Management of High Caries Risk and High Caries Activity Patients: Rampant Caries Control Program (RCCP)


Abstract: The purpose of this article is to describe the Rampant Caries Control Program established in the operative dentistry third-year clinic at the University of Iowa College of Dentistry. This program represents a new approach to the management of high caries risk and high caries activity patients who come to the school. The patients are referred initially to the third-year operative clinic only for disease control (phase I) to help them decrease the caries risk and activity. The disease control phase has three important components: 1) caries risk assessment evaluation and reevaluation throughout their treatment, in which individual risk factors are identified and recommendations are made; 2) caries removal and placement of transitional restorations using fluoride release restorative materials (glass ionomers); and 3) chemotherapeutic agents and preventive treatment in which a therapeutic regimen for prevention and nonsurgical treatment is established according to each patient’s individual risk factors. About 50 percent of patients have dropped from the program, 36 percent currently are under disease control treatment, and 14 percent have finished the disease control phase of the program. After the disease is controlled through modification of risk factors and activity, the patients can be referred for reevaluation prior to beginning the rehabilitation phase.

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Clinical education for dental students requires an ample number of patients to provide the learning experiences necessary for student practitioners to become competent. Dental schools usually attract patients because of the low cost of treatment, patients’ desire to contribute to education of students, and patients’ desire for comprehensive services in one place. In particular, dental schools often serve an increasingly lower socioeconomic status (SES) population. Frequently, these patients have not received dental care for some time, so they often present with complex needs. Many of those patients have rampant decay and come to the clinics due to pain or by referral from other dentists for extensive treatment. Figure 1 depicts the high caries activity often seen among high risk patients in the clinic.

While it is important to balance the clinic’s educational mission with the responsibility of providing oral health care to underserved populations, it is a challenge to manage and treat patients with rampant caries in the student clinics with traditional approaches. A medical approach to dental treatment, based on treating the underlying disease, has gained prominence in recent years and may offer an alternative to traditional approaches in treating these challenging patients. The medical model emphasizes mechanical/chemical removal of plaque (oral hygiene), chemical (antimicrobial) modification of plaque, use of fluorides, dietary modification, and salivary stimulation to better control the underlying disease. With the medical model, it is important to thoroughly evaluate the etiology of the disease to allow for the most appropriate treatment as well as for teaching purposes. Thus, the medical model of disease control provides the foundation for proper diagnosis, prognosis, and treatment of dental caries.

Given the movement towards the medical model of caries management, the time is ideal to establish this new approach to manage rampant caries patients.

The purpose of this article is to describe a program implemented in the student clinic in January 2003 at the University of Iowa College of Dentistry that applies the medical model to address rampant caries patients. The Rampant Caries Control Program (RCCP) was established in the third-year operative clinic to manage patients with high caries activity, with the goal of helping them control the disease throughout life.
The RCCP Phases

Phase I disease control has three important components: 1) acute/emergency treatment, 2) operative treatment, and 3) chemotherapeutic agents and preventive treatment. The first component, acute/emergency treatment, such as root canal therapy, is provided only if necessary to address emergency needs. Extractions are also completed for any tooth that cannot be restored.

Operative treatment, the second component, is based on caries management by individual risk assessment. This phase consists of caries risk assessment, caries removal and placement of transitional restorations, and sealants. Caries risk assessment is absolutely necessary to select optimal therapeutic regimens for the prevention, diagnosis, and management of caries as an infectious disease. The students use a worksheet (Figure 2) to identify the risk factors that may contribute to dental caries as well as any protective factors. Factors include plaque accumulation, oral hygiene practices, dietary habits, attitude, health beliefs, presence of physical, mental, or social factors, saliva quality and quantity, systemic disease or medication, alcohol, drug abuse, fluoride exposure, education level, SES, and tooth morphology.

The students discuss their worksheet findings with the patients and make individual chemotherapeutic recommendations for each patient. Caries removal and placement of transitional restorations is accomplished by the students working on one quadrant or arch at each appointment. This rapid caries removal and temporization is designed to eliminate the infection as quickly as possible, but also provides a method of diagnosis that allows for a more accurate assessment of restorability and prognosis for each individual tooth. This is accomplished in as few appointments as possible, but typically requires four to five appointments.

The transitional restorations are placed after the removal of all carious tissue using rotary and hand instruments. Adhesive transitional fluoride releasing restorative material (Fuji IX, GC America, Alsip, IL, USA) is used (Figures 3 and 4). This procedure is
Caries Risk Assessment Worksheet

Name ____________________________
Chart # __________ Date ____________
C0180 Initial Caries Risk Assessment
C0181 Caries Risk Re-Assessment

<table>
<thead>
<tr>
<th>Evidence of disease or past disease</th>
<th>Yes/No</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active caries lesions</td>
<td></td>
<td>(if Yes, patient is high risk)</td>
</tr>
<tr>
<td>Recent restoration for active caries (within the last 3 years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Past dental history, i.e., high DMFT &gt;8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White spot lesions or occlusal discoloration</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>Yes/No</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diet (sugar beverages, snacks-meals, and frequency)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inadequate topical fluoride exposure (toothpaste, rinses, etc.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inadequate oral hygiene record: brushing/flossing frequency (a visible heavy plaque)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Xerostomia (medications, radiation head and neck, systemic reasons)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exposed root surfaces</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Challenges to physical/cognitive ability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other factors: ortho appliances, RPDs, recreational drugs</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Re-evaluate date: ____________________________
Comments ____________________________________
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
new Guzman Figure 2.doc

Caries Risk/Activity Treatment Options
(check off preventive measures that are recommended and/or prescribed)

Oral Hygiene and Other Instruction:
- Brush twice a day with an ADA-approved fluoride toothpaste; swish and spit
- Floss (and use other cleaning aids) as recommended by our office
- Discuss risk factors, and recommend and record interventions
- Diet assessment/modification

Restorations:
- Seal susceptible fissures in newly erupted teeth
- Seal all susceptible fissures
- Restore or temporize existing carious lesions for disease control
- Definitive restorations for rehabilitative phase of treatment plan

Fluoride Application:
- PreVent 5000 Plus or other Rx fluoride
  Date: 1/day 2/day
- Topical fluoride varnish (Cavity Shield) at each visit
- Topical fluoride (neutral sodium fluoride gel, foam, or varnish) at recalls

Antibacterials:
- Salivary counts of mutans streptococci for continued high caries activity
- Chlorhexidine rinse
  Rx: Chlorhexidine 0.12% mouthrinse 5 ml @ bedtime for 2 weeks, NPO for 30 minutes
- Chlorhexidine rinse
  Rx: Chlorhexidine 0.12% non-alcohol mouthrinse 5 ml @ bedtime for 2 weeks (3rd floor dental pharmacy ONLY), NPO for 30 minutes

Others:
- Xylitol gum (2 pieces immediately after meals or snacks for 10 min.)
- MI Paste: Use after meals and snacks. Apply pea size on teeth with finger and distribute with the tongue. Do not rinse.
- Xerostomia: refer to questioner and recommendation form. Trial kit of products available in the dental pharmacy (3rd floor College of Dentistry)

Recalls:
- Recall 3-4 months (reevaluate caries risk & activity levels). Confirm lowered risk before proceeding with rehabilitative phase of treatment.
- Recall 3-6 months (reevaluate caries risk & activity levels).
- Recall 6 months (reevaluate caries risk & activity levels).
- Recall 6-12 months (reevaluate caries risk & activity levels).

Figure 2. Caries risk assessment worksheet
consistent with current scientific rationale relating to caries management. In a very few cases, some demineralized dentin is left close to the floor of the cavity, as part of a Stepwise excavation protocol in an attempt to avoid pulpal complications during disease control. After six to eight months, teeth treated in this manner are re-entered, all remaining demineralized dentin is removed, and a final treatment is provided as appropriate, either a final restoration or endodontic therapy. Sealants are placed in deep and retentive pits and fissures of all surfaces that are otherwise sound and unrestored. Since the process of disease control and lifestyle changes takes time, it is very important to seal all retentive tooth surfaces to prevent any new lesions from developing during the initial phase of treatment.

In the third component—chemotherapeutic agents and preventive treatment—individualized prevention is provided at both the dental visit and through home care. Individualized home-based caries prevention regimens include many of the following.

Use of high fluoridated toothpaste (5000 ppm) twice a day. Fluoride toothpaste has been considered for several years the most effective and widely used method of applying fluoride. The efficacy of conventional fluoride toothpaste (1000 ppm) has been documented in many studies, and evidence suggests that toothpaste containing 5000 ppm F can be effective for the control of rampant caries.

Diet modification. The relationship among refined sugar, frequency of snacks/meals, and dental caries is well documented. Individualized diet evaluation and counseling are accomplished by a dietician emphasizing simple concepts to reduce exposures (i.e., sugared beverages such as regular pop/soda, juice drinks, sports drinks).

Antimicrobials. Given the fact that bacteria cause dental decay, it is logical to use antimicrobials, such as Chlorhexidine rinses, to slow caries progression and prevent future caries. The main goal of antimicrobial therapy is to achieve a shift from an ecologically unfavorable to an ecologically favorable biofilm. Evaluation of salivary counts of mutans...
streptococci (SM) using a semi-quantitative method for SM analysis is one of the diagnostic tools utilized for these RCCP patients. After the evaluation of SM levels for these patients, when appropriate, 0.12% Chlorhexidine rinses are prescribed as part of an intensive, short-term regimen. Specifically, patients are instructed to use ½ ounce of Chlorhexidine rinse (if possible, nonalcohol) for thirty seconds once a day, preferably before bedtime. Bedtime application is recommended because saliva flow diminishes overnight and the concentration of the drug in the oral cavity remains high until morning, prolonging its effectiveness. A fourteen-day regimen is usually used as such a regimen will suppress the SM infection for twelve to twenty-six weeks. These rinses may play a very important role in disease control, particularly when combined with other preventive agents.

Xylitol or other sugar-free gum. Xylitol gum use has been shown to be an effective caries preventive agent. Xylitol is a polyol (a type of carbohydrate) and can be used as a sugar substitute. This gum sometimes is known as a “sugar-free” noncariogenic and also appears to have antimicrobial properties. Xylitol is a five carbon sugar alcohol that is not a metabolizable substrate for SM. Longitudinal trials from Finland show not only decay reductions, but also actual reversal of incipient lesions. Frequent consumption of xylitol appears to selectively disrupt SM, creating impaired adhesion properties. A forty-month study in Belize showed a 43 percent decrease in carious lesions. Chewing xylitol gum for five minutes three times a day has shown consistently positive results. The protocol we recommend for the RCCP patients is to chew two pieces of xylitol gum three to five times a day, for five to ten minutes per chewing episode.

Application of calcium-phosphate paste (MI Paste, GC America, Alsip, IL, USA). MI Paste is a milk-derived product, casein phospho-peptide-amorphous calcium phosphate (CPP-ACP; Recaldent®). The CPP-ACP allows an increase in calcium and phosphate ions to produce a supersaturated solution, which then precipitates a calcium phosphate compound onto the exposed dentin surface, providing treatment of dentinal hypersensitivity. MI Paste...
has not been used in caries preventive clinical trials although the active ingredient (CPP-ACP) has been tested to evaluate remin/demin results when delivered by gum chewing in in situ studies and with solutions in rat caries studies.\textsuperscript{17}

The CPP-ACP has been shown to adhere to the bacterial wall of microorganisms\textsuperscript{18} as well as the tooth surface. The exact extent of this substantivity is unknown; therefore, the frequency of application needed to optimize effectiveness is unknown. It is felt that daily applications are beneficial in high caries risk patients,\textsuperscript{19} and for this reason, CPP-ACP is recommended for daily use in RCCP patients.

\textit{Floss every day.}

In addition to these home-based measures, in-office preventive treatment for RCCP patients consists of three steps. First, patients attend a consultation appointment for diet evaluation and receive individual nutritional counseling. Second, patients receive a fluoride varnish (Vanish, Omni Preventive Care, 3M ESPE, West Palm Beach, FL, USA), which is an in-office method of providing high concentration fluoride to the teeth (5% NaF in an alcohol suspension of natural resins, 22,000 ppm). Varnishes are now available and used worldwide to deliver concentrated levels of fluoride directly to teeth in a very simple, effective, and cost-efficient way. Six-month applications have resulted in a 37 percent caries inhibition in children with high caries risk.\textsuperscript{20} Rampant caries patients have fluoride varnish application at least twice a year. Two or more applications of fluoride varnish a year have shown to be effective in preventing caries in high risk populations.\textsuperscript{21} Third, risk factors and recommendations are discussed with the patient, and findings are documented in the patient’s record.

All these at-home and in-office recommendations are established according to the individual risk factors as identified at the beginning of treatment and reevaluated throughout the course of treatment.

Figures 1, 3, and 4 show an example of the operative phase treatment of an RCCP patient as provided by a third-year student. In addition to the operative treatment, this patient also received appropriate periodontal treatment. As part of the medical approach to disease control, this patient was placed on a high-fluoride toothpaste (5000 ppm), received application of fluoride varnish at every appointment, completed a two-week regimen of once-daily Chlorhexidine rinse, received dietary counseling, and subsequently modified his diet. The patient is currently in a rehabilitation phase, with placement of definitive restorations.

\section*{RCCP Implementation in Student Clinics}

The University of Iowa College of Dentistry third-year clinics are based on a clerkship system. This system consists of providing the students with rotations in different departments for a limited period of time (ten to twenty weeks) to concentrate in a specific discipline. The RCCP patients enter this system through the Oral Diagnosis Clinic, which provides comprehensive diagnosis, treatment planning, and referral to specific departments. As part of the program, RCCP patients receive treatment plans only for the disease control phase at this appointment.

During the appointment, the requirements for participating in the RCCP are explained so that the patient is fully informed prior to consenting to treatment. The following conditions and expectations for participation in the RCCP are explained to patients during the informed consent process:

- Patients must be motivated to keep their teeth and cooperate with preventive and disease control measures recommended by the practitioner.
- Patients are expected to have initial dietary counseling with the dietician and must be willing to change their diet accordingly.
- Patients must be willing to pay for the following components of Phase I disease control when it is not covered by their insurance:
  - transitional restorations (02940 Sedative fillings),
  - sealants of all susceptible pits and fissures, and
  - prescriptions for chemotherapeutic agents, prophylaxis, and fluoride application and re-evaluations.
- Patients must make a commitment to comply with the protocol and keep all appointments. If a patient fails three appointments, they are dismissed from the program. (A warning is given by mail after two missed appointments.)
- Following Phase I (disease control and prevention), the patient needs to commit to Phase II (reconstruction/maintenance/monitoring).

After this initial oral diagnosis appointment, patients are treated by third-year dental students in the Operative Clinic for Phase I disease control and prevention with referral to other disciplines (Oral Surgery, Endodontics, Periodontics) as needed. Once Phase I disease control is successfully accomplished (modified contributory risk factors are controlled and caries
risk has decreased), the patient returns to the Oral Diagnosis Clinic for a reevaluation and a final treatment plan for definitive restorative and reconstruction treatment. The patients are then placed on a three-to-six-month maintenance schedule for prophylaxis, caries risk reevaluation, and monitoring of compliance with individualized preventive protocols.

Results of the Program

The goal of the RCCP is to provide appropriate oral health care for all people with rampant caries, who are typically the underserved. Unfortunately, the commitment that it takes for patients to succeed in this process is large because dental care is not a high priority for many of these patients. Thus, it is not surprising that patient reliability and commitment are often quite poor.

Since January 2003, seventy-one patients have been enrolled in the RCCP. A total of thirty-six patients have been dismissed from the program due to several appointment failures and/or financial arrears. One patient was dismissed from the program for health reasons but plans to return; ten patients have completed the disease control treatment and are currently in the rehabilitation phase or maintenance phase. Twenty-four patients are currently in the disease control phase of the program. Thus about 50 percent of patients have been dismissed from the program due to economical concerns and/or lack of time and commitment. While this proportion is very high, it is not surprising, given that most patients are from lower SES backgrounds and have significant needs that require high levels of commitment.

The program acceptance within the school has been favorable in that the faculty and students have come to understand the need for a medical approach to treat patients with high caries activity. The challenges have been to integrate this program into a large institution, which has necessitated creating new procedure codes and protocols to follow up with the patients and procedures in an efficient manner. One of the challenges was to gain the cooperation of multiple departments and to explain in a clear manner that the RCCP was not a protocol to replace the traditional treatment, but rather a medical approach designed to be combined with the traditional approach to enhance prevention and reduce disease recurrence for the benefit of the patients.

We have designed this program to establish a teaching and practice philosophy based on a medical approach in order to provide the best treatment for our patients with rampant caries. Basically, disease control should be seen as a “treatment” of ongoing caries progression. The most important concept for students is that such nonoperative preventive treatment is equally as important as the actual operative treatment, implying that both are true “treatments” of the disease process and both are time-consuming, require skill, and are worthy of payment.

Another important concern has been in identifying ways to motivate the patients to continue the treatment and help them to understand that this requires joint effort from both parties (oral health provider and patient). It also requires that they must lower their risk and in many ways change their lifestyle to be able to have a better long-term prognosis and a successful rehabilitation phase.

Another challenge is that most insurance companies do not reimburse providers for transitional restorations, or if they do, the patients are required to wait from six months to two years to replace the transitional restorations with definitive restorations. To address these challenges, fees were lowered for transitional restorations, so the RCCP patients could better afford the initial treatment. The reduced fees have had a positive impact on our patients, but unfortunately, even at reduced fees some of them cannot continue treatment.

The school also has created internal procedure codes for stepwise excavation and total caries removal as well as codes for chemotherapeutic agents and follow-up assessments. This has improved documentation and helped to avoid misunderstanding and miscommunications.

Enhanced quality of treatment provided by students and improved time management have been two of the most positive and rewarding experiences for the faculty. The third-year students have adapted well to working with this pool of patients; they feel that they are not only helping the patients but also providing a long-term educational benefit for them.

As indicated in Figure 5, our evaluation of the RCCP has also demonstrated that using transitional restorations during the disease control phase of the RCCP has had benefits for patients and allowed for improved restorative treatment.

Patient’s perspective:

- quickly increases self-esteem, providing immediate motivation by improving the esthetics and oral health;
- minimal discomfort and increased efficiency by allowing the students to treat by quadrant;
potential for long-term cost-effectiveness by providing a more accurate prognosis for the final treatment plan and by assessing patients’ caries risk;
• reduces caries risk quickly; and
• immediate access to dental treatment for the underserved.

The benefits from a restorative perspective are as follows:
• gain field control for final restorations by improving the soft tissue health and evaluation of pulp status over time;
• glass ionomer fluoride release restorations proven to be effective in smooth surfaces at three years;
• provide most accurate prognosis and final treatment plan to our patients; and
• establish a medical model teaching philosophy in our school that emphasizes the disease process and its treatment.

This program will continue to evolve and will require changes and improvement over time, but thus far the results appear promising, although many patients have been dismissed from it. In addition, motivating patients to undertake long-term lifestyle changes that give them the opportunity to save their teeth appears to outweigh the challenges involved.

The RCCP has continued to expand and improve. This program may be useful for other schools throughout the nation that are facing the challenges of providing care for patients with high caries activity.

REFERENCES