Clinical outcomes for Early Childhood Caries (ECC): the influence of health locus of control


ABSTRACT. Aim To assess the relationship between clinical outcomes for children treated for ECC and health locus of control. Study design and Methods The study cohort consisted of 79 children (42 males, 37 females) treated for ECC; age range was 2.3-7.3 years (mean 4.2 years) at the time of entry into the study. A questionnaire [developed by DeVellis et al., 1993] was administered to each child’s parent(s) on the day of dental surgery. This questionnaire examined the expectation that healthcare outcomes in children are influenced by one of the following loci of control: Professional, Parent, Child, Media, Fate and Divine. The cohort was evaluated for new caries lesions at 6 months post dental surgery. Relapse was defined as the presence of new smooth surface caries lesions. Statistics For each locus, the scores for the Relapse versus Non-relapse groups (returning patients) and the scores for the returning versus non-returning patients were compared using t-tests. Results 57 children (72%) returned for follow-up and 21 of these 57 (37%) relapsed. No statistically significant difference for Relapse versus Non-relapse groups was indicated with respect to the scores for any locus parameter (p values ranged from 0.35 to 0.95). Returning parents (N=57) versus non-returning parents (N=22) exhibited statistically significant differences with respect to the Parent, Divine and Fate loci. Returning parents exhibited higher scores on the Parent locus (p=0.0392) and lower scores on the Fate (p=0.0024) and Divine (p=0.0031) loci. Conclusion 1) The relapse rate (37%) was high and rapid for children treated for ECC; 2) no meaningful difference existed between the Relapse versus Non-relapse groups with respect to each health locus of control parameter; 3) parents who returned for follow-up care appeared to have an internal health locus of control while those who did not return had an external locus.

KEYWORDS: Early Childhood Caries, Clinical outcomes, Health locus of control.

Introduction

As children are dependent on their parents, parental beliefs may influence parents’ actions related to attending clinics or engaging in preventive strategies such as altering feeding behaviours or oral hygiene practices. Such beliefs, mediating behaviours, may determine clinical outcomes for children treated for ECC. Health locus of control is a concept that has been examined and found related to many health behaviours [Galgut et al., 1987; DeVellis et al., 1993]. On this basis, our study examined the relationship between parental health locus of control and clinical outcomes for children treated for ECC.

Materials and methods

Study population. The study population consisted of 79 children consecutively admitted to the Ambulatory Surgical Center of the Strong Memorial Hospital at the University of Rochester Medical Center (URMC) for treatment of ECC utilizing general anaesthesia. This study cohort consisted of 42 males and 37 females ranging in age from 2.3 to 7.3 years (mean age 4.2 years) at their time of entry into the study. Ethnicity of the study population was as follow: 2 Native American (Amerindian); 2 Asian; 22 Black (not of Hispanic origin); 4 Hispanic; 27 Caucasian; 22 mixed race. All of the subjects were recipients of government support for dentistry as New York State Medicaid or Child Health Plus indicating that they came from families of lower socioeconomic status. All of the subjects harboured only primary teeth at the start of the study and at 6 months follow-up. The criterion for establishing a diagnosis of ECC was dental caries affecting at least

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2 of the 4 maxillary primary incisors and at least 2 of the 4 buccal segments. Dental surgery utilized an aggressive approach: teeth with necrotic pulps and non-restorable teeth were extracted; single surface lesions that did not compromise cusp integrity were restored with intracoronal restorations; teeth requiring pulp therapy were restored with preformed metal crowns; teeth having caries lesions affecting 2 or more surfaces were restored with metal crowns. A prophylaxis and topical fluoride application were performed after all restorative procedures were completed. All patients received preoperative dietary counseling and oral hygiene instruction. This study was approved by the Research Subjects Review Board of the URMC.

**Questionnaire.** A questionnaire was administered to each child’s parent (or primary care giver) on the day of dental surgery. This questionnaire utilized the health locus of control questionnaire developed by DeVellis et al. [1993] (Fig. 1). This questionnaire was chosen because of its internal consistency (scale reliabilities were above 0.70 for all scales) and construct validity. For each of the 6 loci of control (Professional, Parent, Child, Media, Fate and Divine), identified by factor analysis [DeVellis et al., 1993], 1 to 4 questions were posed to assess the extent to which the parents agreed that locus bore an impact on their child’s health. Responses to each question were coded on a scale from 1 (strongly agree) to 5 (strongly disagree). For each parent, the scores for each locus were averaged, thus yielding 6 locus scores per parent.

**Relapse evaluation.** The study population was evaluated for new caries lesions at 6 months after completion of the dental surgery. Caries status was evaluated by two clinical examiners (RJB and IC). One examiner (RJB) was trained and calibrated by one of the authors (RB), who has had extensive experience in dental caries clinical trials. The second examiner (IC) was trained and calibrated by the first examiner (RJB) and each was recalibrated every 2 months during the study period. Relapse was defined as the presence of one or more new smooth surface caries lesion(s) affecting any primary teeth. A surface was diagnosed as having smooth surface caries using the criteria of Radike [1972] with the exception that white spot lesions were not penetrated with an explorer. The subjects were scheduled for the 6 months follow-up visit via telephone by the study coordinator and given a $30 volunteer fee to enhance compliance with follow-up.

**Statistical analyses.** For each locus, the scores for the Relapse and Non-relapse groups were compared using t-tests. An inspection of the locus data indicated that for each parameter the shape of the distribution was nominally bell shaped within relapsing and non-relapsing subjects. Separate tests were performed for each locus parameter, in each

### Locus of control parameter | Questions to assess health locus of control
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Professional | 1) Health professionals keep my child from becoming sick  
2) Having regular contact with a doctor is the best way for my child to avoid illness  
3) Only trained health professionals can influence my child’s health
Parent | 1) I have the ability to influence my child’s well-being  
2) I can do a lot to prevent my child from getting hurt
Child | 1) My child cannot avoid illness with regular professional care  
2) My child is in control of his/her own health  
3) My child is the one who determines his/her own health  
4) My child’s safety depends mostly on what he/she does
Media | 1) What my child sees on TV commercials can affect his/her health  
2) What my child sees on TV programs can affect his/her health
Fate | 1) Whether my child avoids injury is a matter of luck  
2) Luck plays a big part in determining how healthy my child is
Divine | 1) God will decide what will happen to my child’s health

**Fig. 1 - Health locus of control questionnaire used in assessment of parental attitudes in a group of children treated for ECC [after DeVellis et al., 1993].**
case providing a comparison of the Relapse versus Non-relapse groups; thus, in every instance the comparison involved only two groups. Non-parametric analyses of the data utilizing Wilcoxon tests (not reported) yielded similar p values to those obtained using t-tests. In addition, the returning patients (Relapse and Non-relapse groups) were compared with the non-returning patients for each locus using t-tests. A level of significance of $\leq 0.05$ was employed in all statistical tests.

Results

Of the 79 subjects enrolled in the study, 57 (72%) returned for the 6 months follow-up examination; 21 (37%) of these 57 returning patients relapsed. Fifteen of the 22 non-returning patients were lost to follow-up because no forwarding address was available coupled with their telephone having been disconnected. No statistically significant difference between the Relapse and Non-Relapse groups was indicated with respect to the scores for any locus parameter (p values ranged from 0.35 to 0.95) (Table 1). Post hoc power calculations were performed for each locus parameter; these indicated that the power of the comparison to detect a 0.33 unit difference in the locus scores was 80% or greater for all locus parameters. Thus, these findings support the conclusion that there was no meaningful difference between Relapse and Non-relapse groups with respect to any of the health locus of control parameters.

Statistically significant differences between the returning (n=57) and non-returning subjects (n=22) were indicated with respect to the Parent, Fate and Divine locus parameters. Returning subjects exhibited significantly lower scores on the Parent locus (p=0.0392) and on both the Fate and Divine locus parameters (p=0.0024 and p=0.0031 respectively). No statistically significant difference between the returning and non-returning subjects was presented with respect to any other of the locus parameters (Table 1).

Discussion

The observed relapse rate (37%) in the present prospective study was in accordance with the results found in other studies [Sheehy et al., 1994; Berkowitz et al., 1997; Eidelman et al., 2000; Almeida et al., 2000]. Given the morbidity and cost associated with treatment of relapse (for example: general anaesthesia, sedation, physical restraint), these reports indicate that the current standard of care for ECC results in unacceptable clinical outcomes.

Results from this study indicated that 72% of the cohort returned for the 6 months follow-up

<table>
<thead>
<tr>
<th>Locus of control</th>
<th>6 months relapse status</th>
<th></th>
<th>Non-returning</th>
<th></th>
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<tbody>
<tr>
<td></td>
<td>Non-relapse</td>
<td>Relapse</td>
<td>Non-returning</td>
<td>Relapse vs.</td>
<td>Non-return</td>
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<tr>
<td>Parameter</td>
<td>n</td>
<td>mean</td>
<td>SD</td>
<td>n</td>
<td>mean</td>
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<tr>
<td>Professional</td>
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<td>0.86</td>
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<tr>
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<tr>
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<tr>
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</tr>
<tr>
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<td>1.09</td>
<td>21</td>
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<tr>
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<td>36</td>
<td>2.81</td>
<td>1.17</td>
<td>21</td>
<td>2.48</td>
</tr>
</tbody>
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*Non-parametric analyses of the data utilizing Wilcoxon tests (not reported) yielded similar p values to those obtained using t-tests. In addition, the returning patients (Relapse and Non-relapse groups) were compared with the non-returning patients for each locus using t-tests. A level of significance of $\leq 0.05$ was employed in all statistical tests.

Table 1 - Summary of locus scores by 6 months relapse status and Returning versus Non-returning patients in a study to assess parental attitudes in a group of children treated for ECC.
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examination. This is a relatively high compliance rate compared with those observed in previous reports. An earlier study [Berkowitz et al., 1997] retrospectively evaluated 84 children treated for ECC under general anaesthesia and found that only 28.6% presented for recall examination. Almeida et al. [2000] reported that 55% of their patients treated for ECC under general anaesthesia complied with recall visits and Enger and Mourino [1985] reported a 52% compliance rate. Similar findings have been reported by others [Eidelman et al., 2000; Sheehy et al., 1994]. The present study utilized a study coordinator to arrange the follow-up exams and offered a $30 volunteer fee; this probably resulted in an improved compliance with follow-up attendance relative to that observed in earlier reports. These observations indicate that intensive efforts are needed to reach low-income families. It is clear to us that recall efforts that do not allocate resources for such efforts will not be successful.

This study also found that non-returning parents had a statistically significant higher association with the Divine (“God’s will”) and Fate (“Whatever will be will be”) locus parameters, while returning parents had a statistically significant higher association with the Parent locus parameter. Parents who return for follow-up care appear to have an internal locus of control, while those who do not return appear to have an external locus, believing that factors beyond their control will influence the health of their child.

How do we interpret these findings? While it is tempting to try to develop groupings of parents and intervention strategies based on locus of control, such efforts would be premature. Our results point out that there is a disconnection between dental providers and low-income patients. While we were relatively successful in enhancing parent return after dental surgery, it is clear that low-income parents do not routinely return for recommended 6-months follow-up visits. Moreover, an external locus of control is learned; it is a proxy for negative experiences and beliefs. The construct of locus of control does not appear mutable. However, there is evidence that locus of control is shaped by experience [Goldsteen et al., 1994; Wolfe et al., 1996]. Providing parents with compelling evidence from experience or otherwise that dental treatment can be benign and effective in controlling subsequent problems may alter their locus of control beliefs and in turn their dental behaviours.

Contrary to what was anticipated, no association was identified between relapse status and any of the health loci of control parameters. It was initially hypothesized that there would be an association between Parent locus scores and low relapse rates; however this was not the case. This observation may likely be explained by the bacteriologic characteristics of ECC which is typified by a rampant oral mutans streptococci infection [Van Houte et al., 1982; Berkowitz et al., 1984; Milnes and Bowden, 1985]. Dental surgery, coupled with recommendations regarding feeding behaviours for ECC, results in reductions in oral populations of mutans streptococci [Twetman et al., 1999] but nevertheless salivary levels that still pose a high caries risk [Wright et al., 1992; Chase et al., unpublished data]. Hence, irrespective of health locus of control, clinical outcomes for treatment of ECC are deplorable as the microbiologic risk factor is not disposed of via current standards of care. New treatment strategies need to be developed that address the microbiologic culprit if improvements in clinical outcomes are to be realized.

Conclusion
The relapse rate (37%) was found to be high and rapid for children treated for ECC and there was no meaningful difference between the Relapse versus Non-relapse groups with respect to each health locus of control parameter. Parents who returned for follow-up care appeared to have an internal health locus of control, while those who did not return had an external locus.

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