

Comparison of recovery profile of desflurane and sevoflurane in dental surgeries

Roopal Rambhai Garaniya^{1,*}, Vandana Hooda², Vaishali Gautam³

^{1,2}Resident, ³Assistant Professor, Dept. of Anaesthesia, BJ Medical College, Ahmedabad, Gujarat

*Corresponding Author:

Email: roopalgaraniya@gmail.com

Abstract

Aim: Is to find the recovery profile of desflurane anaesthesia to sevoflurane anaesthesia during dental surgeries.

Settings and Design: Single Blind Randomized controlled trial.

Methods: Forty ASA I and II patients undergoing dental surgeries were randomly allocated into two groups of 20 each, Desflurane (Group D) and sevoflurane (Group S). Group D received desflurane as maintenance agent & Group S received sevoflurane as maintenance agent.

Results: There was no difference in demographic profile between both the groups. Time of eye opening in Group D was (6.85 min \pm 1.01) and was Group S was (11.7 min \pm 1.30), Time of stating name in Group D was (9.75 min \pm 0.626) and in Group S was (15.4 min \pm 0.66), Time of walking in Group D was (110.65 min \pm 1.23) and Group S was (152.4 min \pm 1.74), Time of discharge from PACU in Group D was (159.4 min \pm 1.39) and Group S was (198.5 min \pm 1.5), all these value were statistically significant.

Conclusion: Desflurane is superior to sevoflurane for early recovery during dental surgeries.

Keywords: Desflurane, Sevoflurane, Dental surgeries, Recovery times, Hemodynamic changes.

Introduction

Mechanism of action of inhaled anaesthetics is that after reaching the cell, it enter immediately into cellular membranes and causes expansion of the cell membrane volume leading to distortion of channels responsible for sodium entry which subsequently causes generation of action potentials required for signal transmission.

As titrability of volatile anaesthetics is very easy, it allows faster recovery from general anaesthesia. As blood: gas partition coefficient of newer inhaled anaesthetic like desflurane and sevoflurane is quite low, rapid recovery from anaesthesia is very much possible in comparison to typical older volatile anaesthetics.

Desflurane was discovered between 1959 and 1966 when Terrell and associates synthesized more than 700 compounds in an attempt to develop a better volialite anaesthetic. The 653th compound was desflurane but because of its high vapour pressure they were unable to use it in a contemporary vaporizers and was discarded. But in 1987 it was reinvestigated and because of its stability and low blood gas solubility is becomes very popular among anaesthetics during ambulatory surgeries because of its unique recovery profile. Desflurane is basically a fluorinated methyl ethyl ether mainly use during maintenance phase of general anaesthesia. Mechanism of action of Desflurane may be by activation of GABA, leading to hyperpolarization of cellular mambrane. Some also postulate that it may block glutamate channel and inhibit neurotransmitter release with the help of calcium channel inhibition.

Sevoflurane was synthesized by Regan in 1970, which is a fluorinated isopropyl ether which has very low blood gas solubility leading to early recovery profile. Mechanism of action is thought to be mainly by activation of the GABA_A receptor, although it may also cause NMDA receptor antagonism, activation of

glycine receptor and blocks both nACh and 5-HT₃ receptors. Sevoflurane is a non-irritant and literally odourless anaesthetic agent which is very popular as induction agent in paediatric population.

In comparison to all currently available volatile anaesthetics adequate depth of anaesthesia can be easily provided by both Desflurane and sevoflurane with immediate smooth emergence because of their very low blood gas solubility. Desflurane cannot be easily degraded and biotransformed in comparison to sevoflurane. But because of its irritant nature on the respiratory tract and its pungent odor Desflurane is not use for inhalational inductions. Desflurane is also blamed that with CO₂ absorbent it causes CO production. Desflurane is not widely use in cardiac anaesthesia because of its inherent property of sympathetic nervous system activation. Other than this sympathetic nervous system stimulatory action the physiological and hemodynamic effect are similar in both desflurane and sevoflurane. Mixed datas are there about economics of using desflurane, but it has a definite advantage on rapid postoperative emergence time. In contrast with desflurane, sevoflurane is odorless and nonirritating to the respiratory epithelium; so easy and rapid inhalational induction of general anesthesia with sevoflurane is very much possible. As sevoflurane is instable with soda lime, it degrade in increasing amount with increasing temperature. Baralyme degrade sevoflurane at an even greater rate at higher temperature leading to production of toxic byproducts. These byproducts like Compound A and fluoride, whose production is mainly depend on fresh gas flow rate, lesser the flow more is the production. Risk for iatrogenicity from sevoflurane does exists, but chances of long-term adverse effect seems to be very low.

As volatile anesthetics are easy to administer and having predictable recovery profile these agents are used for maintenance of anaesthesia in most of the surgeries now a day. As Dental surgeries are oral surgeries early gain of consciousness may lead to better protection of airway. Till now there was always a constant search for a suitable maintenance agent which can result in a fast tract recovery during dental surgeries. As blood-gas partition coefficients of newer maintenance agent like sevoflurane (0.69) and desflurane (0.42) is quite low, early recovery from anesthesia is very much possible.^(1,2,3) In this study we compared the recovery profile of sevoflurane with those of desflurane in patients undergoing dental surgeries.

Material

After Ethics Committee approval 40 patients with ASA grade I-II, aged between 20 to 60 years, undergoing dental surgeries were divided into 2 groups, Group S and Group D. Group S received sevoflurane as maintenance agent and Group D received desflurane as maintenance agent. Pregnant patient, lactating mother, patient with renal impairment, hepatic dysfunction, cardiovascular and respiratory disease were excluded from study.

Methods

All patients received glycopyrrolate, midazolam and fentanyl as premedication. Induction was done with inj. thiopental 4–7 mg/kg, and inj. vecuronium 0.1 mg/kg intravenously. After intubation, anaesthesia was maintained with vecuronium as muscle relaxant with 50% O₂, 50% N₂O in all patients, group S was maintained with sevoflurane and group D was maintained with desflurane. Intra operative volatile anesthetic concentration was adjusted according to MAP and HR. The target was to maintain HR and MAP within 20% of baseline values. At the end of surgery, the volatile agent was stopped and controlled ventilation with 100% oxygen was continued until the end-tidal volatile anesthetic concentration was less than

0.1%. Patients were reversed with a combination of neostigmine and glycopyrrolate intravenously. Time of extubation, time of eye opening, time of telling name, time of walking and time of the discharge from PACU were measured from discontinuation of volatile anaesthetic agent. Post-operative complication were also noted.

Statistical Analysis: Sample size was calculated from the data of previous studies with power of the study being 80% and α error of 0.05. Quantitative values are presented as mean \pm SD and qualitative are as numbers and percentage. One way analysis of variance and *post hoc* comparison are used for mean. Chi-square test was used for qualitative variables. The $P < 0.05$ was considered statistically significant.

Statistical analyses was performed with SPSS software.

Results

Demographic data, duration of surgery and hemodynamic changes were compatible in both the groups.

Table 1: Demographic profile and duration of surgery

Criteria	Desflurane	Sevoflurane	P value
Mean age (years)	32.85	32	0.8208
Mean wt (kg)	52.75	49.9	0.2203
Sex ratio(M:F)	15:5	13:7	0.78
Duration of surgery (min)	115.75	112	0.5864

As seen in table mean age in group D is 32.85 and in group S is 32, mean wt in group D is 52.75 and group S is 49.9 and duration of surgery in group D is 115.75 and group S is 112 which is not significant. Sex ratio in both groups are also compatible.

Table 2: Comparison of Heart Rate between Desflurane and Sevoflurane

HR	Desflurane		Sevoflurane		P Value
	Mean	SD	Mean	SD	
Basal	85.35	13.65018	85.65	6.784464	0.0571
At Induction	73.75	11.38804	77	6.299541	0.2711
At Intubation	88.85	9.598307	90.4	9.560885	9.560885
5 Min	73.75	8.539090785	76.7	4.485062929	0.1793
10 Min	88.85	8.773261597	85.55	3.471310992	0.1259
20 Min	85.15	8.143059	85.25	4.178579	0.9613
30 Min	82.5	9.006215	81.55	6.11706	0.5823
45 Min	80.75	8.289516	82.45	6.030405	0.4625
60 Min	76.4	6.506188	76.4	7.32264	1
75 Min	75.35	6.884774	74.7	8.832357	0.7965
90 Min	71.4	5.242864	72.65	9.297849	0.6033
At Extubation	72.6	6.92511	75.7	10.73656	0.2844

5 Min after Extubation	72.4	6.281871	73.6	8.887602	0.6246
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There was no significant difference in HR between desflurane group and sevoflurane group.

Table 3: Comparison of Mean Blood Pressure between Desflurane group and Sevoflurane group

Map	Desflurane		Sevoflurane		P Value
	Mean	SD	Mean	SD	
Basal	89.55	2.783433132	88.65	4.693346354	0.4649
At Induction	81.55	5.508857	91.1	4.836321	0.5915
At Intubation	83.7	4.648656	90.1	5.590405	0.4846
5 Min	92.15	5.091905	93.3	7.384906	0.5696
10 Min	90.05	6.028889	90.95	7.416021	0.6727
20 Min	81.4	6.568105	85	5.675432	0.071
30 Min	79.55	4.74842079	80.65	6.217758946	0.5327
45 Min	81.05	7.586006855	77.55	5.862234171	0.1106
60 Min	80.45	5.152427	78.05	4.616618	0.1288
75 Min	78.65	6.302975	78.65	6.072154	1
90 Min	79	7.231874	80.3	5.676359	0.5307
At Extubation	87.85	7.192183	90.15	3.990449	0.2186
5 Min after Extubation	85.3	4.172529	88	5.866946	0.1014

There was no significant difference in MAP between desflurane group and sevoflurane group.

Table 4: Difference in Recovery Times and Time of Extubation between Desflurane group and Sevoflurane group

	Desflurane		Sevoflurane		P Value
	Mean	SD	Mean	SD	
Time of Extubation	3.4	0.663325	5.65	0.47697	0.0001
Time of Eye Opening	6.85	1.013656747	11.7	1.307669683	0.0001
Time of Stating Name	9.75	0.62249498	15.4	0.663324958	0.0001
Time of Walking	110.65	1.235921	152.4	1.743559577	0.0001
Time of Discharge from PACU	159.4	1.392839	198.5	1.5	0.0001

There was significant difference in recovery times and time of extubation between desflurane and sevoflurane group ($P < 0.05$). Mean time of extubation in group D is 3.4 and in group S is 5.65, mean time of eye opening in group D is 6.85 and in group S is 11.7, mean time of walking in group D is 110.65 and in group S is 152.4 and mean time of discharge from PACU in group D is 159.4 and in group S is 198.5.

Tidal concentration in desflurane (Mean \pm SD) after induction was 4.9% \pm 0.76, at skin incision was 4.55% \pm 0.66, at skin closure was 3.25% \pm 0.43 and after anaesthetic agent discontinuation was 2.2% \pm 0.4, while in sevoflurane (Mean \pm SD) after induction was 1.5% \pm 0.5, at skin incision was 1.65% \pm 0.47, at skin closure was 1.15% \pm 0.35 and after anaesthetic agent discontinuation was 0.61% \pm 0.18.

In recovery room out of 20 patients in Group D, 4 patients suffered from nausea, 1 patient had sore throat and 1 patient had cough while in Group S, out of 20 patients 3 patients had nausea and 1 patient had sore throat.

There was no significant changes in oxygen saturation during the surgery in both the groups in comparison with the baseline value and were never less than 96% in any patient at any time.

Discussion

The hemodynamic parameters during our study in both the groups were comparable and relatively stable. During all the surgeries cardiovascular stability was maintained in both the groups as mean blood pressure and heart rate were remain within 20% of pre-induction value. This was very much predictable, as one of the

criteria of the study is to maintain mean arterial blood pressure within 20% of basal values by changing the dial concentration of the volatile anesthetics.

In our study recovery characteristics were measured with time of eye opening, time of stating name, time of walking and time of discharge from PACU after discontinuation of volatile agents. There was significant difference between the two groups in recovery characteristics, much shorter in group D than in group S.

Till date various research has been carried out in patients to demonstrate that desflurane is better than sevoflurane for early recovery. Cohen *et al.*,⁽⁴⁾ compared emergence and recovery characteristics in children posted for adenoidectomy who received desflurane anesthesia with those who received sevoflurane anesthesia and noticed that use of desflurane results in early recovery than sevoflurane. White PF *et al.*,⁽⁵⁾ demonstrate that in adult patients recovery time was significantly shorter with desflurane. Bennett *et al.*,⁽⁶⁾ demonstrate that in elderly patients use of desflurane was very much beneficial than isoflurane in term of emergence and recovery times.

In our study time of extubation from discontinuation of volatile anaesthetics was significantly less in group D than group S. In support with this finding Dexter F *et al.*,⁽⁷⁾ conclude that mean extubation time was decreased by 20–25% with desflurane as compared to sevoflurane. Jakobsson *et al.*,⁽⁸⁾ noticed in female patients undergoing gynecological procedures who received desflurane volatile anaesthetics were extubated faster as compared to isoflurane.

McKay RE *et al.*,⁽⁹⁾ demonstrate that as faster emergence is possible with desflurane there will be early recovery of postoperative protective reflexes. As Dental surgeries are oral surgeries early recovery of protective reflexes of airway is always beneficial.

In both the groups, at the end of surgery minor complications such as nausea, sore throat, cough etc. have occurred but in terms of incidence of side effect there was no significant difference between both the groups. Wallenborne *et al.*,⁽¹⁰⁾ used three maintenance agents (isoflurane, desflurane, sevoflurane) in patients posted for spine surgeries and noticed that there were no noticeable differences in complications after surgeries between the groups.

Conclusion

Desflurane was far better than sevoflurane in terms of recovery profile and time of extubation in patients undergoing dental surgeries. But there was no significant difference in hemodynamic profiles between sevoflurane and desflurane.

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