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CRAFT- A Proposed Framework for Caries Risk Assessment in Indian Children

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Received: January 11,2022; **Published:** February 23, 2022

Abstract

Caries Risk Assessment (CRA) is 'prediction of future caries based on the diagnosis of current disease by evaluation of risk and protective factors for making evidence-based clinical decisions.' Various CRA tools have been reported in the literature. However, for the Indian scenario, none is available. "Caries Risk Assessment for Treatment (CRAFT)" is the first and indigenous, chair-side, simple, non-invasive, inexpensive and quick-to-use tool that has been developed with a four-point scale to categorize caries risk and propose risk-based management in children. This paper discusses the need, evidence-base, components, and recommendations of the CRAFT approach. CRAFT allows a dentist to customize a risk- based caries management plan and presents a framework for enhanced patient-participation.

Keywords: *Caries; Caries Risk Assessment Tools; Review; Fluoride; Minimal Invasive Dentistry; Cariogram; CAMBRA*

Abbreviations

CRA: Caries Risk Assessment; CRAFT: Caries Risk Assessment for Treatment; CAMBRA: Caries Management by Risk Assessment; C0: No Risk; C1: Low Risk; C2: Risk; C3: High Risk; ADA: American Dental Association; AAPD: American Academy of Pediatric Dentistry; MS: Mutans Streptococci; F: Fluoride; WHO: World Health Organization; E: Energy Intake; Ppm: Parts Per Million; DMFS/T: Decayed Missing Filled Surfaces/Teeth; Dmfs: Number of Affected Teeth in The Primary Dentition; CFU: Colony Forming Unit; ECC: Early Childhood Caries; HIV: Human Immunodeficiency Virus; MIH: Molar Incisor Hypoplasia; Ph: Potential of Hydrogen; RMGIC: Resin Modified Glass Ionomer Cement; RCT: Randomized Controlled Trial; NIH: National Institute of Health; DM: Disease Management; SMGs: Self-Management Goals; ISPPD: Indian Society of Pedodontics and Preventive Dentistry; DCI: Dental Council of India; IAPD: The International Association of Paediatric Dentistry

Introduction

Finding an accurate method for detecting and diagnosing any disease has been the goal of healing arts since the time of Socrates [1]. Caries disease diagnosis is not the classical hypothetical-deductive process that diagnosis based on presentation of signs and symptoms by a patient. Dentists often focus on detecting and treating the carious lesion rather than diagnosing it first and hence, a few treatment options (usually more conservative alternatives) may be left out [2,3].

During the past few decades, the paradigm of caries as detectable lesions or cavities has shifted to caries as a continuous process or

disease. New approaches in caries detection, assessment, and management have been developed based on the biological understanding of the caries process [3].

Risk is defined as "a probability that a (harmful) event will occur" [4]. Caries Risk Assessment (CRA) involves "an analysis of the probability that there will be a change in number, size, or activity of caries lesions". CRA is necessary to identify people (individuals) at risk of developing new lesions as well as for identifying the risk of progression of already present carious lesions in individuals [5]. CRA takes into consideration the risk and protective factors that affect the dynamics of the caries process. CRA is important for making evidence-based clinical decisions [6]. Various CRA approaches have been used in the Western countries such as Cariogram, Caries Management By Risk Assessment (CAMBRA), etc. However, in Indian scenario, such a tool is unavailable.

Overview of current CRA tools

Earlier attempts of CRA were based on identification of "risk groups" with respect to the age, teeth, tooth surfaces, and individual risk profiles. The key age groups identified were 1 - 2 years, 5 - 7 years, and 11 - 14 years. Bottle-feeding and vertical transmission were the identifiable risk factors in age 1 - 2 years. The key risk periods for initiation of caries in the permanent teeth were reportedly the eruption of permanent molars until the secondary maturation of molars. The occlusal surfaces of molars were regarded as having significant risk; however, approximal lesions on the molars were regarded to be a result of higher risk. A yearly increment of two or more lesions, detected clinically and/or radiographically, would indicate higher risk. Based on the analysis of several such factors, an individual may be termed as having no risk (C0), low risk (C1), risk (C2), and high risk (C3) [7].

According to Bratthall and Petersson (2005), CRA models can be 'risk models' or 'prediction models.' The prediction models based on factors such as the past caries experience could tell "who are at risk" whereas the risk models can identify "the existing risk" factors for future caries in individuals. CRA takes into consideration three factors: past caries experience, socio-economic and biological factors [8].

The first two factors although may be predictors but are not true 'risk model factors.' The biological factors are the true 'risk model' factors. Cariogram was developed as a computer program which can be regarded as both risk model and prediction model. It includes a 'weighted' computerized analysis of risk factors such as the caries experience, systemic conditions, diet (nature and frequency), plaque amount, MS levels, fluoride availability, saliva amount and buffering capacity. A pie-diagram depicts four colour-coded sectors which include bacteria (red), diet (dark blue), susceptibility (light blue) and circumstances (yellow) leaving the chance factor to account for avoiding caries. When the chance of avoiding caries is high, the risk is small and vice versa. Cariogram cannot specify the number of lesions that may or may not occur but can express a probability (90% chance of avoiding caries) [7,8].

Caries management by risk assessment (CAMBRA) is an evidence-based approach to preventing or treating the cause of dental caries at the initial stages based on risk categorized as low, moderate, or high. ADA developed two forms that determine low, moderate, or high risk: one for patients 0 - 6 years old, and one for patients older than six years. The AAPD, too has developed two forms: one for children 0 - 5 years old, and one for children older than 5 years. Although, a few differences exist, the different forms assess the risk based on the Caries Balance Concept that takes into consideration the multifactorial nature of dental caries. Caries disease indicators indicate the signs of the presence or past disease and activity, but do not explain the causes.

CAMBRA supports clinical decision-making by suggesting the periodicity of recalls, investigations and addition of preventive and treatment measures (fluoride, xylitol, antimicrobials, i.e., chlorhexidine, calcium phosphate, sealants- resin-based and glass ionomers, pH neutralizing agents) [5,9].

Although the above-mentioned models have been validated for use in the respective populations, they lack generalizability, and their application in another population with different characteristics may lead to problems both for the practitioners and the patients. In India, no precise tool is available for the purpose of CRA. Therefore, development of a CRA tool must be based on the etiological characteristics

of caries in Indian Children and the ideal requirements for the CRA.

CRA: Evidence-base

Assessment of as well as preventive and therapeutic recommendations must be based on current best evidence.

DIET

Various observational and experimental studies in the early and mid-20th century associated the risk of sugar in dental caries. Dietary factors, specifically the amount and frequency of sugar intake remain the major determinants of the caries process; in the recent WHO (2015) Guidelines, reduction of the intake of free sugars throughout the life course is recommended [10]. The intake less than 10% of energy intake (%E) of free sugars reduces the risk of overweight, obesity and tooth decay, and sugars below 5% of total energy intake would provide additional benefits in terms of reduced dental caries [10,11]. Even a small reduction in the risk of caries in childhood is of significance later in life, and modified dietary behavior patterns will surely alter the caries risk of an individual [10]. A recent prospective cohort study from the early childhood to young adulthood found an evident relation between higher life course sugar consumption and higher dental caries increment; with caries being present even in low sugar consumers despite their exposure to multiple sources for fluoride [12]. This sustains that diet has a relevant role even in the presence of fluoride, and limiting sugar is a logical advice [10].

Inappropriate bottle-feeding practices exhibits a significant relationship with increasing severity of early childhood caries. The use of sugar as an additive to weaning foods or drinks can amplify the risk [13].

Likewise, sugar-based medications taken for a duration of three months, or more are a risk factor for increased level of caries. Parental counselling on the risk factors of caries is shown to reduce the risk considerably of their children [14].

Therefore, more than two between meal-sugar exposures per day, bottle-feeding and long-term syrupy medicines can be summarized as the evidence-based dietary risk factors.

Fluoride

Caries is both diet-dependent and fluoride-mediated and is controllable by prevention and management at both the individual and population levels [15]. The modern evidence related to fluoride has been assimilated from a series of Cochrane reviews. Fluoride toothpastes are reportedly efficacious in preventing caries in children and adolescents [16]. Parents should be informed to brush their child's teeth twice daily with fluoridated toothpastes, this being the last action at night and on one other occasion or supervise toothbrushing [17]. A meta-analysis illustrated that the use of standard concentration (1,000 - 1,500 ppmF) fluoride toothpaste reduced caries in primary teeth compared to placebo or no intervention. To balance the benefits of preventing dental caries against the potential harms of fluorosis associated with ingesting fluoride toothpaste; children under three years of age are recommended to use no more than a rice-size amount or an average smear of approximately 0.1 ml of toothpaste per brushing. This would allow 13 brushing episodes with 1,000 ppm fluoride toothpaste per day before breaching the upper tolerable limit of fluoride intake, if 100% of toothpaste used was ingested. For children over the age of three years a pea-sized amount (0.25 ml) per brushing is recommended [17,18]. Additionally, after 3 years of age advise should be given to spit out after brushing and not rinse, to maintain fluoride concentration levels [17]. Proactive dental health behaviours related to the use of a fluoride dentifrice, toothbrush and the brushing methods have significantly reduced the caries experience in primary dentition. Hence, such behaviours reflect the parental knowledge and level of motivation [19].

Professionally applied fluoride contributes towards maintaining the caries balance [16]. A Cochrane review found that children aged 5 to 16 years who received fluoride in the form of toothpastes, mouth rinses, gels or varnishes had fewer decayed, missing and filled teeth regardless of whether their drinking water was fluoridated [20]. Use of fluoride gel exhibited a clear caries-inhibiting effect, based on the

14 placebo-controlled trials, a 20% reduction in D(M)FS was reported [21]. Fluoride varnishes applied two or more times in a year help reduce dmfs by 37% in primary teeth and DMFS by 43% in young permanent teeth [22]. Therefore, professionally applied topical fluoride has shown to reduce caries with additional benefits in children and adolescents more than fluoride toothpaste alone. Professionally applied topical fluoride treatment could be a part of a comprehensive preventive care [20].

Alternatively, regular twice daily exposure to low concentration fluoride as present in the toothpaste, and semi-annual applications of the fluoride varnish can therefore be regarded as the best recommendations for caries prevention, particularly in the low fluoride areas.

Caries experience

Dental caries being an infectious and transmissible disease [23]. Unlike other infectious diseases, caries is not a self-limiting disease. Untreated caries in the primary dentition has consequential and costly short term, long term adverse effects on the overall health of children, affecting their quality of life [13,23]. Undoubtedly, the past caries experience is regarded as one of the most powerful single predictors in all age groups, but with a higher accuracy in preschool children and adolescents [6]. A few longitudinal studies have clearly illustrated that early infection with mutans streptococci is a significant risk factor for future development of dental caries [24]. Nonetheless, the absence of caries is not a useful risk predictor for infants and toddlers as even if these children are at high risk, initially white spot lesions are apparent and there may not have been enough time for carious lesion development [25].

Correlation between parents' and children's caries status was recognized as early as 1940s. A study has reported that when mothers harbored greater than 10^5 colony forming units (CFU) of MS per mL of saliva, the frequency of infant infection was 58%. Whereas, when mothers harbored 10^3 CFU of MS per mL of saliva or more, however, the frequency of infant infection was 9 times less (6%) [26]. Similar findings have been reported by AAPD (2014) [27]. This event in amalgamation with inappropriate feeding practices by caregivers enhances the risk of ECC in infants and children [13].

Infections after childbirth have become increasingly common, so was observed in infants delivered by caesarean section who acquired MS 11.7 months earlier than did vaginally delivered infants. This observation indicates that medical history assessment of the pediatric dental patient should include mode of delivery to identify infants at potential risk for early MS infection [24]. Furthermore, regardless of the current understanding which sustains that oral colonization with MS mainly occurs depends upon the 'window of infectivity'; however, an exception to this concept is the condition 'ECC', due to both dietary and immunologic factors [23]. In a study, after testing the bacteriocin typed isolates of MS results showed that, even when a child acquires MS after the age of 5, there may be similarity between MS in mother, father, siblings and child indicative of horizontal transmission between the family members. The presence of caries in the mother has a direct effect on the young child's risk [28].

The presence of existing carious lesions in the teeth; and in absence of carious lesions (untreated or otherwise in young children), the parental caries status can aggravate caries risk.

Other factors

Saliva is irrefutably known to be an influencing factor in the caries process. The unstimulated salivary flow rates are observed to have the strongest predictive validity for assessing caries risk [2]. Conditions that compromise the lifelong maintenance of good oral hygiene are positively associated with caries risk [28]. These may include systemic conditions, hypoplasia, hyposalivation and crowded teeth. Conditions that predispose to inherent immunological aberrations such as HIV, upper respiratory tract, middle ear, asthma, post-natal infections, gastrointestinal infections, etc may be regarded as 'risk factors' for caries [23,29]. Recent evidence exists that suggests HIV-infected children/adolescents have an increased caries experience in primary dentition [30]. Furthermore, such conditions primarily require treatment with syrupy medicines which have a marked effect on the caries risk [31]. In India as many as 82% of all liquid medicines

marketed use a syrupy base yet the sugar content is rarely listed [32]. Besides, certain conditions as well as medicines may reduce salivary flow and quality and may affect caries risk. The patients with low salivary flow may experience recurrent xerostomia, increased caries risk, often at sites not normally prone to caries, such as the incisal edges [31,33]. Similar effects are seen in mouth-breathers, in whom evaporation of water through the oral mucosa can only occur during mouth-breathing but could reach a maximum rate of about 0.21 ml/min at rest, although normally it would be much less [33].

Another integral factor could be the presence of enamel hypoplasia. It can be in part a proxy indicator for childhood infection and/or substandard nutrition [34]. Hypoplasia may be associated with ECC as the "structural integrity of the teeth is compromised prior to their emergence into the oral cavity. Hence, it has a good potential to serve as a predictor of caries [23,24]. Few Indian studies have found a significant association between enamel hypoplasia and caries in the non-spaced dentition, particularly in the primary mandibular anteriors. Also, a significant correlation has been established between caries and interdental spacing in the posterior segment of the mandibular arches [35]. Molar Incisor Hypo mineralization (MIH) is also a known risk factor for caries in mixed dentition [52]. One study reported that 10-year-old children with at least one episode of respiratory disease had 2.48 times higher risk for the development of MIH/3 (enamel hypoplasia on at least one first permanent molar and a permanent incisor) [36].

In children with risk pertaining to the parameters such as decay or presence of any of the other factors, chemotherapeutic agents are essential recommendations depending on the patients age, compliance, and caries risk level. Various studies have indicated that xylitol is superior to chlorhexidine and fluoride varnish in impeding the vertical transmission of cariogenic bacteria from caregivers to infants [17,18]. The use of xylitol has been supported by AAPD for caries prevention. Dosing frequency for xylitol should be a minimum of two times a day, not to exceed eight grams per day. Xylitol in syrup form has been recommended for use in children less than four years of age due to the risk of choking [18,37].

Beneficially, xylitol is synergistic to other home care products and strategies. Studies have shown that remineralizing agents help tip the balance in favour of a healthy oral environment. Moreover, for patients with xerostomia, topical dry-mouth formulations provide symptomatic relief by preserving the oral ph. Saliva stimulants or substitutes (artificial saliva) in the form of swabs, sprays, lozenges, liquid can be prescribed [37].

To summarize, several interrelated risk factors can shift the balance towards health or disease. Hence, risk assessment is a key component and needs to be integrated early in the caries management of every dentate patient. Lastly, for this rational strategy to work, there is a need to shift from practicing informal CRA to now broadly adopting ideal electronic CRA aids/tools. As they can help dentists in establishing and documenting the caries risk status of their patients as well as timely management of the causal factors [5,6].

Dental caries - indian scenario

A recent study assessed the trend in caries prevalence and the mean decayed, missing, filled/Decayed, Missing, Filled (dmf/DMF) index score among Indian children for the past 25 years. In the 2 - 5, 6 - 10, and 11 - 15 year, of age group, the prevalence of dental caries was 48.9%, 69.1%, and 52.1%. This review suggests that one out of two children in all the regions of India are affected by dental caries [38]. The National Oral Health Survey and Fluoride Mapping Report by Central Government of India in 2002 - 2003 indicated a need for early treatment and prevention of dental caries in the population as the disease levels increased with advancing age [39].

Major cities in India receive non-fluoridated piped water; however, fluoride levels in drinking water have huge diversity across the country.

Ideal requirements for a CRA tool in Indian context

A CRA tool needs to be simple, questionnaire-based, practical, evidence-based, inexpensive, and easy for the use of a general dental practitioner. It should be feasible for use at the child's first dental visit and on recall visits. Moreover, it need not include an expensive or elaborate laboratory testing as it may lead to dental care being expensive for the patient in turn, and the practitioner may lose interest. A CRA tool must be objective and multivariate so that precise and customized recommendations can be made as per individual need by the practitioner. Also, the tool should be useful in categorizing the risk, and guide the clinician for interventions and enhance patient participation in the care [5,6].

CRAFT – Conceptual framework, recommendations and treatment suggestions

Craft components

"Caries Risk Assessment for Treatment (CRAFT)" is a simple, chairside, non-invasive, four-point approach proposed for the management of caries based on risk assessment. While ascertaining caries-risk in children, parents can be interviewed using the CRAFT. The CRAFT tool uses a chart that includes four parameters: Diet, Decay status, Fluoride exposure and Other factors. Based on the available information, caries-risk can be determined which ranges form 0 - 4 (Very low/No, Low, Moderate, High). A green star is used to indicate 'safety' while a red star for the 'risk'.

CRAFT Recommendations

DIET • ≥ 2 exposures per day of sugar or starch containing food items between meals (Yes/ No) • Bottle feeding (Yes/ No) • Long-term exposure to syrupy medicines (Yes/ No)	DECAY STATUS • Present untreated caries (Yes/ No) • Past treated caries (Yes/ No) • Parent's caries status (Yes/ No)
FLUORIDE EXPOSURE • Use of fluoridated toothpaste (Yes/ No) • Use of fluoride mouthrinse (Yes/ No) • Professional six-monthly fluoride application (Yes/ No) • Living in area with high/ optimally fluoridated water (Yes/ No)	OTHER FACTORS • Conditions related to suppressed immunity such as asthma, allergies, recurrent infections (respiratory or gastrointestinal), etc. (Yes/ No) • Hypomineralization (Yes/ No) • Malocclusion/ crowding/ improper contacts (Yes/ No) • Hyposalivation (Yes/ No)

Table 1: *Caries Risk Assessment for Treatment (CRAFT).*

Preventive measures in the office	Minimum interventional and restorative measures
Fluoride application	Surface modification (making non-accessible surfaces accessible for easy plaque-elimination)
Pit and fissure sealants	Reduction and stabilization of caries activity with interim restorations
Oral prophylaxis	Sealing caries (Sealants, Preventive Resin Restorations, Preformed Metal Crowns)
Dietary and hygiene advice and recalls	Partial/ Stepwise excavation and restorations (Glass-ionomer and Composite Resins)

Table 2: *A CRAFT based treatment plan includes various office-based measures as depicted in the table below (can be customized as per patients' individual needs).*

Based on the risk as ascertained from the CRAFT, age-appropriate recommendations can be chosen from below.

- Reduce sugar intake to less than two exposures per day and preferably at meals.
- Stop bottle-feeding.
- Consider non-syrupy medicines (Ask for a suitable alternative from the doctor for the same).
- Use appropriate toothpaste (non-fluoride for less than 2-year-olds, junior fluoride for 2 - 6-year-olds, and regular fluoride for all above 6 years), and fluoride mouthrinse (for those above 6 years)
- Take treatment for untreated carious teeth of the child.
- Take treatment for untreated carious teeth of the parent/s.
- Consult your family physician/ pediatrician/ specialist regarding recurrent illnesses, allergies, etc.
- Strengthen the teeth enamel with the use of remineralizing agents (Consult your dentist for the same).
- Use hydrating agents or sugar-free chewing gums (Consult your dentist for the same).
- Have teeth alignment corrected/ contacts modified (Consult your dentist for the same).

As the risk increases from Very Low/No to High, the number of recommendations would increase. Also, there could be a higher requirement of home-based as well as office-based preventive measures and treatments. The treatments could range from minimal invasive approaches to conventional restorations.

CRA primarily focuses on modifying unhealthy behaviours and increasing resistance to the disease. Customized interventions may be beneficial in the prevention of dental caries in individual patients [26].

The paradigm has shifted from just trying to remove the biofilm to the significance on maintaining a healthy biofilm by modifying dietary behaviours [17,40]. When caries has progressed to a stage which is clinically detectable; implementation of the biological approach i.e. arresting of lesions via surface modification followed by fluoride therapy, sealing caries and partial or stepwise excavation followed by glass ionomer and composite restorations. Yet, in terms of disease management, dental practice is still in the gray years of the "restorative era", and we are still at crossroads in between preventive and restorative approach. It is not suggested that this approach is any easier than

surgical repair, but it is far more conservative of tooth structure and offers the possibility of far greater longevity of a functional dentition [40].

CRAFT Treatment suggestions

Following are details of contemporary evidence-based minimal interventional and restorative measures that may be recommended for managing non-cavitated or cavitated carious lesions:

Surface modification

'A clean tooth does not decay'. The simplest way and best strategy for managing the disease is to intervene before its signs and symptoms are clinically detected. Disturbance of the biofilm (dental plaque) from the surface is an effective measure which contributes to the control of enamel carious lesion development. Even disturbing the biofilm from cavitated dentine lesions appears to arrest further caries progression. It should be done with topical fluoride to control, slow down or arrest the caries lesion [3,40].

Sealing caries

The recent concept of 'seal is to heal' has been adopted widely due to its successful outcomes. The tooth anatomy especially of the molars i.e., morphology of pits and fissures has been reported to be one of the main caries risk. Sealing aims to amend patent pits and fissures into smooth surfaces that are protected from bacterial colonization and exposure to fermentable substrate and can be cleaned easily. The strategy is an efficacious preventive measure as well as arrests the non-cavitated enamel carious lesions in pits and fissures and control caries by lowering risk. The superiority of pit and fissure sealants over fluoride varnish application in the prevention of occlusal carious lesions has been reported. A Cochrane review demonstrated that sealing the occlusal surfaces of permanent molars in children and adolescents reduces caries up to 48 months when compared to no sealant [41].

Selective caries removal and restorations

The focus is on maximum conservation of demineralized, non-cavitated enamel and dentin by repair of the lesion [40]. Increasing numbers of clinical trials have demonstrated the benefits of incomplete caries removal in both primary and permanent dentition. A Cochrane Review summarized that stepwise and partial excavation reduced the incidence of pulp exposure in symptomless, vital, carious primary as well as permanent teeth and can be considered clinically advantageous over complete caries excavation. It showed that, stepwise excavation resulted in 56% reduction in pulp exposure, whereas 77% reduction followed by partial removal of caries [42]. Furthermore, after the evidence-based success of incomplete caries removal techniques, no caries removal technique was also developed. Clinical trials published since 2006 till date have shown clinical success using such methods of caries management as it also resulted in favourable outcomes for pulpal health and longevity of treatment [43].

Minimally invasive operative treatment approaches and adhesive materials and systems go hand in hand. As per a recent review, which includes evidence from three decades illustrated that the annual failure rates in stress-bearing cavities of primary molars were determined to be: 0 - 14% for stainless steel crowns, 0 - 25.8% for glass-ionomer restorations, 2 - 29.1% for atraumatic restorative treatments, 0 - 15% for composite restorations, and 0 - 11% for compomer restorations [44]. The main reasons for failure reported were secondary caries, marginal deficiencies, fracture, and wear. Whereas, the prime reason that repaired restorations may even outlast those that were replaced apparently relates to the fact that most of the restoration's original form is kept intact, limiting the introduction of new factors that can affect the success of the restoration.

Discussion

Very few individuals can be regarded as truly 'caries free' [44]. Even now, paediatric dentists face the unmet challenges of favourably addressing and altering the caries risk profiles. As a result, the incorporation of caries risk assessment in routine dental practice has now gained popularity [5]. Prior to the execution of any CRA framework, first the dentists themselves have to be truly embarked and believe in the efficacy and value of prevention methods, then only can the patients succeed [5-7]. AAPD (2014) has recognized that CRA is an eminent part of contemporary clinical care for infants, children and adolescents [5]. Training the dental professionals can help them in delivering efficient and targeted preventive services to children, thereby sustain the pathway of caries prevention [5,7]. In due course, a more appropriate use of dental resources and lower dental costs for some individuals can be made possible. It can also encourage the concept of minimally invasive dentistry in clinical practice. The practice of caries risk assessment in India is not common. A recent Indian study found that around 80.5% of the practitioners were aware of CRA tools among which only one-fourth assessed the caries risk, without using any office-based CRA tool [45].

Despite remarkable success in using biological approaches for disease management, private practitioners are still resistant to change from the traditional restorative mindset to more of chemo-reparative and preventive approach [5,45]. The recently published consensus recommendations on carious tissue removal (2016) revealed that carious management at tooth-level followed by caries management at patient-level may stem the source of the problem (the cause of the cause) [46]. There have been multiple issues surrounding prevention [52]. Literature shows that lack of training and incentives for practicing non-operative treatments has made students and dental professionals believe it as unnecessary [40].

From the standpoint of prevention, the dentist must make sure that the patient is made aware of the factors that play a role in caries development. A suitable caries risk assessment framework should provide information, set goals and re-intervene timely through combined efforts can result in quality improvements [47]. Thereby, resulting in better patient outcomes (health), system performance (care), and professional development (learning) [47]. Repeated reinforcement of the explained concepts over a short time span is a must, as also displayed by a research that confirms the possibility of some attrition in the information retained by parents over an 18-month time period [48].

It has now been ascertained that caries can be managed behaviourally by controlling the risk factors rather than removal of bacteria only [46]. Along with the clinical preventive therapies, a disease management (DM) protocol must include motivational interviewing including self-management goals (SMGs) tailored to the child's age and individual risk. Modern research unveils those individualized recommendations and family-centered approaches have proved to be more beneficial in engaging parents to change specific practices. Consequently, recent findings affirms that CRA and SMGs in combination are cornerstones of DM approach. Such an approach has assisted in achieving highly consistent level of performance of patients with their healthcare provides [47]. Thus, an integration of such skills can facilitate deliver dental care in a cost-effective manner.

Essentially, to put the CRAFT model into use, behaviour goals ought to be set for the patients after training the dentists for its use. In terms of treatment planning, evidence-based dentistry has been integrated into an analytical framework which can be used in clinical practice. In this manner, a framework will highlight the biologic behaviour of lesion, the personal care and social behaviours of the patient and this information will help the dentist set individualized recall intervals.

Hitherto, caries risk assessment is not performed in routine practice or as a part of public health programs due to several reasons. Lack of practical knowledge for using the existing CRA tools have not been adequately introduced in the clinical scenarios during the undergraduate program. Even, the private practitioners are not sufficiently trained to use the CRA tools. Besides, they may not possess the special skills to counsel, motivate and inspire behaviour changes which are a part of the evidence-based, disease management protocol. The dental set-ups may not have the armamentarium for certain microbial tests. Eventually, the cost-benefit ratio (multiple visits, material costs) may not suite the dentists as well as the patients.

The existing caries risk assessment tools such as Cariogram with some additional assessment measures have shown significant reduction in caries risk when tested in Indian children (also among differently abled children) [49]. A CAMBRA based program with targeted preventive intervention and recall schedules showed positive results, when tested in Indian population for high-risk children. In addition to routine preventive care, the essence of this program was repeated client centred MI sessions to induce behaviour change for successful outcomes.

The Cariogram or any other predictive tool predicts development of new caries in percent, but on the condition that risk factors remain constant during observation period [50]. The Cariogram cannot predict the exact number of new caries lesions probable. Cariogram is easy to use, validated affordable but does not include all current evidence-based treatment options. Whereas, with the CAMBRA model, four treatment plans are fixed depending upon the risk. Thus, the main limitation being that these treatment plans are not individualized. Even the patients close to the lower limit of the risk group must receive the general interventions. The Cariogram model is more distinctive than CAMBRA in terms of the factors, the risk level and treatment plan. However, it is of concern that the accuracy of the various risk assessment models is limited to the population for which it is developed and hence has limited generalisability.

CRAFT developments

Following are a few significant developments related to the CRAFT over last 5 years.

1. CRAFT was proposed in 2016; the first presentation of it at the 13th National Post Graduate Convention of the Indian Society of Pediatric and Preventive Dentistry (ISPPD) where the author (Dr Rinky Thakkar) won first prize for the same.

2. Dental Council of India adopted CRAFT for consideration after a meeting (DCI WORKSHOP: FIRST DECADE NO DECAY) in February 2018.

3. At IAPD Global Summit on ECC (November 2018), Prof. Ashwin Jawdekar won an award in a presentation on his work on CRAFT.

4. A study reporting the association of CRAFT and Alban test is reported by Thakur., *et al.* (2020) showing positive results of association [51].

5. Another study showed a significant association between caries risk assessed using CRAFT Categorization and OHRQoL of 3 - 6-year-old Children, reported by Iyer, Jawdekar (2021) [52].

6. Several studies based on CRAFT are presented at the national conferences of Indian Society of Pedodontics and Preventive Dentistry over the past 5 years.

Limitations of the CRAFT Model

This model requires further testing in various populations related to its validity and its acceptance to dentists and parents. Saliva and socio-economic parameters.

Conclusion

The CRAFT model is simple, objective, chairside, versatile, evidence based, non-invasive, less time consuming due to limited armamentarium, family-centered and suitable for the Indian scenario. It can also be used by the patient for self-assessment of the level of risk at intervals. Furthermore, dental professionals can use CRAFT for an individualized, age appropriate and risk-based approach to care and monitoring.

Disclaimer

Authors declare no conflict of interest.

This is a self-funded research and publication.

Bibliography

1. Rochlen GK and Mark Wolff. "Technological Advances in Caries Diagnosis". *Dental Clinics of North America* 55 (2011): 441-452.
2. Douglas A Young., *et al*. "Current Concepts in Cariology". *Dental Clinics of North America* 54.3 (2010).
3. Fejerskov O., *et al*. "Dental caries: the disease and its clinical management". 2nd edition. Oxford (UK): Blackwell Munksgaard (2008).
4. Burt B. "Concepts of risk in dental public health". *Community Dentistry and Oral Epidemiology* 33.4 (2006): 240-247.
5. Guideline on Caries-risk Assessment and Management for Infants, Children, and Adolescents. American Academy of Pediatric Dentistry". Reference manual 37.6 (2019): 15-16.
6. Twetman. "Caries risk assessment in children: how accurate are we?" *European Archives of Paediatric* Dentistry 17.1 (2015): 27-32.
7. Axelsson. "Diagnosis and Risk Prediction of Dental Caries (Volume 2). Illinois: Quintessence Publishing (2000).
8. Bratthall D and Petersson G. "Cariogram - a multifactorial risk assessment model for a multifactorial disease". *Community Dentistry and Oral Epidemiology* 33 (2005): 256-264.
9. Featherstone Ramos Gomez Crystal. "CAMBRA® Caries Management by Risk Assessment: A Comprehensive Caries Management Guide for Dental Professionals". *Journal of the California Dental Association. CAMBRA Projects* (2019).
10. Guideline: Sugars intake for adults and children". Geneva: World Health Organization (2015).
11. Sheiham A and James WP. "A reappraisal of the quantitative relationship between sugar intake and dental caries: the need for new criteria for developing goals for sugar intake". *BMC Public Health* 14 (2014): 863.
12. Peres MA., *et al*. "Sugar Consumption and Changes in Dental Caries from Childhood to Adolescence". *Journal of Dental Research* (2016): 1-7.
13. KB Hallett and O'Rourke PK. "Social and behavioural determinants of early childhood caries". *Australian Dental Journal* 48 (2003): 27-33.
14. Sahgal J., *et al*. "A Comparison of oral hygiene status and Dental Caries in children on long term liquid oral medications to those not administered with such Medications (2002).
15. Edelstein BL. "The Dental Caries Pandemic and Disparities Problem". *BMC Oral Health* 6.1 (2006): S2.
16. Marinho VC., *et al*. "Fluoride toothpastes for preventing dental caries in children and adolescents". *Cochrane Database of Systematic Reviews* 1 (2003).
17. Sue Gregory. "Delivering better oral health: an evidence-based toolkit for prevention". 3rd edition. Public Health England (2014).

18. Guideline on Fluoride Therapy. American Academy of Pediatric Dentistry". Reference Manual 37.6 (2014): 15-16.

19. Prakash P., *et al*. "Prevalence of early childhood caries and associated risk factors in preschool children of urban Bangalore, India: A cross-sectional study". *European Journal of Dentistry* 6.2 (2012): 141-152.

20. Marinho VCC., *et al*. "Topical fluoride (toothpastes, mouthrinses, gels or varnishes) for preventing dental caries in children and adolescents". *Cochrane Database of Systematic Reviews* 4 (2003).

21. Marinho VC., *et al*. "Fluoride gels for preventing dental caries in children and adolescents". *Cochrane Database of Systematic Reviews* 2 (2002).

22. Marinho VCC., *et al*. "Fluoride varnishes for preventing dental caries in children and adolescents". *Cochrane Database of Systematic Reviews* 7 (2013).

23. Caufield PW and Griffin AL. "Dental caries: an infectious and transmissible disease". *Compendium of Continuing Education in Dentistry - Journals* 26.1 (2005): 10-16.

24. Berkowitz RJ. "Mutans Streptococci: Acquisition and Transmission". *Pediatric Dental Journal* 28 (2006): 106-109.

25. Chu S. "REVIEW - Early Childhood Caries: Risk and Prevention in Underserved Populations". *Journal of Young Investigators* (2006).

26. Chaffee BW., *et al*. "Maternal Oral Bacterial Levels Predict Early Childhood Caries Development". *Journal of Dental Research* 93.3 (2014): 238-244.

27. Policy on Early Childhood Caries (ECC): Classifications, Consequences, and Preventive Strategies. American Academy of Pediatric Dentistry". Reference Manual 37.6 (2016): 15-16.

28. National Institutes of Health. Diagnosis and management of dental caries throughout life, National Institutes of Health, Bethesda, Md (2001).

29. Alaki SM., *et al*. "Middle Ear and Respiratory Infections in Early Childhood and Their Association with Early Childhood Caries". *Pediatric Dentistry* 30.2 (2008).

30. Cristiana Oliveiraa., *et al*. "Is dental caries experience increased in HIV-infected children and adolescents? A meta-analysis". *Acta Odontologica Scandinavica* 73.7 (2015).

31. Foster H and Fitzgerald J. "Dental disease in children with chronic illness". *Archives of Disease in Childhood* 90 (2005): 703-708.

32. Kulkarni ML., *et al*. "Colourings, flavourings, and sugars in children's medicines in India". *British Medical Journal* 307 (1993): 773.

33. Dawes. "How Much Saliva Is Enough for Avoidance of Xerostomia?" *Caries Research* 38 (2004): 236-240.

34. Hong L., *et al*. "Association between Enamel Hypoplasia and Dental Caries in Primary Second Molars: A Cohort Study". *Caries Research* 43.5 (2009): 345-353.

35. Subramaniam P., *et al*. "Interdental spacing and dental caries in the primary dentition of 4–6-year-old children". *Journal of Dentistry* 9.3 (2012): 207-214.

36. Kühnisch J., *et al*. "Respiratory diseases are associated with molar-incisor hypomineralizations". *Swiss Dental Journal* 124.3 (2014): 286-293.

37. Guideline on Xylitol Use in Caries Prevention. Clinical Guidelines. American Academy of Pediatric Dentistry. Reference manual 37.6 (2014): 15-16.

38. Mehta A. "Trends in dental caries in Indian children for the past 25 years". *Indian Journal of Dental Research* 29.3 (2018): 323-328.

39. National Oral Health Survey and Fluoride Mapping, 2002-03, Dental Council of India, New Delhi, India, (2004).

40. Kidd E. "Essentials of dental caries: The disease and its management". 3rd edition. New York: Oxford University Press Inc (2005).

41. Ahovuo-Saloranta A., *et al*. "Pit and fissure sealants for preventing dental decay in the permanent teeth of children and adolescents". *Cochrane Database of Systematic Reviews* (2008): 4.

42. Rickets D and Kidd E. "Operative caries management in adults and children". *Cochrane Database of Systematic Reviews* (2013).

43. Nicola Innes and Evans. "The Hall Technique- A minimal intervention, child centred approach to managing the carious primary molar: A User's Manual. University of Dundee". 3rd edition (2010).

44. Hickel Kaaden., *et al*. "Longevity of occlusally-stressed restorations in posterior primary teeth". *The American Journal of Dentistry* 18 (2005): 198-211.

45. Nagaraj A., *et al*. "Perception of Dentists about Caries-risk Assessment tools in Jaipur, India: A Cross-sectional Study". *Journal of International Oral Health* 7.8 (2015): 77.

46. Schwendicke F., *et al*. "Managing Carious Lesions: Consensus Recommendations on Carious Tissue Removal". *Advances in Dental Research - SAGE Journals* 28.2 (2016): 58-67.

47. Ramos-Gomez FJ., *et al*. "Pediatric dental care: prevention and management protocols based on caries risk assessment". *The Journal of the California Dental Association* 38.10 (2010): 746-761.

48. Kulkarni GV. "Long-Term Effectiveness of Parent Education Using the "Baby Oral Health" Model on the Improvement of Oral Health of Young Children". *International Journal of Dentistry* (2013): 137048.

49. Mitha MM., *et al*. "Caries risk assessment among 12–13-year-old school-going children of government and private schools of Tirupur district, Tamil Nadu". *Journal of Indian Society of Pedodontics and Preventive Dentistry* 34 (2016): 244-248.

50. Krishan Gauba., *et al*. "A CAMBRA Model For High Caries Risk Indian Children: A Pragmatic Comprehensive Tailored Intervention". *Journal of Clinical Pediatric Dentistry* 40.1 (2016): 36-43.

51. Thakur JH., *et al*. "Evaluation of CRAFT as a Tool for Caries Risk Assessment in 3- to 6-year-old Children and its Validation against Alban's Test: A Pilot Study". *International Journal of Clinical Pediatric Dentistry* 12.6 (2019): 538-542.

52. Iyer CR and Jawdekar AM. "ECC Status, CRAFT Categorization and OHRQL Assessment in 3-6-year-old Children: A Cross-sectional Study". *International Journal of Clinical Pediatric Dentistry* (2021).

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