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Standardized DIAGNOdent Protocol for Early Caries Detection: Technical Description and Clinical Implementation.

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ABSTRACT

Objective: This technical note aims to describe and validate a standardized clinical protocol for using the DIAGNOdent laser fluorescence device to detect and quantify early caries lesions, facilitating consistent decisionmaking in minimally invasive dentistry.

Methods: A detailed, step-by-step protocol is presented, encompassing device calibration, systematic surface preparation (cleaning and drying), zero baseline measurement on sound enamel, and sequential examination of tooth surfaces. The interpretation of numerical scores follows manufacturer-recommended thresholds to guide clinical management. The practical application and added diagnostic value of this protocol are demonstrated through three clinical cases.

Results: Application of the standardized protocol in clinical practice enabled the detection and quantification of early demineralization, with device scores ranging from 13 to 24. These lesions, some not yet visible on radiographs or classified as early-stage (ICDAS 1), were managed with non-operative interventions. The protocol provided objective, quantitative data that directly informed therapeutic decisions, leading to treatments such as intensive fluoride prophylaxis, fissure sealing, and resin infiltration, thereby avoiding unnecessary restorative procedures.

Conclusion: The implementation of a standardized DIAGNOdent protocol provides a reliable, reproducible, and quantitative method for the early detection of caries. Its ability to objectify the diagnosis of precavitated lesions makes it a valuable tool for adhering to the principles of minimally invasive dentistry, allowing for interventions that preserve tooth structure.

1. INTRODUCTION

Early detection of carious lesions represents a major challenge in conservative dentistry. Initial enamel lesions present as white spots resulting from enamel hypomineralization. Physically, this white opaque appearance is explained by optical laws: demineralized enamel presents multiple interfaces between mineral (refractive index = 1.62) and organic (RI = 1.33) phases, creating an "optical labyrinth" that diffuses light (1).

The ICDAS classification (International Caries Detection and Assessment System), while providing a standardized visual framework, only detects lesions from the stage where they become visible (code 1: change visible after drying) (2). DIAGNOdent (KaVo), utilizing 655 nm laser fluorescence, offers quantitative detection of demineralization (3), potentially enabling "pre-ICDAS" detection. This technical note presents a comprehensive standardized protocol for DIAGNOdent implementation in clinical practice.

2. MATERIALS AND METHODS

2.1. Device Specifications and Principle

DIAGNOdent pen (Fig.1) employs 655 nm diode laser technology. The device measures fluorescence intensity increases resulting from bacterial metabolites and enamel porosity. The measurement range extends from 0 to 99.

Fig.1: DIAGNOdent pen

Available probes include:

- Probe A: Occlusal and smooth surfaces
- Probe B: Proximal surfaces (thinner and longer)

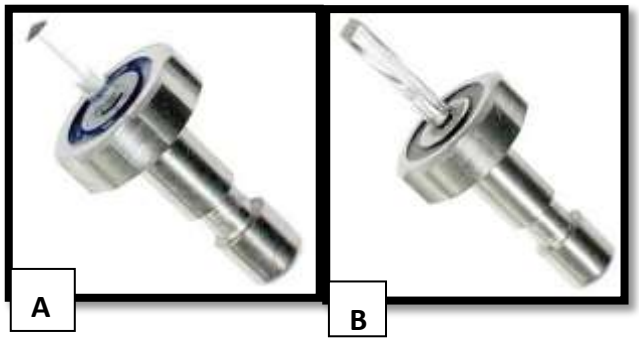

Fig.2: DIAGNOdent probe tips

A : Probe for occlusal and smooth surfaces

B : Probe for proximal surfaces

2.2. Standardized Protocol

- **Calibration :** Reference block calibration preceding each examination session (Fig.3) **Zero Baseline Measurement:** Systematic recording on sound tooth surface (Fig.4).
- **Systematic Examination:** Sequential assessment of occlusal pits/fissures, vestibular, lingual, and proximal surfaces
- **Surface Preparation:** Professional cleaning and careful drying before measurement.
- **Documentation :** Numerical scores recorded on standardized dental chart

Fig. 3: Calibration

Fig.4: Zero Baseline Measurement

2.3. DIAGNOdent Score Interpretation Guide

Manufacturer's recommended thresholds were applied:

Fissure Caries and Smooth Surface Caries

DIAGNOdent Score	Clinical Interpretation	Recommended Treatment
0 to 12	Healthy tooth structure / Initial demineralization	Normal prophylaxis (fluoride toothpaste)
13 to 24	Early caries / Moderate demineralization	Intensive prophylaxis (fluoridation, KaVo HealOzone)
> 25	Advanced caries / Cavitation	Minimally invasive restorative procedures with composite materials and intensive prophylaxis

Proximal Caries

DIAGNOdent Score	Clinical Interpretation	Recommended Treatment
0 to 7	Healthy tooth structure / Sound enamel	Normal prophylaxis (fluoride toothpaste)
8 to 15	Early proximal caries / Demineralization	Intensive prophylaxis (fluoridation, KaVo HealOzone)
> 16	Advanced proximal caries	Minimally invasive restorative procedures with composite materials and intensive prophylaxis

3. RESULTS: Clinical Applications

3.1.Clinical Cases Summary

Case	Presentation	ICDAS	DIAGNOdent Scores	Therapeutic Decision
1	26-year-old female, occlusal lesions after drying, without cavitation	Code 1	14- 20	Intensive prophylaxis (fluoridation, sealing)
2	22-year-old male, post-orthodontic white spots	Code 2	13-24	Resin infiltration (Icon®)
3	11-year-old female, cervical lesions	Code 2	13-24	Resin infiltration

3.2.Diagnostic Value

- **Case 1 :** DIAGNOdent detected significant demineralization where visual examination classified as ICDAS1(appearance of lesions after drying).
- **Cases 2 & 3 :** DIAGNOdent provided quantitative assessment of lesions visually detected as ICDAS 2.

4. DISCUSSION

Our standardized protocol ensures reproducible DIAGNOdent implementation. The device demonstrated superior sensitivity for early demineralization detection compared to conventional methods, corroborating previous studies (4,5).

The detection of demineralization in Case 1 (ICDAS 1) demonstrates the device's ability to identify precarious lesions, enabling earlier intervention. This early detection capability is crucial for minimally invasive dentistry, allowing treatment when lesions are still reversible.

The quantitative scores (13-24 across all cases) provided objective criteria for selecting minimally invasive treatments (fissure sealing and resin infiltration) rather than proceeding directly to restorative interventions.

Limitations include potential interference from dental plaque and extrinsic stains, necessitating proper surface preparation. However, standardized calibration and zero baseline measurement significantly enhance measurement reliability.

5. CONCLUSION

DIAGNOdent, used according to a standardized protocol, provides reliable, quantitative early caries detection, enabling minimally invasive therapeutic decisions. Its ability to detect demineralization before visual changes become apparent makes it particularly valuable for early intervention strategies. Integration into routine practice is recommended for enhanced diagnostic accuracy in conservative dentistry.

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