



## Evaluation of Time Consumption and its Cost Effectiveness in Operating Theatre for Treatment of Pediatric Dental Patients Under General Anesthesia

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### Abstract

**Introduction:** Operating theatres consume a substantial proportion of hospital resource in terms of capital, equipment, drugs and staffing. Whilst there is variation between hospitals as a result of speciality, case-mix and internal financial arrangements, Ideally, hospitals should aim to use 90% of planned theatre time

**Aim:** To describe the use of operating room (OR) time for pediatric dental procedures performed under general anesthesia (GA) at Riyadh elm university over a 2-year period.

**Materials and Method:** Pediatric dental GA records of the normal pediatric dental patients and medically compromised patient for 2 years duration were performed at Riyadh elm university where pediatric dental treatment was done under GA. Demographic data, dental and anesthesia operator types, and procedures were recorded. Utilization of OR time was analyzed.

**Results:** When examining the median duration for each of the treatment groups, the operating time component accounted for the greatest proportion of the total time; there were statistically significant differences between the various case types, with times for restorative/extraction being greater than those for minor oral surgery and times for minor oral surgery being greater than those for extraction. When comparing the overall treatment time, there was a statistically significant difference between the mixed restorative/extraction cases, and both the extraction and minor oral surgery cases. There was, however, no statistically significant difference between extraction and minor oral surgery cases.

**Conclusions:** Knowledge of theatre time usage should allow optimal utilization of operating time. Since ours is a dental university, we did not face difficulties in listing patients while it may not be the case in a general hospital setup where multiple case may have to be managed effectively.

**Keywords:** Anesthesia; Operating Theatre; Pediatric Dental

### Introduction

Operating theatres consume a substantial proportion of hospital resource in terms of capital, equipment, drugs and staffing. Whilst there is variation between hospitals as a result of speciality, case-mix and internal financial arrangements, Ideally, hospitals should aim to use 90% of planned theatre time [1]. Assessment measures for theatre sessions usage include determining both the number of sessions held and cancelled, as well as the utilization of both available and potential theatre time. Regarding the use of theatre time, two further key aspects of session utilization are planned/actual start and finish times, as well the proportion of cases that are cancelled [2]. Areas where there appear to have been no previous study in paediatric dentistry are the concept of 'lost' operating

time during dental general anaesthetic (DGA) procedures, and also, the effect of grade of operator on the duration of the procedure. As such, the aim of this study was to evaluate amount of theatre time during day-case for dental procedures on a pediatric patient and its impact on the utilization of theatre sessions.

### Materials and Methods

Data were recorded retrospectively for 290 operating lists at Riyadh elm university, Riyadh. Pediatric patients were in the age group of 5 to 14 years. Range of dental procedures were undertaken on all patients presenting for dental treatment under general anaesthetic over a 2-year period from January 1, 2016 and January 1, 2018. Data for three operators were collected, including one specialist and two residents of Paediatric Dentistry.

Both operator status and the procedure being undertaken were recorded. Procedures were assigned to restorative/extraction, extraction (including, where necessary, suture insertion) and minor oral surgery cases. In addition, the following times were recorded.

**Times during theatre**

- **Pre-anaesthetic time:** The time between the official start of the operating list or the time that the previous patient was sent to recovery;
- **Anaesthetic time:** The time from the start of either intubation or gaseous induction, including connection to the anaesthetic machine and the monitoring devices;
- **Operating time:** The time taken to perform the dental procedure;
- **Disconnection time:** The time between the end of the operation, and the patient leaving the operating room and entering the recovery room; and
- **Total case time:** The sum of all other time periods.

**Data analysis**

Median values were calculated and analysed with Mann-Whitney U-tests (MINITAB™ Statistical Software, Release 13.31, State College, PA, USA).

**Results**

Over the time periods examined, 290 lists were allocated were included in the study.

When examining the median duration for each of the treatment groups, the operating time component accounted for the greatest proportion of the total time; there were statistically significant differences between the various case types, with times for restorative/extraction being greater than those for minor oral surgery and times for minor oral surgery being greater than those for extraction (Table 1). When comparing the overall treatment time, there was a statistically significant difference between the mixed restorative/extraction cases, and both the extraction and minor oral surgery cases. There was, however, no statistically significant difference between extraction and minor oral surgery cases.

- A total of 290 cases were analyzed. And met the described inclusion criteria,
- Amount of total OR time required per case (including anesthesia and dental treatments) was 71.70
- Minutes (±33.053). for a full mouth rehabilitation of pediatric patients, considering full mouth rehabilitation is more or equal to treatment of 5 teeth requiring any or combination of restorations, pulpotomies, pulpectomies,

extractions, ss crowns, zirconia crowns, fissure sealants and oral prophylaxis.

- Mean cost of treatment is SR 3851.73
- Mean no of teeth treated is 10.49 per patient.

A comparison of operating times between groups revealed statistically significant differences, as indicated by the superscript letters.

- No significant difference was found between male and female with respect to age, cost, time and no. of teeth treated.
- Comparing the rank of the operator to the age and no. of teeth of the patient treated there is no sig difference.
- Comparing cost and time with respect to the rank, there is a significant difference.

Variable	Rank	Mean	Standard deviation	T-test p value
Age	p	5.03	2.243	0.772
	s	5.12	2.285	
Cost	p	3377.71	868.026	0.000
	s	4491.46	1701.527	
No of teeth	p	10.52	4.003	0.867
	s	10.44	4.198	
Time in minutes	p	75.38	35.089	0.023
	s	66.71	29.479	

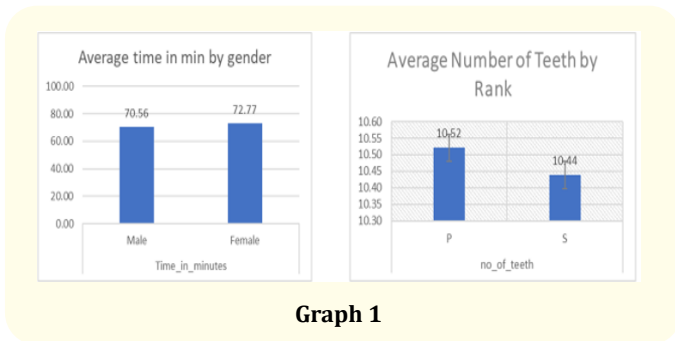
**Table 1**

Gender		Mean	Standard deviation	Test p value
Age	Male	5.23	2.157	0.245
	Female	4.92	2.345	
Cost	Male	3866.79	1523.162	0.861
	Female	3837.58	1280.386	
No of teeth	Male	10.36	3.833	0.622
	Female	10.60	4.307	
Time in minutes	Male	70.56	30.917	0.571
	Female	72.77	34.999	

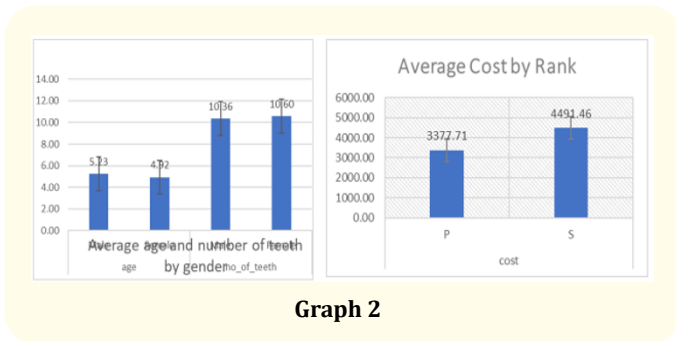
**Table 2**

Variable	Level	n	Percentage
Gender	Male	140	48.3
	Female	150	51.700
Rank	P	167	57.586
	S	123	42.414
Year	2016	132	45.517
	2017	158	54.483

**Table 3**



Graph 1



Graph 2

## Discussion

The aim of this study was to determine the utilization of theatre time for each session of dental treatment for a pediatric patient under general anesthesia over a 2-year period, with data available for all lists that were appointed.

Comparing case types, the operating time component accounted for the greatest proportion of the total time/patient experience. The order of operating time for the different case types was as follows: restorative/extraction was greater than minor oral surgery, which was, in turn, greater than extraction cases. Given the time constraints of a theatre list, knowledge of the expected length of procedure types for individual cases should, in theory, allow the optimal utilization of each session. Previous authors have demonstrated that both a pre-admission clinic, and also, the use of a grading system to estimate the anticipated duration of operating time, increased theatre utilization from 70% to 98%, in addition to increasing the number of day-case patients seen on a theatre list [3]. Regarding the current study, for children for whom adequate dental assessment pre-operatively is difficult, the exact treatment needs and associated duration can only be estimated. If patients, however, can be categorized pre-operatively (e.g. extraction or restorative case), this should aid theatre planning. Further factors to be taken into account when planning sessions are both the duration and variability of the pre-anaesthetic time. Concerning the variable pre-anaesthetic time seen amongst and between lists in this study, delays were noted in patients being transported from the ward to theatre following premedication. In addition, a significant pool of anaesthetic nurses staffed the dental list, and

it is possible that unfamiliarity of these staff with both the layout and procedures involved in day-case/inpatient paediatric dental general anesthesia may have increased the pre-anaesthetic time. Such difficulties could be overcome by relocation of the sessions to the main theatre suite, adjacent to the paediatric wards. In addition, a dedicated core 'team' of anaesthetic nurses trained specifically for dental general anesthesia lists could alleviate unfamiliarity with both surroundings and techniques.

Comparing operators, there were no statistically significant differences for either mixed/restorative or minor oral surgery cases, although the median consultant operating time for extraction cases was lower than that of the specialist registrars. The reasons for this are unclear, although difficulties with haemostasis and suture placement could have been contributory factors. There are no similar, comparative studies, although other authors have determined that the grade of anaesthetist impacted on the length of a case [4].

Previous authors, however, have determined that difficulties arise with theatre time utilization when clerical staff select and appoint patients based on a fixed number of cases on each session [5]. As such, it has been suggested that improved use may be made of theatre time by appropriate case selection; for example, using a grading system which estimates the anticipated duration of operation time [6]. In the present study, the principal factor responsible for lists overrunning was the pre-anaesthetic time. This is an area where efficiency could be improved; for example, by sending for patients sooner, increasing the number of porters and the establishment of a 'core' team of staff for theatre sessions. Recording actual start and finish times of individual sessions that can be compared and analysed with planned timings would identify where sessions under- or overrun regularly. Where problems are identified, then the reallocation of theatre sessions should be considered, in conjunction with the theatre users' committee [7].

## Conclusion

In conclusion, the majority of lists in the present study finished either early or on time. Routinely, the total operating time accounted for just over 50% of the overall time available, with nearly one-quarter of the time being taken up by pre-anaesthetic time. These results provide a baseline for comparison with other centres. Given that health boards incur costs regardless of whether theatre time is used, the avoidance of wasted time and maximization of operating time should help to reduce the pressure on waiting lists. Studies such as this may help to identify areas in which time may be more efficiently used and may confirm best practice.

The American Academy of Pediatric Dentistry (AAPD) endorses GA for pediatric dental patients who: are unable to cooperate; experience ineffective local anesthesia; are extremely

fearful, anxious, or uncommunicative; require significant surgical procedures; can benefit from GA protecting them from psychological trauma and/or reducing medical risks; and require immediate, comprehensive oral care [8,9]. Furthermore, many medical conditions present with oral disease that must be managed in an inpatient setting, and the operating room (OR) is often the best place to provide such care. Pediatric dentists are trained to recognize the need for hospital-based dental treatment and to work with an anesthesia team to provide optimal care for their patients [10].

Knowledge of theatre time usage should allow optimal utilization of operating time. Since ours is a dental university, we did not face difficulties in listing patients while it may not be the case in a general hospital setup where multiple case may have to be managed effectively.

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