

Pederson scale fails to predict how difficult it will be to extract lower third molars

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Accepted 13 December 2005

Available online 24 January 2006

Abstract

We report a consecutive series of 105 extractions of impacted lower third molars, in each of which operative difficulty was predicted preoperatively using the Pederson scale (radiographic appearance of the anatomical position of the lower third molar), and postoperative difficulty was scored with a modified version of the Parant scale (operative manoeuvres that were needed for extraction of the third molar). Preoperative classification as “difficult” on the Pederson scale was not an accurate predictor of true difficulty (postoperative classification as “difficult” on the modified Parant scale). There was no significant association between the Pederson score and duration of operation, but high Parant scores were significantly associated with longer operations. We suggest that scales for the prediction of operative difficulty in the extraction of impacted lower third molars should take into account factors other than the anatomical position of the tooth.

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Keywords: Third molar surgery; Pederson classification; Parant classification

Introduction

Although the extraction of impacted lower third molars is common in oral surgical practice, it may be difficult. Various methods have been proposed for the preoperative evaluation of difficulty, but these have often been of limited validity. García-García et al.¹ showed that the Pell–Gregory scale,² which is widely cited in textbooks of oral surgery, is not reliable for the prediction of operative difficulty. Pederson³ proposed a modification of the Pell–Gregory scale that included a third factor, the position of the molar

(mesioangular, horizontal, vertical, or distoangular; [Table 1](#)). The Pederson scale is designed for evaluation of panoramic radiographs.

The aim of the present study was to evaluate the Pederson scale.

Patients and methods

We studied a consecutive series of 105 extractions of impacted lower third molars, from a total of 73 patients (30 men, 43 women; mean (S.D.) age 26 (8) years). The operations were done between September 2002 and July 2003 by five, second-year students of the Master in Oral Medicine, Oral Surgery and Implantology at the University of Santiago de Compostela, assisted by the same training oral surgeon (M.D.F.). Each extraction was randomly assigned to one of

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Table 1
Criteria and scores of the Pederson scale

Criterion	Value
Position of the molar	
Mesioangular	1
Horizontal	2
Vertical	3
Distoangular	4
Relative depth	
Class A	1
Class B	2
Class C	3
Relation with ramus and available space	
Class 1	1
Class 2	2
Class 3	3
Difficulty score	
	Total
Easy	3–4
Moderate	5–6
Difficult	7–10

Class A: The occlusal plane of the impacted tooth is at the same level as the occlusal plane of the second molar. Class B: The occlusal plane of the impacted tooth is between the occlusal plane and the cervical line of the second molar; Class C: The impacted tooth is below the cervical line of the second molar.

Class 1: There is sufficient space between the ramus and the distal part of the second molar for the accommodation of the mesiodistal diameter of the third molar. Class 2: The space between the distal part of the second molar and the ramus is less than the mesiodistal diameter of the third molar. Class 3: All or most of the third molar is in the ramus of the mandible.

the five trainees and done according to a standard protocol under local anaesthesia.

Operative technique

Local nerve-block anaesthesia of the inferior dental, lingual, and buccal nerves was induced with two capsules of 1.8 ml of 4% articaine (Articaine) containing 1:200,000 epinephrine (Articaine, Inibsa, Barcelona, Spain). In cases in which forceps were not effective, a vestibular flap was retracted. We then did an osteotomy with a no. 8 tungsten carbide round bur, with coronal or root resection if necessary. The wound was sutured with 3/0 silk. The sutures were removed a week later.

Evaluation of operative difficulty

Operative difficulty was predicted preoperatively from panoramic radiographs using the Pederson scale. After the operation, difficulty was assessed using the modification by García-García et al.¹ of the Parant scale⁴ (Table 2). For each extraction we also recorded duration of operation (from start of extraction to final suture).

Table 2
Criteria of the modified Parant scale

	Class
Easy I	Extraction requiring forceps only
Easy II	Extraction requiring osteotomy
Difficult III	Extraction requiring osteotomy and coronal section
Difficult IV	Complex extractions (root section)

Statistical analysis

Sensitivity, specificity, and odds ratios were calculated using the modification of the Parant scale by García-García et al. as the “gold standard”. To assess whether the duration of operation varied significantly according to the values of difficulty proposed by Pederson and Parant, or among the five trainee surgeons participating in the study, we used a non-parametric ranking test (Kruskal–Wallis) and a probability of less than 0.05 was accepted as significant.

Results

Classification of the 105 extractions by preoperative Pederson score (easy, moderate, or difficult) and postoperative Parant score (easy [I or II], or difficult [III or IV]) is shown in Table 3. For prediction of difficulty, the Pederson scale showed a sensitivity of 23.8% (of the 63 extractions classified as difficult by the Parant scale, 15 had been classified as difficult by the Pederson scale), and specificity of 76.2% ($TN/[TN + FP]$, $TN = \text{true negatives} = 3 + 4 + 11 + 14 = 32$, $FP = \text{false positives} = 1 + 9 = 10$; see Table 3).

Odds ratios for prediction of the Parant categories from the Pederson categories are listed in Table 4; in all cases the values are close to one, and so not significant.

Extractions with longer duration of operation showed significantly higher Parant scores. By contrast, no significant correlation was found between duration of operation and Pederson score (Table 5).

Duration of operation did not vary significantly among the five trainee surgeons (Table 6).

Table 3
Classification of the 105 extractions by preoperative score on the Pederson scale and postoperative score on the modified Parant scale

	Parant				Total
	Easy		Difficult		
	I	II	III	IV	
Pederson					
Easy	3	4	10	4	21
Moderate	11	14	19	15	59
Difficult	1	9	4	11	25
Total	15	27	33	30	105

Table 4
Pederson scale. Predictive values (P1, P2) of the different Pederson categories for prediction of each Parant category. Likelihood ratios are also shown

	Parant				Odds ratio (95 CI)
	Difficult		Easy		
	No	P1	No	P2	
Pederson					
Easy	14	0.	7	0.2	1.3 (0.6 to 3.0)
Moderate	34	0.5	25	0.6	0.9 (0.6 to 1.3)
Difficult	15	0.2	10	0.2	1.0 (0.5 to 2.0)
Total	63		42		

Odds ratios (ORs), calculated as P1/P2 are a measure of the degree to which knowledge of that Pederson values affects the predicted probability of “difficulty”: an LR of 1 indicates no effect, an OR less than 1 indicates reduced probability, and an OR of more than 1 indicates increased probability.

Discussion

Prediction of operative difficulty before the extraction of impacted third molars allows a design of treatment that minimises the risk of complications. Both radiological and clinical information must be taken into account.^{5,6} Factors such as sex, age, position of the molar in relation to the occlusal plane, and operative difficulty as judged by the surgeon, have all been reported to be associated with a significantly increased duration of postoperative recovery. It seems likely that patients judged to be at higher risk for delayed recovery will benefit from a more exhaustive postoperative follow-up, and from specific postoperative measures to aid recovery.⁷ Prediction of operative difficulty is therefore important for correct management. The Pederson scale is widely cited in oral and maxillofacial surgical texts as a useful way of predicting the difficulty of extraction of impacted lower third

molars. We evaluated the value of the Pederson scale, with reference to postoperative evaluation of difficulty, using our modified version of the Parant scale.¹ We think that our modification of the Parant scale is a reliable and consistent measure of operative difficulty, and an appropriate gold standard. In support of this view, we found a strongly significant association ($p=0.000$) between the score on this scale and duration of operation. Taking the modified Parant scale as gold standard, our results indicate that the Pederson scale has poor sensitivity: over 75% of difficult extractions were not identified. Similarly, odds ratios for prediction of the different categories of the Parant scale from the categories of Pederson scale again indicate that the Pederson scale is of little value in predicting operative difficulty, with values close to 1 (according to Jaeschke et al.⁸ likelihood ratios must be below 0.5 or above 2 for prediction to be significant).

The duration of operation depends on various factors, including the age of the patient, operative difficulty, the surgeon’s experience, operative technique, and of course the way in which the duration of operation is defined and measured.^{5,9,10} Previous studies have reported durations for extractions of third molars of between 7 and 105 min.^{11,12} In the present study there was no significant variation in duration among the five trainee surgeons ($p=0.769$), indicating similar experience and similar difficulty.

Although the Pederson scale can be used for predicting operative difficulty, it is not widely used because it does not take various relevant factors into account, such as bone density, flexibility of the cheek, and buccal opening.^{5,13} Other more complex preoperative scales such as the WHARFE scale¹⁴ have been proposed, but in view of their complexity are rarely used in routine practice. Yuasa et al.¹⁵ proposed a new scale that takes into account not only relative depth (the A–C subscale in the Pell–Gregory classification) and rela-

Table 5
Median (range) duration of operation (min) in each category

	Parant				Total	p^a
	I	II	III	IV		
Duration (min)	15(49.70)	20(51)	40(105)	50(65)	35(118.70)	0.000
	Pederson					
	Easy	Moderate	Difficulty			
Duration (min)	35(78.70)	30(115)	55(83)			0.055

Parant I: extraction requiring forceps only; Parant II: extraction requiring osteotomy; Parant III: extraction requiring osteotomy and coronal section; Parant IV: complex extractions (root section).

Easy: Pederson values 3–4; Moderate: Pederson values 5–6; Difficulty: Pederson values 7–10.

^a Kruskal–Wallis.

Table 6
Median (range) duration of operation for each of the five trainee surgeons included in the study

	Trainee surgeon				
	1	2	3	4	5
Duration (min)	37.50 (78.70)	38.50 (110)	32 (70)	25 (83)	31 (51)

Kruskal–Wallis, $p=0.769$.

tion with the ramus of the mandible (the 1–3 subscale in the Pell–Gregory classification), but also width of the root, considered the most important factor. These authors also point out that curvature of the root is an unpredictable factor, as it is often not visible in radiographs. We agree, and consider that scales for the prediction of operative difficulty should take into account the anatomy of the root. It is possible that the low predictive values of the Pell–Gregory and Pederson scales are attributable to the fact that they do not take this into account.

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