

The extent of trauma and postextraction pain in children

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Abstract

A survey of pediatric dental patients was undertaken to determine the possible association between the extent of trauma and the report of postextraction pain. The extent of surgical trauma was quantitated on the basis of the number of teeth extracted and the amount of remaining alveolar support of the extracted tooth. A parental questionnaire revealed a significant association between the number of teeth extracted and the incidence of postextraction pain. Additionally, the amount of remaining alveolar support was associated significantly with the report of pain. Although both factors are associated with increased report of postextraction pain, the number of teeth extracted may carry increased expectations for pain. However, the amount of remaining alveolar support represented a predictor of the pain response that appeared not to be biased by parental or patient expectations for postextraction pain. The "degree of difficulty" of the extraction, a semi-quantitative measurement, may provide a useful objective predictor in the assessment of a child's reactions to a common dental procedure and may help the dentist plan for postoperative care.

The multifactorial nature of the pain response has been well established (Melzack 1975; Van Buren and Kleinknecht 1979). Many studies have examined the incidence of postextraction pain in adults (Swedlow et al. 1963; Schludermann and Zubek 1982); however, factors influencing the reporting of pain in children have not been well defined. Quantification of some of the multifactorial elements such as race, culture, and socioeconomic status is difficult (Woodrow et al. 1975). The subjective nature of the pain response likewise makes the study of pain in adults difficult to assess because of the possible existence of expectations for pain, based on previous experiences or hearsay. Children, however, represent a group in which the subjective

nature of the pain response may be minimized due to the minimal exposure to many of the identified and unidentified elements that ultimately form an individual's response to noxious stimuli (Acs et al. 1986).

Very few pain studies have included children as subjects. Most studies that have examined pain in children have only investigated the phenomenon of chronic pain (Savendra 1977; Stickler and Murphy 1979). Only in recent years have various investigators studied the incidence of acute postoperative pain in children. Some of these studies have shown that children do experience postoperative pain and do require postoperative analgesics, thus helping to dispel some popularly held notions that children neither experience pain nor require postoperative analgesics (Mather and Mackie 1983). Additionally, investigators using a pediatric dental extraction model recently have demonstrated the existence of postextraction pain in children and their use of postextraction analgesics (Acs et al. 1986; McGraw et al. 1987).

Levine et al. (1982) demonstrated that the amount of physical trauma induced in adult patients, as measured by the number of third molars extracted, was significantly associated with an increased incidence of pain. The purpose of the present study was to validate the use of quantitative and semi-quantitative measures of induced trauma and to investigate the association between the extent of the injury and the report of postextraction pain in children.

Methods

A questionnaire was developed and distributed to the parents of 229 pediatric dental patients undergoing dental extraction. In recognition of the multifactorial nature of the pain response, several broad categories for investigation were identified. However, for purposes of this report, only the extent of surgical trauma was

analyzed. The questionnaire was distributed within a private practice specializing in pediatric dentistry and orthodontics. All children who were to undergo dental extraction were eligible for inclusion in the study. The survey form was distributed to parents of all children who were to undergo dental extraction and who agreed to participate in the study. Additionally, the survey form was accompanied by a letter that explained that the intent of the questionnaire was to help understand children's reactions to common dental procedures. Following the extraction procedure, the pediatric dentist was instructed to avoid the suggestion of pain to the parent or child, but to answer any questions that may have been posed by the parent or child. The survey form also was distributed to the parents of 20 children who were to undergo noninvasive procedures, such as routine examination or dental prophylaxis and topical fluoride application. This group of patients represented the study control.

The returned survey forms were collected and assembled for statistical analyses. The dependent variable was defined as the reported presence or absence of pain. The independent variables chosen to represent the extent of the injury were defined on the basis of the number of teeth extracted (NTEETH) and on a radiographic measure of the amount of remaining bony support following the extraction. This measure was referred to as the "degree of difficulty" (DOD) of the extraction (Table 1). DOD ratings were made independently by 2 pediatric dentists trained in the use of this scale. In instances where there was no agreement on the

TABLE 1. Degree of Difficulty Ratings

Rating	Description
1	Exfoliating, tissue borne tooth No local anesthetic used
2	Primary canines, up to 3/4 root structure Primary incisors
3	Primary molars, less than 1/2 root structure Primary molars, greater than 1/2 root structure Primary canines, greater than 3/4 root structure
4	Ankylosed primary teeth Permanent teeth Any teeth requiring soft tissue surgical procedures

DOD rating, the principal investigator analyzed the radiographs and assigned a rating, without consultation with the 2 rating dentists. Additionally, in instances of multiple extraction, the DOD rating given was that for the tooth that had the greatest amount of remaining alveolar support.

The raw data then were analyzed to ascertain the numbers and relative proportions of those children who

reported pain. Subsequently, data were analyzed to determine the possible association between the number of teeth extracted and the report of pain, as well as the DOD of the extraction and the report of pain. The possible association between the DOD of the extraction and the report of pain was investigated for those patients who had single tooth extractions. Additionally, the association of the arch from which the tooth was extracted and the report of pain was evaluated for those patients undergoing single tooth extractions. Inter-rater reliability testing was performed to determine the validity of DOD as a measurement tool, and Chi-square testing and contingency testing for significance were performed on all data generated from the questionnaire.

Results

The questionnaires were returned by 221 of 229 patients surveyed (96.5%). The mean age was 9.1 years, with 90% of the patients in the 6 to 13-year age range. The sample study included 114 females (51.6%) and 107 males (48.4%). For purposes of analyses, ages were grouped as follows, 2-5 years, 6-9 years, 10-13 years, and 14-17 years. However, since the number of responses in the youngest and oldest groups was too low for statistical analysis, comparison was made only between the two middle groups.

Inter-rater Reliability

There were 17 disagreements among the raters. In each instance the principal investigator rated the radiograph, without prior knowledge of the nature of the disputed rating assignment. The inter-rater reliability was 0.92, based on 221 observations.

Report of Pain

The incidence of pain in this study population has been reported previously (Acs et al. 1986); 37.6% of the study group reported pain, while none of the patients in the control group reported pain following their dental visit. This finding was statistically significant ($P < 0.01$). Although age was not associated with the report of pain, overall, older children tended to report pain more often. Comparing the 6 to 9-year-old group to the 10 to 13-year-old group, revealed that the older group was significantly more likely to report pain ($P < 0.05$, Table 2 – next page).

Number of Teeth Extracted (NTEETH)

A significant increase in the incidence of postextraction pain was observed when more than 2 teeth were extracted ($P < 0.01$) — 34.8% of the patients who had 1 or 2 teeth extracted reported pain. However, 60.6% of

TABLE 2. Incidence of Postextraction Pain in Children

Age (years)	Subjects	Reporting Pain (%)
6-9	109	34 (31.2)
10-13	91	142 (46.2)

$P < 0.05$, Chi Square = 4.10, 1 df.

those patients who had 3 teeth extracted reported pain ($P < 0.01$, Table 3).

Degree of Difficulty of the Extraction

As the DOD of the extraction increased, the report of pain increased. Although 34.9% of the patients who had extractions of DOD 2 or less reported pain, 58.9% of the patients undergoing extractions of DOD 3 or greater reported pain. Pooled data indicated that the DOD was significantly related to the report of pain ($P < 0.01$, Table 4). Additionally, for those who had single tooth extractions, the DOD was significantly related to the report of pain ($P < 0.05$, Table 5). Only 29.5% of patients with extractions of DOD 2 or less reported pain following single tooth extractions, whereas 60.0% of patients undergoing single tooth extractions of DOD 3 or greater reported pain.

There was no significant difference in the report of pain for single maxillary tooth vs. mandibular extractions of DOD 2 or less. However, those patients undergoing single maxillary tooth extractions of DOD 3 were significantly more likely to report pain ($P < 0.05$, Table 6).

Discussion

The multifactorial nature of the pain response makes it an exceedingly difficult area of study. Since pain is partially a learned response (Grainger et al. 1972), it is appropriate to examine the responses of children to painful stimuli, because they presumably have fewer biases due to their limited life experiences. Additionally, the dental practitioner and the patient can benefit from advanced knowledge of any of the variables that may ultimately influence a patient's response to painful stimuli. Accordingly, those factors may either be minimized or planned for during the postextraction recovery period. Numerous studies in the medical and psychosocial literature have investigated the influences of age, sex, race, culture, and other "tangible" variables in adults. The results of many of these studies have been contradictory. The present study sought to identify objective factors that the dentist may use in predicting a child's post-treatment response to a common dental procedure.

The survey tool utilized has been validated previously (Savedra et al. 1982). It has been demonstrated

TABLE 3. Report of Pain and Number of Teeth Extracted

Number of Extractions	Subjects	Pain (%)
1	86	30 (34.9)
2	95	33 (34.7)
3	33	20 (60.6)

$P < 0.01$, Chi Square = 7.83, 2 df.

that children older than 5 years can represent their feelings adequately (Ross and Ross, 1984). Additionally, it has been shown that parents are the most capable individuals in interpreting their children's reactions and expressions (Williams et al. 1985).

Although Levine et al. (1982) demonstrated that the reporting of pain was significantly associated with the number of third molar extractions, not all third molars extractions are of similar ease nor do they disrupt the same amount and types of tissue. The number of teeth extracted does offer one means of quantifying the extent of the injury. However, another means of objectively assessing the extent of the injury may be useful.

In pediatric dentistry there is clearly a distinction in the ease or difficulty of extraction of teeth. The exfoliating incisor and the severely ankylosed second primary molar are reflective of the spectrum encountered in clinical practice. In an attempt to distinguish among the various clinical presentations, the DOD scale was defined. This rating is based on the amount of remaining alveolar support and on the amount of tissue manipulation necessary to successfully complete the extraction procedure.

The present study indicates that the number of teeth extracted is significantly associated with the report of pain in children. Children who had more than 2 teeth extracted were more likely to report pain. Additionally, as the DOD of the extraction increased, so did the report of pain.

Of interest is the diminished significance of DOD when only those patients undergoing single tooth extractions were evaluated. Although the association between DOD and the report of pain is still significant for these patients, the degree of statistical significance is reduced. This observation seems to indicate that multiple extractions are, indeed, associated with the report of pain. However, the mechanism of that association may be twofold. Multiple extractions certainly result in an additive level of injury, but by their very nature, multiple extractions may result in increased expectations of pain. With this possibility in mind, the number of teeth extracted may not be a totally objective predictor of the pain response in children. The continued significant association between the DOD of the extraction and the report of pain for single tooth extractions indicates that DOD is an objective predictor of the pain response. It represents a measure that is not subject to

TABLE 4. Report of Pain and Degree of Difficulty

DOD	Subjects	Pain (%)
1	18	5 (27.8)
2	158	55 (34.8)
3	25	12 (48.0)
4	14	11 (78.4)

$P < 0.01$, Chi-Square = 16.22, 3 df.

interpretation by the patient, yet provides the practitioner a means of assessing the extent of surgical trauma and the likelihood of postextraction pain.

As reported by Acs et al., patients in the 10 to 13-year-old group were significantly more likely to report postextraction pain than patients in the 6 to 9-year-old group. When only those patients who had undergone single tooth extractions of standardized difficulty were considered, the significant relationship persisted. It is interesting to speculate that with advancing years there may come increased expectations for pain, regardless of the extent of injury. This finding points out one of the "intangibles" in assessing the puzzle of pain.

The incidence of postextraction pain reported in this study was 37.6%. In a recent study in the pediatric population, a significantly higher portion of the study population, 82.9%, reported pain (McGraw et al. 1987). It is worthwhile to note several factors that may account for these differences. In the present study the mean age of subjects was 9.1 years compared to 14.4 years in McGraw's study. Additionally, 65% of the extractions in that study involved the removal of one or more unerupted or impacted teeth. In fact, 76% of all these patients had multiple extractions and all extractions were of permanent teeth. Utilizing the DOD criteria established in the present study, all of McGraw's extractions would be assigned a DOD 4 rating. The increased patient age, as well as the increased level of surgical trauma can account for the differences in the incidence of postextraction pain.

The arch of the extraction was not significantly associated with the report of pain when the DOD was 2 or less. However, patients undergoing single tooth extractions of DOD 3 in the maxilla were more likely to report pain than patients undergoing similar mandibular extractions. This difference may either be representative of decreased anesthetic efficacy for the infiltration procedure compared to block anesthesia or may be related to a relatively increased level of injury for maxillary teeth. The latter may be related to the difference in the number of roots of maxillary and mandibular molars. The amount of bone disrupted may, therefore, be greater for maxillary molar extractions.

Conclusions

Patient age, the number of extractions, the arch of the

TABLE 5. Degree of Difficulty and Report of Pain for Single Tooth Extractions

DOD	Subjects	Pain (%)
1	9	2 (22.2)
2	62	19 (30.6)
3	13	7 (53.8)
4	2	2 (100.0)

$P < 0.05$, Chi Square = 5.29, 2 df. Combining DOD 3 and 4.

TABLE 6. Report of Pain and Arch of Extraction

Arch	Subjects	Pain (%)
Maxilla	4	4 (100.0)
Mandible	9	3 (33.3)

$P < 0.05$, Chi Square = 4.97, 1 df.

extraction, and the DOD of the extraction are all significantly related to the report of postextraction pain in children. Although the dentist may not be able to modify such risk factors as age, other factors, such as the number of teeth extracted at each visit, may be modified as one means of minimizing the incidence of postextraction pain. Additionally, unlike the number of teeth extracted, the DOD of the extraction is unknown to the patient and can, therefore, serve as a truly objective predictor of the pain response in children. The dentist may consider the number of teeth extracted together with the DOD in determining the potential for postextraction pain and the need for postextraction analgesics.

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