

Pilot Study of Rapid Caries Treatment Needs Screening – A Brief Communication

Harold D. Sgan-Cohen, DMD, MPH; Alon Livny, DMD, MPH; Nirit Yavnai, DMD; Roberto Fichtenholz, DMD

Abstract

Objective: To evaluate a newly developed screening method for caries-related treatment needs. **Methods:** The Rapid Caries Treatment Needs Screening (RCTNS) Index includes five ordinal nominal scores. Comparisons with conventional examinations were conducted among 565 young Israeli adults (aged 23 ± 5.3 years) by the same dentist. **Results:** According to conventional examination, 79.5 percent demonstrated caries-related treatment needs as compared to 54.9 percent according to RCTNS. The sensitivity of RCTNS was 68.1 percent; specificity was 96.5 percent; positive predictive value was 98.7 percent; and negative predictive value was 43.9 percent. The calculated percentage of explained variance (R^2) of the conventional examination results according to RCTNS was 55.6 percent. **Conclusions:** The data reveal the relevance of a rapid visual screening method for caries-related treatment needs. This is a pilot study that demands further methodological refinement. Preliminary results revealed a potential, which should be further investigated.

Key Words: caries, screening, predictive values

Introduction

Dental surveys are essential for planning and assessing population treatment needs. The classic DMF Index describes caries experience and includes an “untreated” (“D”) caries component (1). Several caries treatment needs indices have been proposed (2-4).

The World Health Organization Oral Health Assessment Form, based upon the DMF, is probably the most common survey method for screening of caries prevalence. It is a thorough, accurate, detailed, and time-consuming procedure. A brief visual examination, employing a simpler index, might provide a practical and even preferable option for diagnoses of large populations not attending dental practices.

The objective of the present study was to evaluate a newly developed rapid caries-related treatment needs screening index and to compare it

with conventional clinical caries diagnosis.

Methods

The Rapid Caries Treatment Needs Screening (RCTNS) Index is based upon visual examination, employing a dental mirror and standard dental unit light. The index ranks the need for caries-related treatment. It does not differentiate specific treatment modalities.

Caries lesions are operationally defined as typical visual changes in outer dental structure, characterized by brownish color with or without cavitation.

The nominal ordinal index scale of RCTNS includes five scores:

- RCTNS 1: intact dentition – healthy teeth, no restorations, except for fissure sealants;
- RCTNS 2: well-restored dentition – undamaged restorations present, but no carious lesions detected;

- RCTNS 3: compromised restored dentition – defective restorations (obviously partly broken or completely lost), but without adjacent carious lesions;
- RCTNS 4: moderate caries experience – one to three teeth with visually detected carious lesions (including secondary carious lesions, with or without defective restorations); and
- RCTNS 5: severe caries experience – more than three teeth with visually detected carious lesions (including secondary carious lesions, with or without defective restorations).

The study population consisted of soldiers serving compulsory military service in the Israeli Defense Forces. No intentional sampling was conducted. Dental treatment is provided free of charge, and examinees had arrived at their own initiative in order to assess their dental status.

Evaluation was conducted in the following stages: a) participants were screened, employing the newly proposed index criteria; b) bitewing radiographs were taken in a separate room; and c) a thorough dental examination was conducted. All screening and examinations were conducted by one and the same examining dentist (N. Y.).

Criteria for required treatment were both clinical (clear visual breakdown in the tooth surface, and/or soft walls or floor, and/or undermined enamel, easily entered by explorer, after cleaning and drying of teeth, or damaged restoration) and radiographic (radiolucency clearly reaching or beyond the DEJ).

Send correspondence and reprint requests to Harold D. Sgan-Cohen, Department of Community Dentistry, Hebrew University–Hadassah School of Dental Medicine, POB 12272, Jerusalem 91120, Israel. Tel.: +972-2-6758569; Fax: +972-2-6415574; e-mail: harolds@cc.huji.ac.il. Harold D. Sgan-Cohen and Alon Livny are with the Hebrew University–Hadassah School of Dental Medicine. Nirit Yavnai and Roberto Fichtenholz are with the Israel Defence Forces Medical Corps. Manuscript received: 2/11/07; accepted for publication: 6/15/07.

Table 1
The Predictive Properties of the Rapid Caries Treatment Needs Screening (RCTNS) Index

Conventional Clinical Examination of Teeth	RCTNS Screening		Total
	Scores 1-2 (no treatment needed)	Scores 3-5 (treatment needed)	
No treatment required*	112	4	116
Treatment required*	143	306	449
Total	255	310	565

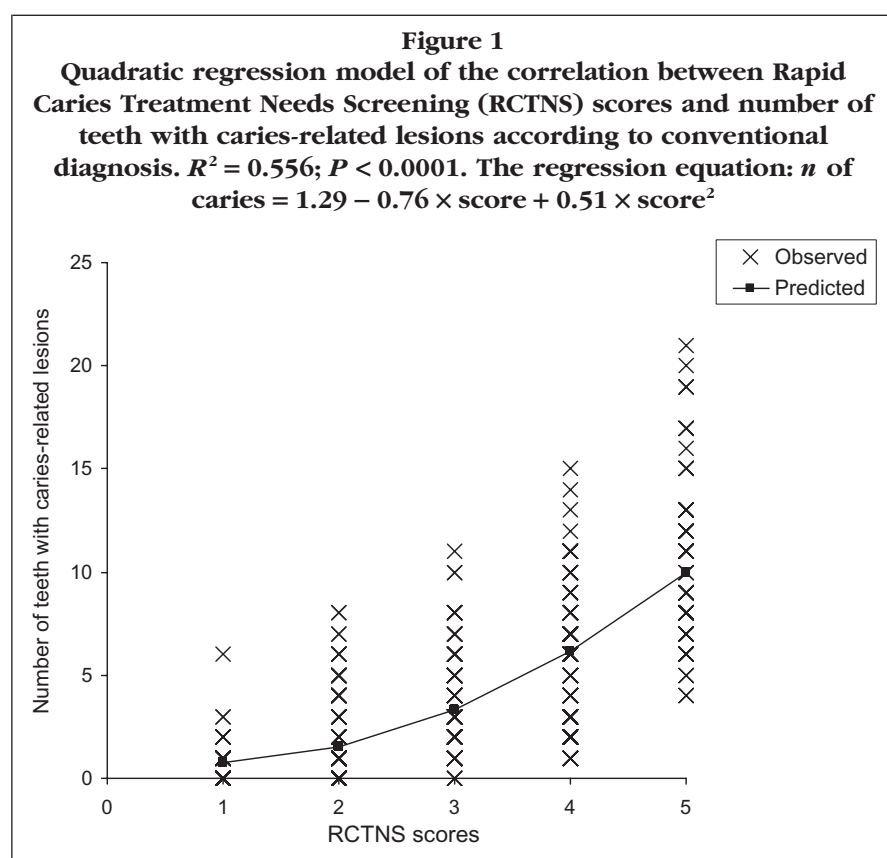
Sensitivity of RCTNS: $306/449 = 68.1$ percent.

Specificity of RCTNS: $112/116 = 96.5$ percent.

Positive predictive value of RCTNS: $306/310 = 98.7$ percent.

Negative predictive value of RCTNS: $112/255 = 43.9$ percent.

* Treatment of teeth required (or not required) because of caries or defective restorations.



These criteria follow the conventional clinical dental practice norms, as taught in Israeli and many US dental schools (5,6).

After data collection and coding, a comparison was made between the findings of the RCTNS and those of the conventional clinical examination. Statistical analyses included the assessment of sensitivity, specificity, positive predictive and negative predictive values, and calculation of regression coefficients.

Results

The study sample included 565 patients (246 females, 319 males). Their mean age was 23 ± 5.3 years. According to the conventional examination, 116 (20.5 percent) did not require caries-related treatment. The remaining 449 revealed a range of 1 to 21 teeth that required restorative treatment: 36.8 percent of the total had 1 to 3 teeth that needed treatment, while 42.7 percent had more than three teeth affected.

Using RCTNS, 12.0 percent were ranked as score 1 and 33.1 percent as score 2. This fraction of the study group (45.1 percent) was not indicated (by RCTNS) for restorative treatment. The remaining group was comprised of 121 subjects (21.4 percent) with score 3, 126 (22.3 percent) with score 4, and 63 (11.2 percent) with score 5.

Table 1 presents the comparison between the two methods, exhibiting the predictive properties for this index. The five RCTNS scores were reassigned into two dichotomous treatment need groups. Similar dichotomization was applied to the conventional examination findings, separating the subjects with no caries-related treatment needs from those who were in need of treatment. Four subjects, who were diagnosed according to the conventional method as not requiring caries-related treatment, were graded as "needing treatment" by RCTNS; however, 143 subjects, who were conventionally diagnosed as needing treatment, were graded as RCTNS 1 or 2 (no treatment needed).

Figure 1 illustrates the comparison between RCTNS and conventional caries diagnosis. According to a quadratic regression model, an R^2 value of 0.556 was calculated.

Discussion

Public health has a commitment to reach out to all communities, including populations not regularly attending dental clinics. Optimal treatment priorities, based on community diagnosis and screening procedures, need to be established.

Table 1 presents four subgroups. The first includes 112 persons who are predicted by RCTNS as "no treatment required" (scores 1 and 2) and "truly" do not require treatment according to the conventional examination ("true negative"). Avoiding a comprehensive examination could be beneficial for this group (almost one-fifth of the total population) as well as for the health care delivery system.

The second subgroup includes four persons and represents the "false positive" group, who do not

require treatment but were predicted by RCTNS as needing treatment, and therefore referred for a comprehensive examination. This represents a minor waste of resources.

The third subgroup is the 306 subjects, who were predicted both by RCTNS and by the conventional examination as needing treatment. This is the "true positive" group. According to the conventional examination, most of this subgroup (68.3 percent, 209/306), had more than four teeth with caries. An important advantage for this is that, following the screening, they would be identified for highest treatment priority. Screening would therefore be efficient for them, for the dental team, and also from the public health point of view.

The final subgroup includes 143 subjects (25.3 percent of the total population) and deserves special attention. It displays a "false negative" prediction by the proposed screening method – people who were screened as "no treatment needed" but according to the conventional examination needed treatment. Among this group, most subjects (84.6 percent, $n = 121$) were scored as RCTNS 2 (well-restored dentition, no carious lesions detected). These cases might indicate the underestimation of secondary caries, which were detected by the conventional method with radiographs. Unfortunately, the relative contribution of the radiographs to the final treatment decisions was not assessed and needs to be addressed in further research. The issue of "hidden" caries could be problematic. In the present study, 143 subjects would have been misled by being told that their teeth were healthy. A screening test aimed at referral of patients for further examinations might require a higher sensitivity level.

The present study group could be considered as a relatively high caries risk group (79.5 percent by conventional examination required caries-

related treatment). Based upon the low sensitivity level, this screening method might be more appropriate for low and medium caries risk groups.

The scatter diagram, presented in Figure 1, demonstrates the correlation between the RCTNS scores and conventional clinical examination. At the lower RCTNS scores, the values are more concentrated around the regression line, which demonstrates that prediction is better than for the higher scores. The asymmetric dispersion of RCTNS levels 1 to 3 (more values above the line), might signify underestimation. The calculation of the regression coefficient demonstrated that 55.6 percent of the predicted number of carious lesions could be explained by the RCTNS values.

It should be noted that treatment threshold criteria, based upon conventional norms, have lately been debated. The old paradigm of restoring every tooth that shows radiolucency reaching the DEJ, or gaps along restoration borders, is no longer an axiom. The concepts of caries management based on risk assessment and minimal intervention dentistry are emerging in the literature and dental education, with growing enthusiasm (7,8). Modifying the conventional criteria of restoring and especially re-restoring teeth may minimize the differences between visual- and radiographic-based decisions.

All examinations were conducted by the same dentist, and the issue of bias should be addressed. However, it was impractical to separate the two sets of examinations, making them totally "blind" and independent. We believe that the three-stage structure of the clinical setting lessened this potential intra-examiner bias effect.

This preliminary study indicates further research needs: comparing validity levels with other indices; addressing the problematic and relatively low sensitivity; employing the index among diverse populations and different age groups; analyzing cost-

benefit issues; more examiner training; addressing potential intra- and inter-examiner potential biases; and examining potential use among non-dentist health professionals (e.g., public health nurses, dental hygienists, etc.). Dental professionals should be flexible in accepting and exploring different approaches in both individual and public health care. Despite its fallibilities, the refinement of the RCTNS should be continued. This potential public health screening tool might be convenient, feasible, and useful for large and not easily accessible populations, and can be a potential public health tool for identifying high treatment need groups among large populations. RCTNS could save "chair time," which is often of public health importance. The method is rapid and easy for the examiner and painless and unthreatening for the examinees.

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