatment (VPT) are encompassed within the recommendations from the European Society of Endodontology (ESE). The ESE recently published a series of Position Statements and S3 Level Clinical Practice Guidelines for this purpose. In brief, VPT appears as a suitable alternative to Root Canal Treatment (RCT) for the preservation of pulp vitality in reversibly affected teeth due to the presence of deep carious

lesions. VPT involves the chemical-mechanical disinfection of the carious lesions in a selective manner, removing any infected tissue and preserving affected tissue with a predictable regenerative/reparative potential.

In the event of pulp exposure, attending to a thorough preoperative and intraoperative diagnosis of the pulp's inflammatory status, the removal of the irreversibly affected pulp tissue and preservation of the reversibly affected pulp tissue is recommended. The different treatment approaches within VPT are classified according to the extension of the pulp tissue removal, as follows: direct pulp capping (no o minor pulp tissue removal), partial pulpotomy (removal of part of the coronal portion of the pulp tissue), and coronal or full pulpotomy (total removal of the coronal pulp tissue). The decision of the extension of the pulpotomy will be based on a series of preoperative and intraoperative criteria, namely the patient's symptoms, clinical signs, radiographic signs, and potential haemostasis of the affected pulp tissue. In order to preserve the reversibly affected pulp tissue, the placement of a pulp capping agent is recommended. This agent should at least be biocompatible, meaning that it should be capable of being placed in direct contact with the affected tissue and allow its normal functioning without disruption of its physiological processes. Ideally, this agent should also be bioactive, meaning that it should be capable of forming a mineral attachment to the mineralized portion of the tissue substate via an ionic interchange and, parallelly, be able to induce a favourable response from the tissue's cells with regenerative potential i.e. stem cells. Lastly, an immediate restoration of the cavity resulting from the carious lesion removal is recommended.

2. *Review of the best practices and evidence-based recommendations in Europe and Universitat de València to help ensure that the dental treatment protocols are based on the latest research and knowledge in the field*

Diagnosis and treatment plan

According to the classical classification of pulp inflammation from the American Association of Endodontists (AAE) from 2009:

- Reversible Pulpitis: The preferred treatment is vital pulp therapy.

- Irreversible Pulpitis (symptomatic or asymptomatic) and Pulp Necrosis: The treatment of choice is root canal therapy.

In contrast, the 2017 classification by Wolters et al. provides a more comprehensive approach. This classification does not allow for a preoperative treatment plan but instead relies on evaluating preoperative signs and symptoms along with intraoperative findings. This assessment follows the logic of selective caries removal, where the clinician determines the specific modality of vital pulp therapy intraoperatively, considering the severity of the deep caries lesion and the characteristics of the remaining dentin-pulp tissue.

Preoperatively, the clinician can establish a tentative treatment plan as follows:

- Initial or Mild Pulpitis: It is likely unnecessary to access the pulp chamber, and indirect pulp protection can be applied.
- Moderate or Severe Pulpitis: Access to the pulp chamber is necessary, and if viable pulp tissue remains, direct pulp protection should be performed. If not, root canal therapy is indicated.

Intraoperatively, the clinician will decide among the following vital pulp therapy modalities: indirect pulp capping, direct pulp capping, partial pulpotomy, or coronal pulpotomy. If vital pulp therapy is contraindicated, root canal therapy is indicated. The diagnostic criteria and characteristics of each vital pulp therapy modality will be detailed subsequently.

Vital Pulp Treatment procedure

Preparation of the Operating Field

The European Society of Endodontology (ESE) emphasizes the necessity of isolating the operating field with a rubber dam to ensure optimal aseptic conditions. They also recommend applying a disinfectant agent to the surface of the operating field. Furthermore, performing the entire procedure under magnification is advised to enhance precision and outcomes.

Chemical-Mechanical Disinfection of the Lesion

Selective Caries Removal: The ESE advocates for selective caries removal rather than complete (non-selective) removal. This approach aims to preserve healthy dentin and avoid pulp exposure, which is considered a negative prognostic factor.

Mechanical Disinfection:

- Remove carious tissue from the periphery to the centre of the lesion.
- In the lesion's periphery, eliminate carious tissue until hard dentin is reached.
- At the lesion's centre, remove carious tissue until firm or leathery dentin is encountered.

Chemical Disinfection and Haemostasis (in case of pulp exposure):

- Apply 0.5–2.5% sodium hypochlorite or 0.2–2% chlorhexidine using a sterile cotton pellet to the lesion's surface.

Intraoperative Pulp Diagnosis and Final Treatment Plan

In managing deep carious lesions, the final treatment plan is determined after visual inspection and manipulation of the remaining dentin-pulp tissue following chemical-mechanical disinfection. Based on definitions from the European Society of Endodontology (ESE) and available evidence, the following treatment modalities are considered:

- Direct Pulp Capping: After ensuring haemostasis and aseptic conditions, application of a biomaterial directly onto the exposed pulp surface, prior to immediate placement of a definitive restoration.
- Partial Pulpotomy: Removal of a portion of the coronal pulp tissue after exposure, followed by application of a biomaterial directly onto the remaining pulp surface, prior to immediate placement of a definitive restoration.
- Coronal Pulpotomy: Removal of all coronal pulp tissue after exposure, followed by application of a biomaterial directly onto the pulp surface at the root canal orifice(s), prior to immediate placement of a definitive restoration.

- Pulpectomy: Complete removal of pulp tissue from the root canal system, followed by root canal treatment and placement of a definitive restoration.

The goal of pulp protection is to provide an environment conducive to repair and/or regeneration. Biocompatible materials that support the physiological function of living tissues upon contact and bioactive materials that induce a favourable response are utilized.

Pulp exposure

Direct pulp capping, partial pulpotomy, full coronal pulpotomy, aims to maintain the remaining pulp tissue with repair and/or regenerative potential and stimulate the formation of a dentin bridge beneath the lesion. The extent of pulp removal depends on intraoperative signs of pulp inflammation and the ability to achieve haemostasis with pressure. it should be possible to obtain an adequate haemostasis of the remaining pulp tissue by applying a sterile cotton pellet with a disinfectant (sodium hypochlorite or chlorhexidine) to its surface and pressing for up to 5 minutes.

If adequate haemostasis is not obtained, a larger amount of pulp tissue should be removed. After haemostasis is achieved, a bioactive material is placed directly on the exposed pulp to promote dentin bridge formation.

For dentin bridge formation or mineralized barrier, migration and differentiation of local progenitor cells into neo-odontoblasts are required. Therefore, biocompatible and bioactive biomaterials that stimulate ionic exchange with the environment to form mineralized tissue and favour migration and differentiation of local progenitor cells are essential. According to ESE recommendations and available evidence, hydraulic calcium silicate cements are the preferred materials for this purpose.

These biomaterials are biocompatible and bioactive, capable of forming calcium hydroxide as a byproduct of their hydraulic setting. Thus, they possess the advantages of traditional calcium hydroxide (high pH, antimicrobial properties, and ion release related to mineralization) but, unlike it, remain stable over time.

The definitive restoration

After biomaterial placement and setting/curing, the ESE recommends immediate definitive restoration of the deep caries lesion. This recommendation is justified by several long-term studies showing that, in contrast to temporisation and delayed final restoration, the placement of an immediate definitive restoration is a strong predictor of a higher success rate.

The advantages of immediate final restoration include prevention of microleakage, protection of the biomaterial and reduction of postoperative sensitivity and thermal conductivity. However, they specify that the clinician must use judgement to consider the absence of signs, symptoms and susceptibility of the treated tooth to fracture to analyse whether it is a candidate for immediate definitive restoration to vital pulp treatment.

Follow-up and prognosis

ESE recommends clinical and radiographic follow-up at 6 months and 12 months after treatment. If symptoms persist and there is uncertainty regarding healing, follow-up should be continued at regular intervals.

The tooth treated with vital pulp treatment should respond positively to cold sensitivity tests, if its characteristics allow it (presence of calcifications, restorations, etc.); except in the case of teeth treated by coronal pulpotomy.

The patient should not report pain or other symptoms. There should be no signs of periapical pathology or root resorption. In the case of immature teeth, a continuation of tooth formation should be observed. Success is defined as the maintenance of pulp vitality after at least one year. Currently, this success rate is between 80 and 90% according to the available evidence.

Review of the improvement areas evident from the literature.

Available protocols establish a series of recommendations regarding the diagnosis, treatment plan, execution and follow-up of vital pulp treatments. However, there are still “gray” areas with regards to specific details, as follows:

- There is no consensus regarding vital pulp treatment in teeth diagnosed with “irreversible pulpitis”. The literature is starting to include clinical studies in this regard, but no evidence-based consensus has been reached.
- The optimal concentrations of chemical agents for the disinfection of deep carious lesions (i.e. sodium hypochlorite or chlorhexidine) have not been established.
- The recommended maximum time to achieve haemostasis of pulp exposures in order to protect the remaining pulp tissue has not been established. Only a range is provided among available evidence, ranging from 1 minute to 10 minutes.

Conclusion

Vital pulp treatment appears as a viable alternative to root canal treatment to achieve the maintenance of pulp vitality in teeth with deep carious lesions with reversible pulp inflammatory stages. Available international protocols establish recommendations regarding the diagnosis, treatment plan, execution and follow-up of vital pulp treatments. However, there is still room for investigation in this field.

References

- **Title of the document**: European Society of Endodontology position statement: Management of deep caries and the exposed pulp
- **Journal**: International Endodontic Journal
- **Year of publication:** 2019
- **Authors**: Duncan, H.F.; Galler, K.M.; Tomson, P.L.; Simon, S.; El-Karim, I.; Kundzina, R.; Krastl, G.; Dammaschke, T.; Fransson, H.; Markvart, M.; Zehnder, M.; Bjørndal, L.
- **Link**: https://doi.org/10.1111/iej.13080
- **Extended summary**: Background/Objectives: This position statement from the European Society of Endodontology (ESE) addresses the management of deep caries and pulp exposure, with the objective of promoting evidence-based clinical decision-making to preserve pulp vitality where possible. It emphasizes the shift from traditional, invasive treatments toward biologically based strategies that consider the pulp's healing potential. Methods: The statement was developed through consensus by a panel of experts in endodontics and is grounded in a critical review of the current literature. It outlines clinical indications, treatment principles, and procedural steps for vital pulp therapies including indirect pulp capping, direct pulp capping, and pulpotomy. Results: The document supports a minimally invasive approach, advocating for vital pulp therapy over root canal treatment when feasible. It stresses the importance of accurate diagnosis, appropriate case selection, aseptic technique, use of biocompatible materials (such as calcium silicate cements), and high-quality coronal restoration. Conclusions: The ESE recommends vital pulp therapy as a first-line approach in the

management of deep caries and exposed pulps in permanent teeth with a normal or reversible pulp status. Adoption of these biologically based protocols can enhance outcomes, reduce overtreatment, and preserve tooth vitality.

- **Title of the document**: Treatment of pulpal and apical disease: The European Society of Endodontology (ESE) S3-level clinical practice guideline
- **Journal**: International Endodontic Journal
- **Year of publication:** 2023
- **Authors**: Duncan, H.F.; Kirkevang, L.L.; Peters, O.A.; El-Karim, I.; Krastl, G.; Del Fabbro, M.; Chong, B.S.; Galler, K.M.; Segura-Egea, J.J.; Kebschull, M.; ESE Workshop Participants and Methodological Consultant
- **Link**: https://doi.org/10.1111/iej.13974
- **Extended summary**: Background/Objectives: This S3-level clinical practice guideline from the European Society of Endodontology (ESE) aims to standardize and improve the management of pulpal and apical diseases in permanent teeth, using a rigorous evidence-based methodology. It focuses on enhancing patient care by guiding clinicians in selecting appropriate diagnostic and therapeutic strategies. Methods: Developed through a structured consensus process involving a multidisciplinary expert panel and a methodological consultant, the guideline follows the AGREE II and GRADE frameworks. It includes systematic reviews, stakeholder input, and strength-of-evidence assessments. Topics addressed range from diagnosis to treatment planning, vital pulp therapy, root canal treatment, and surgical endodontics. Results: The guideline provides clear recommendations for clinical practice based on the strength of evidence and benefit-risk assessments. It supports minimally invasive, biologically oriented treatments when appropriate and highlights the importance of aseptic technique, advanced diagnostic tools, and adequate restoration in achieving successful outcomes. Conclusions: The ESE guideline offers clinicians a comprehensive, evidence-based framework for the management of pulpal and apical disease,

promoting effective, predictable, and patient-centered endodontic care. It encourages individualized treatment planning and the integration of the latest scientific knowledge into daily practice.

- **Title of the document**: Present status and future directions – Vital pulp treatment and pulp preservation strategies
- **Journal**: International Endodontic Journal
- **Year of publication:** 2022
- **Author**: Duncan, H.F.
- **Link**: https://doi.org/10.1111/iej.13688
- **Extended summary**: Background/Objectives: This narrative review explores current concepts and future perspectives in vital pulp treatment (VPT), emphasizing strategies for preserving pulp tissue in teeth affected by caries or trauma. The aim is to shift the clinical mindset from traditional root canal therapy toward biologically based, pulp-preserving approaches whenever feasible. Methods: The paper synthesizes recent literature and clinical guidelines, with a focus on case selection, pulp diagnosis, materials (especially calcium silicate-based cements), and techniques such as indirect/direct pulp capping and pulpotomy. It discusses biological rationale, success factors, and clinical challenges associated with VPT. Results: Vital pulp therapy shows high clinical success rates when proper case selection and technique are applied. Biocompatible materials like MTA and Biodentine have significantly improved treatment outcomes. The review highlights the importance of early intervention, accurate diagnosis, and the use of aseptic techniques and high-quality restorations. Conclusions: VPT represents a reliable and less invasive alternative to root canal treatment for many cases with vital pulps. The future of endodontics lies in preserving pulp vitality through evidence-based, biologically sound interventions. Ongoing research and innovation will continue to refine clinical protocols and improve outcomes in pulp preservation.

- **Title of the document**: Disclosing the physiology of pulp tissue for vital pulp therapy
- **Journal**: International Endodontic Journal
- **Year of publication:** 2018
- **Authors**: da Rosa, W.L.O.; Piva, E.; da Silva, A.F.
- Link: https://doi.org/10.1111/iej.12906
- **Extended summary**: Background/Objectives: This review aims to provide a comprehensive understanding of pulp tissue physiology to inform and enhance the rationale behind vital pulp therapy (VPT). Emphasis is placed on the biological characteristics of the pulp that support healing and regeneration, particularly in response to conservative treatments. Methods: The authors conducted an extensive review of the literature concerning the structural and functional aspects of the dental pulp, including its immune responses, cellular composition, vascularization, and regenerative capacity. The discussion integrates these biological principles with clinical implications for VPT. Results: The pulp possesses a remarkable capacity for repair and defense, mediated by odontoblasts, stem cells, and immune components. The success of VPT depends on understanding these mechanisms, selecting cases with reversible inflammation, and using bioactive materials that support healing. Proper sealing and asepsis are also essential. Conclusions: A deep understanding of pulp physiology enhances clinical decision-making and supports the use of vital pulp therapies. Recognizing the pulp's inherent potential for healing can promote minimally invasive approaches that preserve tooth vitality and function.

- **Title of the document**: Management of deep caries and the exposed pulp
- **Journal**: International Endodontic Journal
- **Year of publication:** 2019

- **Authors**: Bjørndal, L.; Simon, S.; Tomson, P.L.; Duncan, H.F.
- **Link**: https://doi.org/10.1111/iej.13128
- **Extended summary**: Background/Objectives: This review addresses current clinical and biological perspectives on the management of deep caries and pulp exposure. It aims to clarify decision-making pathways that help clinicians determine when and how to preserve pulp vitality through conservative therapies. Methods: The article synthesizes contemporary research findings, consensus reports, and clinical experience regarding caries progression, pulp diagnosis, and outcomes of various vital pulp therapy (VPT) modalities. It discusses the biological basis for maintaining pulp health and healing capacity. Results: Vital pulp therapies, including indirect and direct pulp capping as well as partial and full pulpotomies, are shown to be effective when applied to teeth with reversible pulpitis or minimal inflammation. Treatment success is strongly influenced by accurate diagnosis, aseptic technique, effective hemorrhage control, and the use of biocompatible materials such as calcium silicate-based cements. Conclusions: Preserving pulp vitality is a viable and often preferable approach to managing deep caries and exposed pulps. The review encourages a shift from invasive procedures toward biologically guided, conservative treatments based on sound clinical criteria and a deep understanding of pulp biology.

- **Title of the document**: Minimally invasive endodontics: a new diagnostic system for assessing pulpitis and subsequent treatment needs
- **Journal**: International Endodontic Journal
- **Year of publication:** 2017
- **Authors**: Wolters, W.J.; Duncan, H.F.; Tomson, P.L.; El-Karim, I.; McKenna, G.; Dorri, M.; Stangvaltaite, L.; van der Sluis, L.W.M.
- **Link**: https://doi.org/10.1111/iej.12793
- **Extended summary**: Background/Objectives: This paper proposes a new diagnostic framework to guide clinical decision-making in endodontics, with a

focus on minimally invasive approaches for managing pulpitis. The aim is to align diagnosis with treatment strategies that preserve pulp vitality wherever possible. Methods: A narrative review and expert consensus led to the development of a novel diagnostic system. The proposed classification refines existing diagnostic categories by integrating clinical signs, symptoms, and biological understanding of pulp disease progression. Results: The system offers updated terminology and diagnostic distinctions that more accurately reflect the reversible and irreversible nature of pulp inflammation. This framework supports the use of vital pulp therapies—such as pulp capping and pulpotomy—in cases traditionally treated with root canal therapy. Conclusions: Accurate diagnosis is essential for selecting minimally invasive, biologically sound treatments. The proposed system enhances clinical decision-making by encouraging pulp preservation in cases of early or moderate pulpitis, contributing to a paradigm shift in endodontic treatment philosophy.

- **Title of the document**: Vital pulp therapy in permanent mature posterior teeth with symptomatic irreversible pulpitis: A systematic review of treatment outcomes
- **Journal**: Medicina (Kaunas)
- **Year of publication:** 2021
- **Authors**: Santos, J.M.; Pereira, J.F.; Marques, A.; Sequeira, D.B.; Friedman, S.
- **Link**: https://doi.org/10.3390/medicina57060573
- **Extended summary**: Background/Objectives: This systematic review evaluates the clinical outcomes of vital pulp therapy (VPT) in mature permanent posterior teeth diagnosed with symptomatic irreversible pulpitis—traditionally considered a contraindication for conservative approaches. The objective is to assess whether VPT is a viable alternative to root canal treatment in these cases. Methods: A systematic search of databases was conducted to identify clinical studies reporting on the success of VPT procedures—such as pulpotomy and pulp capping—in teeth with clinical signs of irreversible pulpitis. Studies were critically

appraised, and outcome data were synthesized to determine treatment success rates. Results: The findings demonstrate that VPT can yield high success rates in mature permanent posterior teeth with symptomatic irreversible pulpitis, particularly when using biocompatible materials like MTA and Biodentine. Pain relief and long-term retention of pulp vitality were common outcomes, with several studies reporting success rates comparable to root canal therapy. Conclusions: Vital pulp therapy may be a successful and less invasive treatment option for cases previously considered unsuitable for pulp preservation. These results challenge conventional diagnostic thresholds and support a re-evaluation of treatment strategies for inflamed pulps in mature teeth.

PROTOCOLS FOR DIAGNOSING AND MANAGING MUSCLE-RELATED TEMPOROMANDIBULAR DISORDERS (TMDS)

By Giuseppe Alessandro Scardina and Salvatore Nigliaccio by Università degli Studi di Palermo, M.E.PRE.C.C., Odontostomatology U.O., Italy

Presentation:

This document contains the results of a literature review focused on understanding knowledge and practices on dental treatment protocols that researchers at Università degli Studi di Palermo plan to standardise, including those published by professional organisations, government agencies, and academic institutions in Italy. The reviewed literature covers documents from the last 15 years. While it provides a general overview of European Union or nation-wide best practice studies conducted across Europe to reflect the European perspective, the literature review mostly focuses on documents produced in Italy. The literature includes studies published in English and Italian.

According to the structure proposed in the application form, this review is made up of three sections:

1. An overview of the dental treatment protocols in Europe and Italy;
2. Review of the best practices and evidence-based recommendations in Europe and Italy to help ensure that the dental treatment protocols are based on the latest research and knowledge in the field
3. Review of the improvement areas evident from the literature. (Regarding the education of DTPs)

A similar strategy was used in each of the sub-topics of the literature review addressed in sections 1, 2 and 3 as follows.

Section 1

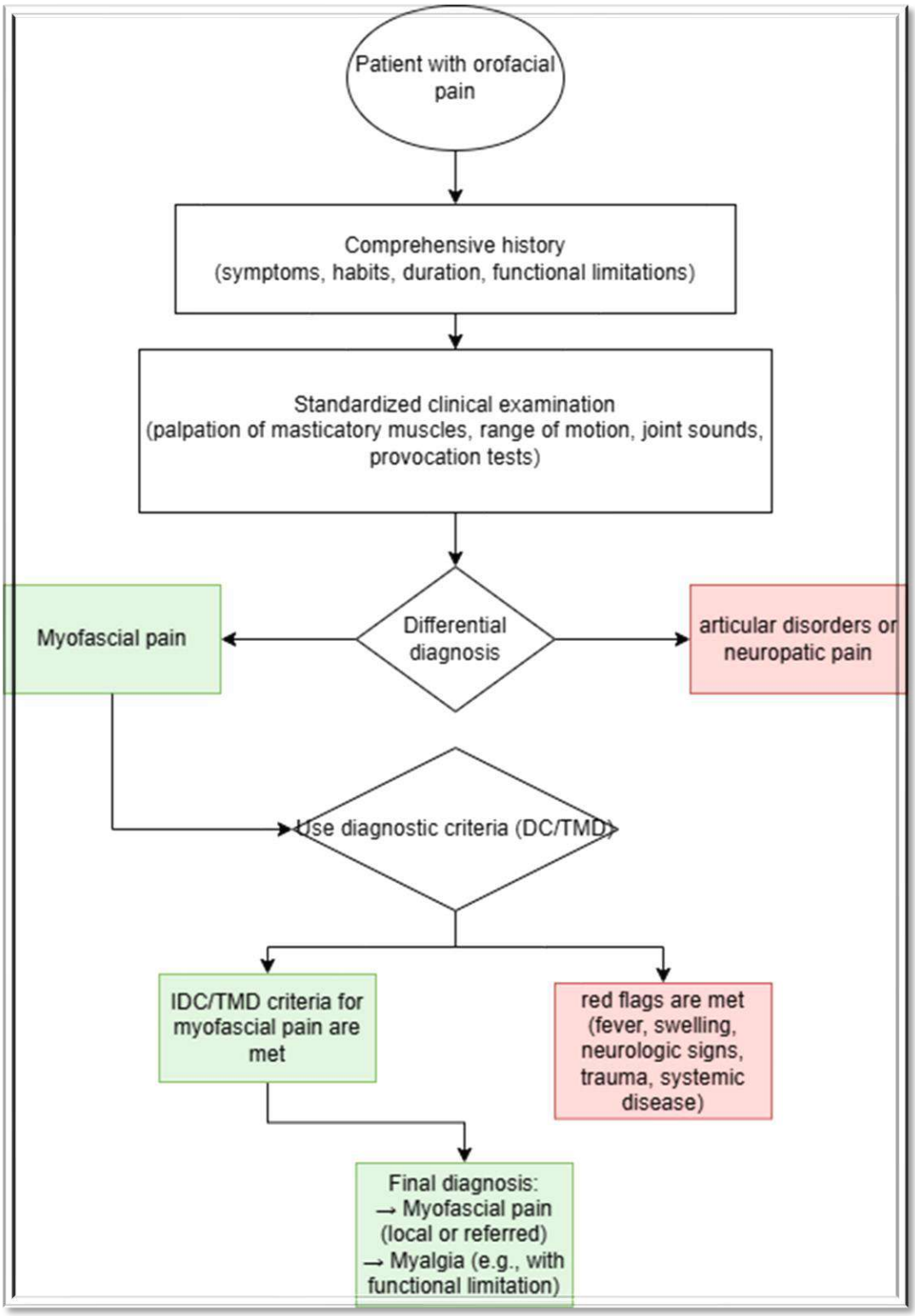
This section provides an overview of existing dental treatment protocols, specifically focusing on the diagnosis and management of myogenic temporomandibular disorders (TMDs), both in Italy and across Europe. Given the high prevalence and significant impact of TMDs on patients' quality of life, standardized and evidence-based protocols are crucial to ensure effective and consistent care.

In Italy, national clinical recommendations, such as those published by the Ministry of Health, serve as foundational documents aimed at standardizing odontostomatological practice. While these guidelines provide essential principles, it is important to note that the existing Italian protocols for TMDs, last updated in 2017, may present limitations in terms of their specificity and currentness when compared to the rapidly evolving body of scientific evidence and more detailed international consensus papers.

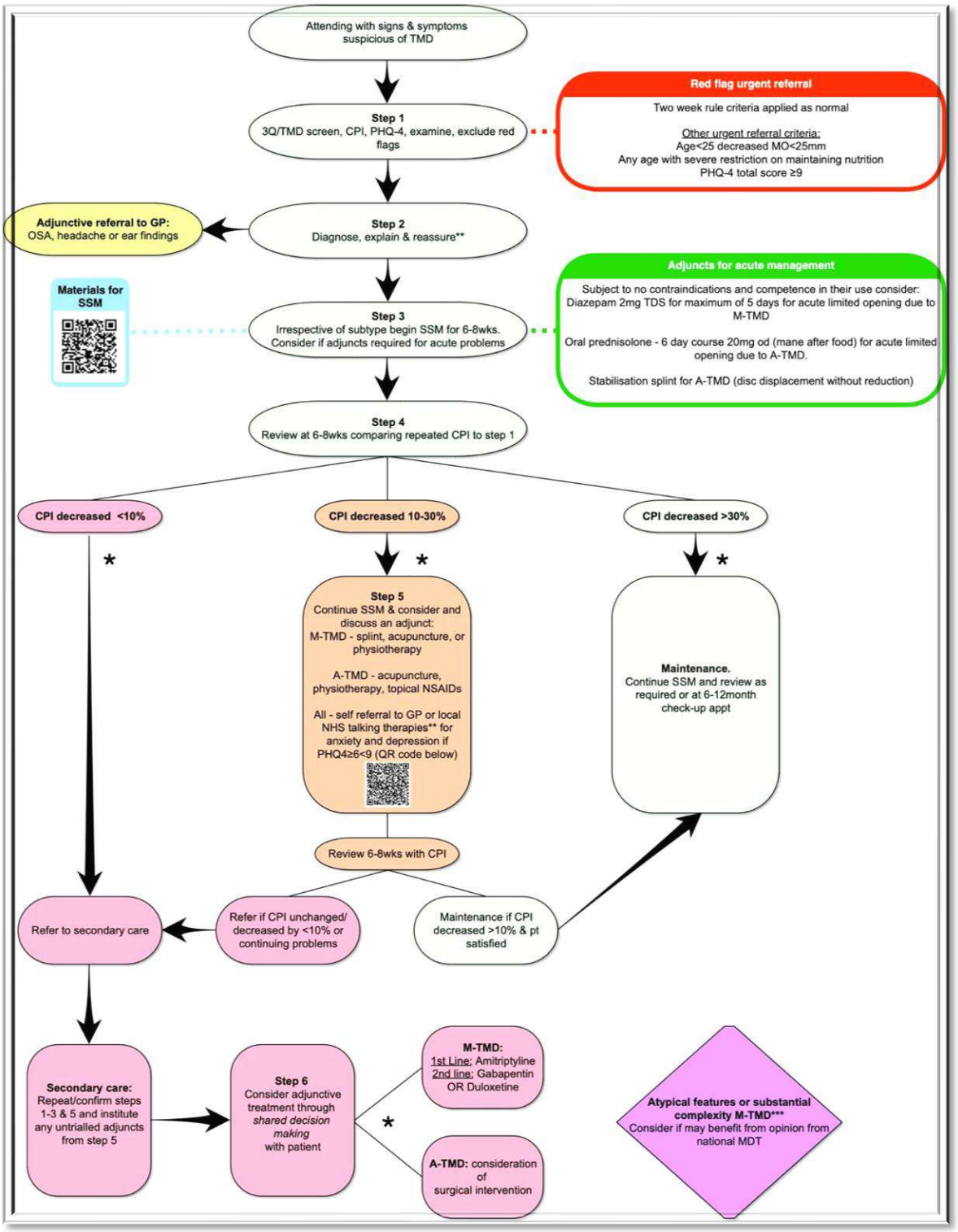
Several European and international organizations have contributed to the standardization of clinical protocols for the management of temporomandibular disorders of muscular origin. Notably, the International Network for Orofacial Pain and Related Disorders Methodology (INfORM) in collaboration with the International Association for Dental Research (IADR) has published key points for good clinical practice based on the current standard of care. Similarly, the National Health Service (NHS) England, through its Getting It Right First Time (GIRFT) programme and the Royal College of Surgeons' Faculty of Dental Surgery, has developed clinical guidelines specifically addressing the management of painful TMDs in adults.

These documents emphasize a conservative, stepwise, and biopsychosocial approach to the diagnosis and treatment of myogenic TMDs. They prioritize accurate clinical assessment, patient education, behavioral strategies, and physical therapies, while advising against irreversible procedures such as occlusal adjustments or pharmacologic injections. The consistency between these recommendations reinforces the adoption of non-invasive, evidence-based protocols across Europe.

Diagnostic pathway for myogenic TMD



Evidence based TMD care pathway



NHS England & Royal College of Surgeons of England. Management of painful temporomandibular disorder in adults – Comprehensive guideline. March 2024. Figure 3: Evidence-based TMD care pathway.

Section 2

Best Practices and Evidence-Based Recommendations

In this section we will analyze the best practices regarding diagnosis and treatments for muscolary TMDs.

Standardized Diagnostic Approach

1. Patient History
    - Key components:
        - Onset, duration, and progression of symptoms (e.g., pain, clicking, limited jaw movement).
        - Pain characteristics (location, intensity, triggers, alleviating factors).
        - History of trauma, parafunctional habits (e.g., bruxism), or systemic conditions (e.g., fibromyalgia, migraines).
        - Psychosocial factors (stress, anxiety, depression).
2. Clinical Examination
    - Physical assessment:
        - Palpation of masticatory muscles (masseter, temporalis, lateral pterygoid) and TMJ for tenderness or hypertrophy.
        - Evaluation of jaw range of motion (opening, lateral excursions, protrusion).
        - Auscultation for joint sounds (clicking, crepitus).
    - Functional tests:

- Provocation tests to reproduce symptoms (e.g., clenching, resisted movements).

3. Diagnostic Criteria

The Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) is the gold standard, classifying TMD into:

1. Myogenous TMD: Primary muscle pain (e.g., myalgia, myofascial pain).
2. Arthrogenous TMD: Joint-related disorders (e.g., disc displacement, osteoarthritis).
3. Combined TMD: Mixed muscle and joint involvement.

Example diagnoses:

- "Myogenous TMD affecting bilateral masseters, comorbid with tension-type headaches."
- "Arthrogenous TMD with disc displacement without reduction, comorbid with sleep dysfunction."

4. Adjunctive Diagnostics
   - Imaging: MRI for soft tissue evaluation (e.g., disc position); CBCT for bony changes.
   - Psychosocial screening: Tools like PHQ-9 or GAD-7 to assess comorbid anxiety/depression

Best Practices in Management

1. Conservative Therapies (First-Line)
   - Patient education:
     - Reassurance about benign nature of TMD.
     - Behavioral modifications (e.g., stress management, habit reversal).

5. Pharmacotherapy:

    - NSAIDs (short-term for pain/inflammation).
    - Muscle relaxants (e.g., cyclobenzaprine for acute myalgia).
    - Low-dose antidepressants (e.g., amitriptyline for chronic pain).
6. Physical therapies:
    - Jaw exercises (e.g., controlled opening/stretching).
    - Manual therapy (e.g., mobilization, trigger point release).
    - Thermal modalities (heat/cold packs).
7. Occlusal Appliances
    - **Stabilization splints**: Flat-plane splints for myogenous TMD (evidence grade: moderate).
    - **Anterior bite splints**: For disc displacement with reduction.
    - Avoid irreversible occlusal adjustments.
8. Interdisciplinary Care
    - **Psychological support**: CBT for pain catastrophizing or sleep disturbances.
    - **Collaboration with specialists**: Rheumatology (for systemic arthritis), neurology (for migraines).
9. Surgical Interventions (Last Resort)
    - Indications: Refractory joint pathology (e.g., advanced osteoarthritis).
    - Options: Arthrocentesis, arthroscopy, open joint surgery

Section 3

The field of temporomandibular disorder management finds itself at a crossroads, where despite decades of research and clinical experience, significant challenges persist that hinder optimal patient care. One of the most pressing issues remains the lack of standardized diagnostic protocols across different clinical settings and geographical regions. In daily practice, we still encounter clinicians who rely heavily on subjective clinical impressions rather than adopting evidence-based frameworks like the DC/TMD criteria. This inconsistency in diagnostic approaches inevitably leads to variability in treatment outcomes and makes comparative research challenging.

Another critical gap lies in the underappreciation of psychosocial comorbidities in TMD patients. While the research literature consistently demonstrates the strong association between TMD symptoms and factors like chronic stress, anxiety disorders, and sleep disturbances, these elements often receive inadequate attention in clinical practice. Many treatment plans still focus predominantly on the mechanical aspects of TMD without adequately addressing the psychological components that may be driving or perpetuating the condition. This oversight is particularly problematic for patients with chronic TMD presentations, where the biopsychosocial model should ideally form the cornerstone of management.

Technological Advancements: The Promise and Challenges of EMG Monitoring

The emergence of innovative diagnostic technologies, particularly portable EMG devices represents a significant leap forward in our ability to understand and manage TMD-related muscle activity. These ambulatory monitoring systems offer several distinct advantages over traditional assessment methods:

1. **Comprehensive Activity Profiling**: Unlike single-point clinical assessments or even polysomnography, these devices provide continuous 24-hour monitoring of masseter muscle activity, capturing both awake and sleep bruxism patterns in the patient's natural environment.
2. **Quantitative Metrics**: The development of indices like the Bruxism Work Index (BWI) and Bruxism Time Index (BTI) moves us beyond simple event counting to more meaningful measures of actual muscle workload and temporal patterns.
3. **Clinical Correlation**: By correlating EMG findings with patient-reported symptoms and clinical examination, we can develop more personalized treatment strategies. For instance, a patient presenting with morning masticatory muscle pain might show elevated BTI during sleep phases, suggesting sleep bruxism as a contributing factor.

However, the integration of these technologies into routine practice faces several barriers:

- Cost and Accessibility: Currently, these advanced monitoring systems remain relatively expensive and may not be readily available in all clinical settings.
- Interpretation Challenges: Clinicians require specific training to properly interpret the complex data these devices generate, and there's a need for more established normative values for comparison.
- Validation Needs: While preliminary studies like the Dia-BRUXO research show promise, larger validation studies across diverse patient populations are still needed.

Educational Reform: The current state of TMD education reveals alarming gaps across international dental curricula. Both the European Academy of Craniomandibular Disorders (EACD) and American Academy of Orofacial Pain (AAOP) identify a critical mismatch between the high prevalence of TMDs (affecting 20-40% of the population) and the inadequate training provided to dental students. This educational deficit manifests clinically as underdiagnosis, misdiagnosis, or inappropriate biomechanical interventions that ignore the biopsychosocial model now recognized as essential for effective TMD care.

1. A Unified Framework for TMD Education

Building on both EACD and AAOP guidelines, dental curricula should implement these core enhancements:

2. Integrated Basic Science Teaching
    - *Early curriculum integration*: Teach masticatory system anatomy and physiology with emphasis on functional relationships and dysfunction pathways.

- *Pain neuroscience modules*: Specific focus on orofacial nociception mechanisms and central sensitization.
- *Psychosocial components*: Stress-symptom cycles, anxiety-pain interactions, and sleep disturbance correlations.

3. Clinical Skills Development
    - Hands-on training in:
        - DC/TMD examination protocols (muscle palpation, joint auscultation, mandibular movement analysis).
        - Differential diagnosis from dental/orofacial pain conditions.
        - Basic management strategies (occlusal appliance adjustment, physical therapy referrals).
4. Multidisciplinary Perspective
    - *Collaborative teaching* with psychologists, physiotherapists, and sleep specialists.
    - *Referral pathway training*: When and how to consult orofacial pain specialists.

Despite CODA's 2020 mandate (US) and EACD recommendations (Europe), adoption faces challenges:

- Faculty knowledge gaps: Prioritize DC/TMD certification programs for educators.
- Curricular constraints: Integrate TMD topics vertically (e.g., discuss TMD risks during restorative courses).
- Lack of clinical exposure: Use standardized patient encounters with TMD case simulations.

References

Future directions: Develop international competency standards and open-access teaching resources to bridge these gaps.

First title: Diagnosis and Management Protocols for Muscle-Related Temporomandibular Disorders (TMDs)

- **Title of the document** RACCOMANDAZIONI CLINICHE IN ODONTOSTOMATOLOGIA
- **Journal:** MINISTERO DELLA SALUTE
- **Year of publication:** 2017
- **Authors:** Working Group established within the Technical Coordination Table for Dentistry
- **Link:** https://www.salute.gov.it/imgs/C_17_pubblicazioni_2637_allegato.pdf
- **Extended summary** This official document by the Italian Ministry of Health serves as a foundational reference for clinical practice across various fields of odonto- stomatology in Italy. Specifically, Section V (pages 201-209) is dedicated to "Disordini Temporo Mandibolari (DTM) e Dolore Orofacciale (DOF)," which encompasses the field of Gnathology as it relates to these conditions. This section provides a structured overview of national protocols for the diagnosis and initial management of TMDs and Orofacial Pain. It outlines key definitions, epidemiological data, etiological factors, and classifications relevant to these complex disorders. Furthermore, the document presents clinical pathways for patient assessment, including history taking and physical examination, and proposes broad therapeutic strategies. These include conservative, non- pharmacological interventions (such as patient education and self-care), pharmacological management (e.g., NSAIDs, muscle relaxants), and considerations for more invasive treatments when indicated. While offering essential principles for the Italian

dental practitioner to standardize the initial approach to TMDs, this section serves as a general guideline within a broader dental context, aiming to promote evidence-based understanding and basic management of gnathological issues within the national healthcare system.

- **Title of the document:** Management of painful Temporomandibular disorder in adults
- **Journal:** NHS England Getting It Right First Time (GIRFT) and Royal College of Surgeons' Faculty of Dental Surgery
- **Year of publication:** 2024
- **Authors:** NHS England Getting It Right First Time (GIRFT) and Royal College of Surgeons' Faculty of Dental Surgery
- **Link:** https://www.rcseng.ac.uk/-/media/FDS/Comprehensive-guideline-Management-of-painful-Temporomandibular-disorder-in-adults-March-2024.pdf
- **Extended summary** This comprehensive guideline, developed by NHS England's Getting It Right First Time (GIRFT) program in collaboration with the Royal College of Surgeons' Faculty of Dental Surgery, provides an evidence-based framework for the management of painful Temporomandibular Disorder (TMD) in adults across the United Kingdom. Published in 2024, it outlines a structured and clear pathway for care provision, aiming to improve patient outcomes and reduce the impact of persistent TMD pain. The document covers a range of topics including screening, diagnosis (often utilizing tools like 3Q/TMD and CPI), red flag identification for serious underlying pathologies, and a detailed overview of non- invasive treatment options. These include patient education, self-management strategies, various types of occlusal splints, jaw exercises,

and physiotherapy techniques. The guideline emphasizes a stepped-care approach and the importance of assessing biopsychosocial factors. As a recent and comprehensive national guideline from a major European country, it reflects current best practices and offers a detailed perspective on the clinical management of TMDs within a structured healthcare system.

- **Title of the document:** Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) for Clinical and Research Applications: Recommendations of the International RDC/TMD Consortium Network and Orofacial Pain Special Interest Group
- **Journal:** Journal of Oral & Facial Pain and Headache
- **Year of publication:** 2014
- **Authors:** Eric Schiffman, et al.
- **Link:** https://files.jofph.com/files/article/20231214-383/pdf/ofph_28_1_Schiffman_02.pdf
- **Extended summary** This landmark publication presents the Diagnostic Criteria for Temporomandibular Disorders (DC/TMD), which represent the global standard for the standardized assessment and classification of TMDs for both clinical and research purposes. Developed by the International RDC/TMD Consortium Network and Orofacial Pain Special Interest Group, this comprehensive document provides a dual-axis diagnostic system: Axis I focuses on physical diagnoses of TMDs (including specific muscular and joint conditions), while Axis II assesses psychosocial status and pain-related disability. The DC/TMD protocol includes detailed operational criteria, standardized examination procedures, and decision trees, ensuring high reliability and validity in diagnosing specific TMDs, particularly those of myogenic origin (e.g., myalgia, myofascial pain). This framework is crucial for evidence-based practice, guiding clinicians in

making precise diagnoses, tailoring treatment plans, and enabling comparable research outcomes worldwide. It is considered an essential 'best practice' for any thorough diagnostic evaluation of temporomandibular disorders.

- **Title of the document:** Temporomandibular disorders: INFORM/IADR key points for good clinical practice based on standard of care
- **Journal:** CRANIO®: The Journal of Craniomandibular & Sleep Practice
- **Year of publication:** 2024
- **Authors**: Daniele Manfredini, Birgitta Häggman-Henrikson, Ahmad Al Jaghsi, Lene Baad-Hansen, Emma Beecroft, Tessa Bijelic, Alessandro Bracci, Lisa Brinkmann, Rosaria Bucci, Anna Colonna, Malin Ernberg, Nikolaos N. Giannakopoulos, Susanna Gillborg, Charles S. Greene, Gary Heir, Michail Koutris, Axel Kutschke, Frank Lobbezoo, Anna Lövgren, Ambra Michelotti, Donald R. Nixdorf, Laura Nykänen, Juan Fernando Oyarzo, Maria Pigg, Matteo Pollis, Claudia C. Restrepo, Roberto Rongo, Marco Rossit, Ovidiu I. Saracutu, Oliver Schierz, Nikola Stanisic, Matteo Val, Merel C. Verhoeff, Corine M. Visscher, Ulle Voog-Oras, Linnéa Wrangstål, Steven D. Bender, Justin Durham & International Network for Orofacial Pain and Related Disorders Methodolog

  Link:

  https://www.tandfonline.com/doi/10.1080/08869634.2024.2405298?url_ver=Z39.88-2003
- **Extended summary** This contemporary consensus paper, developed by the International Network for Orofacial Pain and Related Disorders Methodology (INFORM/IADR), presents a crucial overview of key points for good clinical practice in the management of temporomandibular disorders (TMDs), grounded in the current standard of care. With contributions from

a large international group of experts, including prominent European researchers, the document aims to provide clear, actionable guidance for dental professionals. It covers essential aspects of TMD management, emphasizing patient-centered approaches, evidence-based diagnostic criteria, and a spectrum of non-invasive therapeutic interventions. The paper consolidates contemporary knowledge and expert consensus, making it a valuable reference for understanding the current foundational principles and global perspectives on TMD care.

- **Title of the document:** Curriculum guidelines for orofacial pain and temporomandibular disorders
- **Journal:** European Academy of Craniomandibular Disorders
- **Year of publication:** 2001
- **Authors:** Maria Nilner
- **Link:**https://www.onlinelibrary.wiley.com/doi/abs/10.1034/j.1600-0579.2001.050308.x
- **Extended summary** This seminal document, published by the European Academy of Craniomandibular Disorders (EACD) in the European Journal of Dental Education in 2001, provides foundational curriculum guidelines for both undergraduate and postgraduate programmes in stomatognathic physiology, orofacial pain, and temporomandibular disorders (TMD) at dental schools in Europe. It outlines essential attainment, competence, and attitude goals for dental students, covering basic anatomy, physiology, diagnosis, and conservative treatment procedures such as occlusal stabilization, relaxation therapy, and jaw exercises. Crucially, as of current review, this 2001 publication remains one of the most prominent and comprehensive European documents specifically outlining undergraduate

educational requirements for TMDs and orofacial pain. While it established a vital framework, its age inherently presents a significant area for improvement in contemporary dental curricula. The guidelines predate major advancements in TMD research, diagnostic methodologies (e.g., DC/TMD Axis I and II), and refined evidence-based therapeutic approaches. This highlights the pressing need for updated European educational guidelines to ensure that future dental professionals receive training aligned with the latest scientific understanding and clinical best practices in TMD management.

- **Title of the document:** Temporomandibular Disorders Core Curriculum for Predoctoral Dental Education: Recommendations from the American Academy of Orofacial Pain
- **Journal:** Journal of Oral & Facial Pain and Headache
- **Year of publication:** 2021
- **Authors:** AAOP Committee on TMD Predoctoral Education
- **Link:**https://files.jofph.com/files/article/20231204-47/pdf/ofph_35_4_Chen_3073_p271.pdf
- **Extended summary** This significant document, published in 2021 by the American Academy of Orofacial Pain (AAOP), provides a comprehensive and modern framework for the core curriculum of temporomandibular disorders (TMDs) in predoctoral (undergraduate) dental education. It meticulously outlines the essential knowledge, skills, and attitudes that all graduating dental students should attain to effectively diagnose, assess, and manage basic TMD conditions. The recommendations span from patient history and clinical examination to differential diagnosis and the implementation of initial conservative therapies, aligning with a contemporary biopsychosocial understanding of TMDs. This curriculum serves as a critical benchmark, reflecting current evidence-based approaches to TMD education. Its recent publication highlights the evolving

nature of the field and implicitly underscores the potential need for similar updated and specific curriculum guidelines within European dental education frameworks to ensure that dental graduates are thoroughly prepared to address the complexities of TMDs in modern clinical practice.

Conclusion

This multinational literature review has consistently identified a critical disparity across several key domains of dental practice—including Paediatric Dentistry, Endodontics, and Prosthodontics—between internationally recognised evidence-based protocols (such as those recommended by the European Academy of Paediatric Dentistry (EAPD) or the European Society of Endodontology (ESE)) and local clinical and educational implementation. Across participating countries, particularly noted in Türkiye and Spain, clinical practice often reflects traditional, potentially non-conservative, approaches despite strong evidence supporting minimally invasive techniques like Selective Caries Removal (SR) and Vital Pulp Treatment (VPT). This deficiency is exacerbated by educational strategies that predominantly emphasize theoretical instruction, leaving students uncertain about how to apply the large number of treatment options or select the most appropriate management strategy under different clinical conditions (e.g., deep carious teeth, varied Temporomandibular Disorder (TMD) presentations, or appropriate anxiety control measures). Furthermore, institutions in Türkiye highlight the lack of standardised national protocols, underscoring the necessity of systematic reform to bridge the enduring gap between theoretical knowledge and clinical application.

Based on these findings, the overarching conclusion is that there is a critical need for unified, standardized, and interactive educational protocols to ensure that graduating students are equipped with the knowledge and confidence required for modern, evidence-based practice.

The inherent difficulty students face in translating complex theoretical knowledge—such as diagnostic criteria for deep carious teeth or the selection of root canal filling methods—into accurate clinical decision-making provides strong justification for the objective of this project: the creation of a Digital Interactive Education tool.

By providing accessible, multilingual, and digitally supported learning materials, this initiative is designed to help students learn more effectively and make correct treatment choices more readily, thereby supporting the transition towards consistent adoption of international guidelines, enhancing clinical readiness, and ultimately improving patient outcomes.

This urgency for enhanced clinical application skills is underpinned by consistent multinational findings that identify significant educational gaps requiring systematic curricular reform. Across partner countries, literature reviews reveal specific educational deficits, such as the persistent reliance on theoretical instruction in Türkiye and the statistically demonstrated deficit in Italian students' competency regarding standardized anxiety, pain, and fear management.

The fragmentation extends to highly specialized fields, where the lack of consensus on crucial elements—such as the optimal chemical agents or maximum time to achieve haemostasis in Vital Pulp Treatment (VPT)—continues to create 'gray' areas for clinicians. Similarly, TMD education often fails to incorporate modern biopsychosocial models and standardized criteria like the DC/TMD protocols.

Therefore, the Digital Interactive Education tool serves as a pedagogical bridge, explicitly designed to facilitate the complex translation of validated international knowledge—encompassing minimally invasive techniques like Selective Caries Removal (SR), modern digital Prosthodontic workflows, and standardized diagnostic criteria for Temporomandibular Disorders (DC/TMD)—into practical, outcome-oriented clinical decision-making. By providing this standardized, multilingual, and integrated learning framework, this project aims to foster academic excellence and clinical readiness, ultimately ensuring that graduating dentists possess the foundational confidence and unified adherence required to meet contemporary, evidence-based European dental care standards.

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