

Evaluation of Tooth Decay: Comparing Visual Inspection to BlueCheck Diagnostic Tool

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BACKGROUND

Early detection of dental caries is critical in pediatric populations to enable preventive management and reduce invasive treatment. In community-based settings such as Head Start programs, where radiographs are often unavailable, visual examination is the primary method for caries detection, however, early non-cavitated lesions can be difficult to identify. BlueCheck is a novel caries indicator composed of hemoglobin-based dye that selectively binds to porous hydroxyapatite in demineralized enamel, temporarily staining carious enamel blue and enabling high-contrast visualization of lesions. Caries indicator dyes may improve early detection, yet there is limited research evaluating their use in community-based pediatric settings.

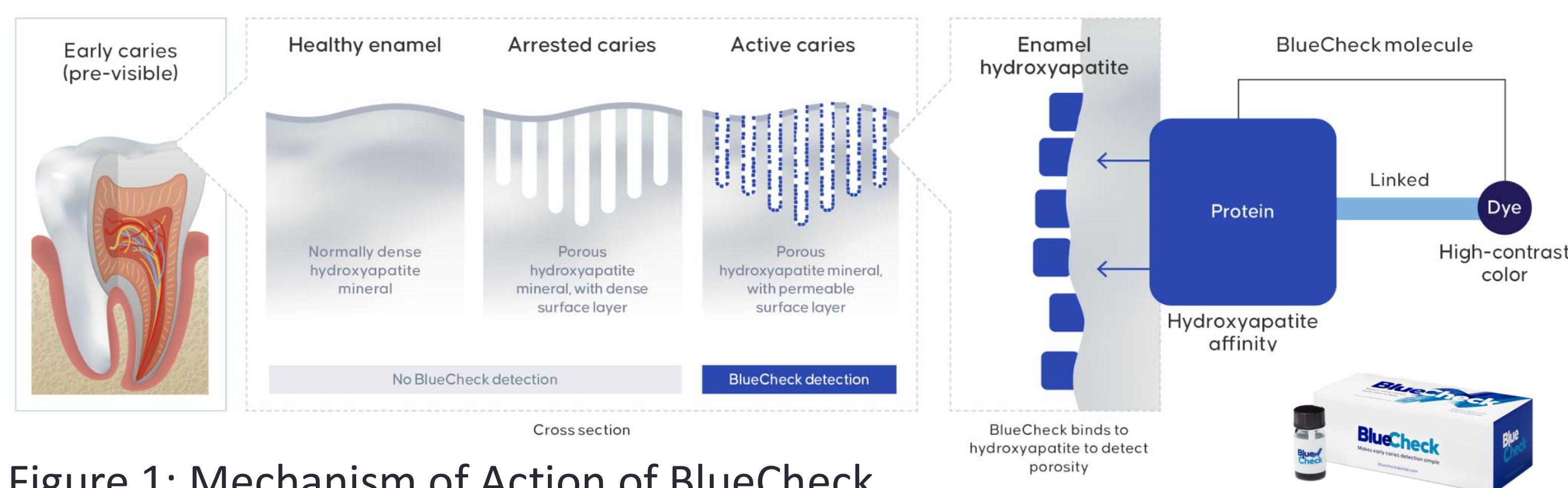


Figure 1: Mechanism of Action of BlueCheck.

OBJECTIVES

The aim of this study was to compare caries detection using a standardized visual examination based on the International Caries Detection and Assessment System (ICDAS) with the BlueCheck diagnostic tool in children enrolled in a Head Start program. If the current standard of care for caries detection, a visual exam conducted by the treating dentist, is outperformed by Blue Check, its incorporation into the standard of care of the Headstart program would greatly benefit patients.

METHODS

This prospective, non-randomized diagnostic comparison study was conducted at two Head Start sites in Stark County, Ohio. Children presenting for routine Head Start dental examinations received a toothbrush prophylaxis followed by an ICDAS-based visual exam. Cooperative children were additionally evaluated with BlueCheck by a separate, calibrated team blinded to visual exam findings. BlueCheck was applied to teeth and assessed for areas of blue discoloration indicative of caries. Caries detection by tooth number and surface was compared within subjects.

RESULTS

1. The mean participant age was 3.69 years (range: 3–5). An average of 2.53 lesions per child were detected using visual examination alone compared to 4.60 lesions per child with BlueCheck. A total of 514 lesions were identified with BlueCheck versus 285 lesions detected visually. Overall, lesions were 1.8 times more likely to be detected with BlueCheck.
2. Visual examination identified lesions in 12.7% of teeth, whereas BlueCheck detected lesions in 23% of teeth, nearly doubling overall detection rates.
3. The diagnostic advantage of BlueCheck was most pronounced for early, non-cavitated lesions (ICDAS 1–2), with 436 early lesions detected compared with 150 by visual examination. Early lesions were 2.9 times more likely to be detected with BlueCheck, with 3.4-fold higher odds of detection compared with visual examination alone.
4. Overall agreement between visual and BlueCheck-assisted ICDAS scoring was moderate ($\kappa = 0.45$), suggesting that BlueCheck provides additional diagnostic information rather than simply replicating visual findings.
5. McNemar analysis showed greater detection of early lesions (ICDAS ≥ 1) with BlueCheck in several teeth, particularly posterior sites, with no consistent advantage for advanced lesions (ICDAS ≥ 3).

Detection of Caries

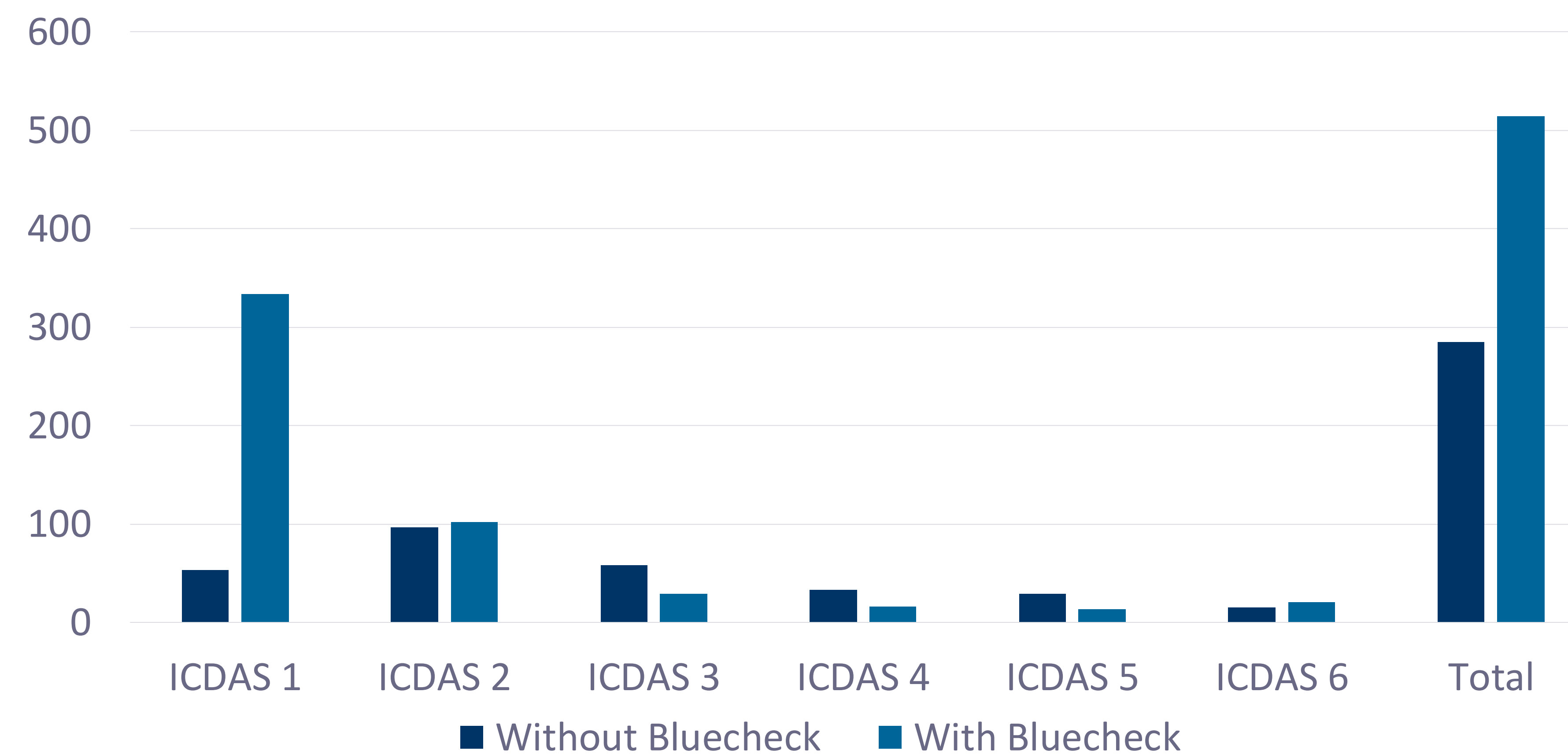


Figure 2. Distribution of Detected Caries by ICDAS Category Using Visual Examination and BlueCheck-Assisted Assessment

ICDAS	Visual N	Visual Percent	BlueCheck N	BlueCheck Percent
0	1952	87.27	1723	77.02
1	53	2.37	334	14.93
2	97	4.33	102	4.56
3	58	2.59	29	1.30
4	33	1.47	16	.72
5	29	1.30	13	.58
6	15	.67	20	.89
Total	2237	100	2237	100

Figure 3. Lesion Detection Yield

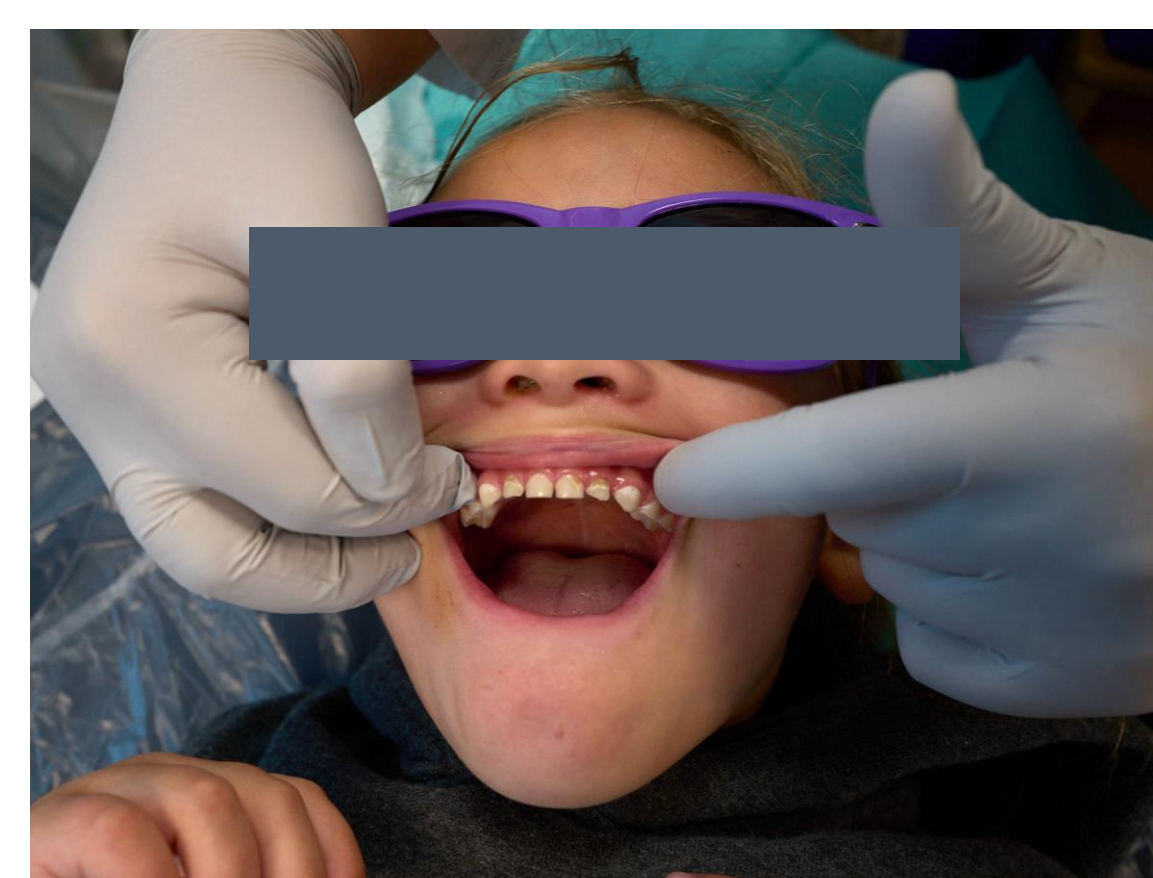


Figure 4. Visual Exam.

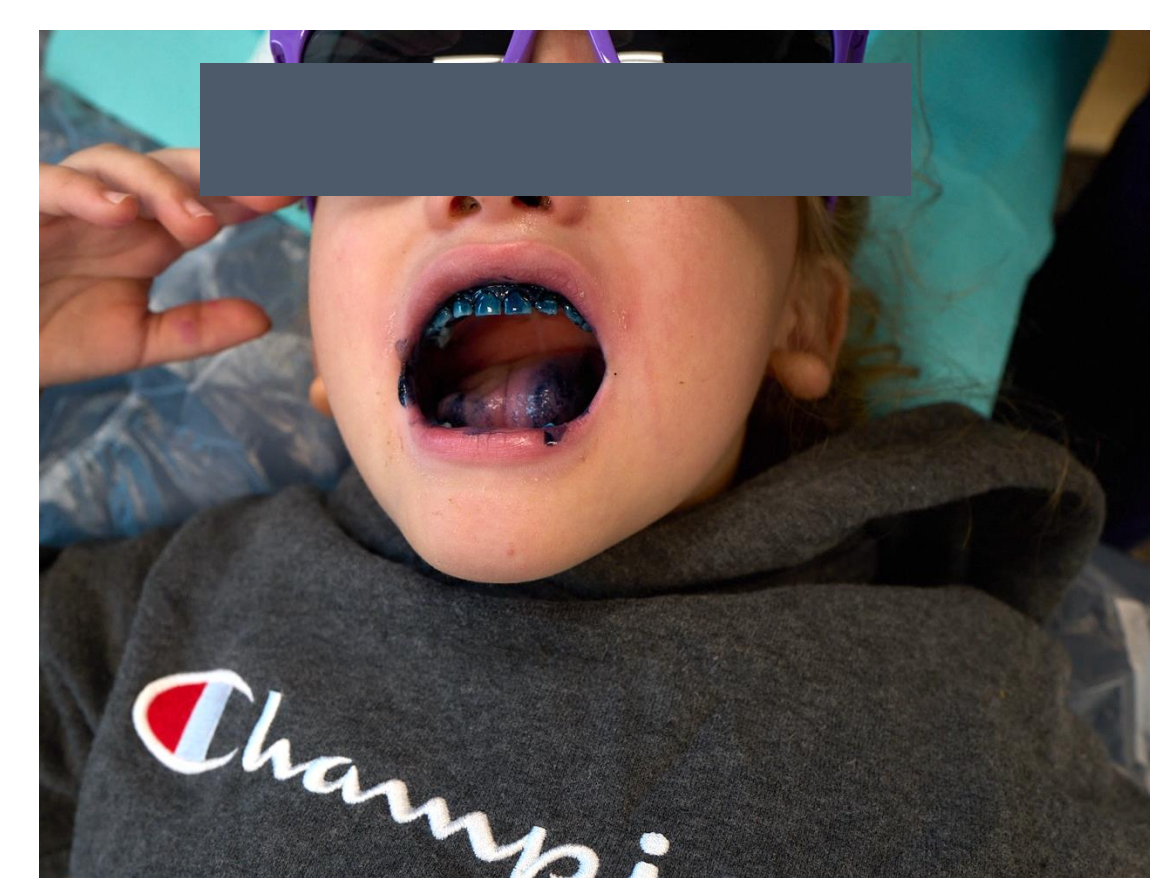


Figure 5. Application Step.

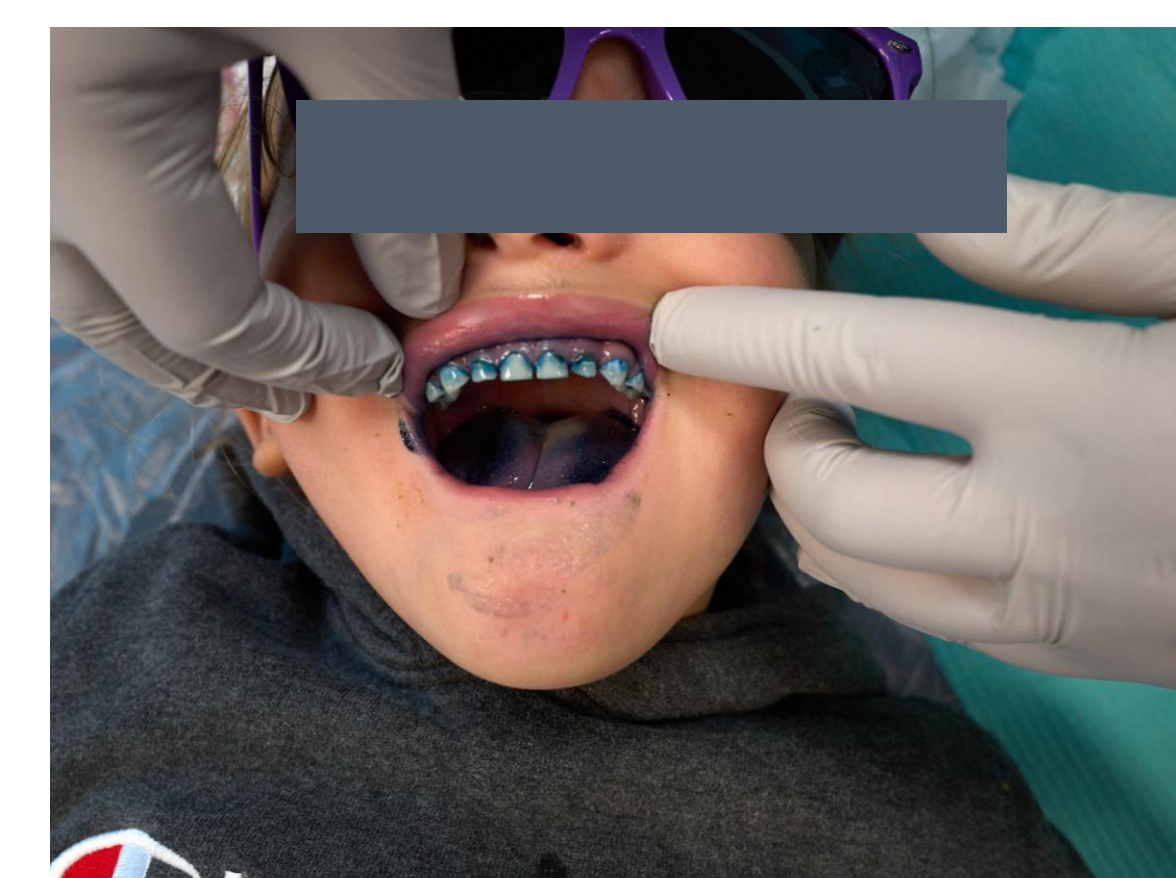


Figure . BlueCheck Exam

CONCLUSION

Collectively, these findings suggest that BlueCheck enhances early caries detection, nearly tripling the identification of non-cavitated lesions while maintaining moderate agreement with conventional visual examination. The diagnostic advantage appears greatest for early lesions and certain teeth, supporting BlueCheck's potential role as a complementary adjunct to visual examination rather than a replacement.

REFERENCES

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