Original Research Article

Indian Journal of Anesthesia and Analgesia
2018; 5(5): 860-868
DOI: http://dx.doi.org/10.21088/ijaa.2349.8471.5518.27

Comparison of Effectiveness of Dexmedetomidine versus Propofol during a wake Fibre-optic Naso-tracheal Intubation

Sanyogita Naik[1], Surekha Chavan[2], Magan Pawara[3]

[1]Professor [2]Associate Professor, Department of Anaesthesia, [3]Medical Officer, BJ Government Medical College, Pune, Maharashtra 411001, India.

Abstract

Awake fibreoptic intubation (AFOI) is often the preferred method for airway management in patients with difficult intubation. The success of AFOI is highly dependent on use of various sedatives, in addition to adequate preparation of airway. Although various pharmacological agents like fentanyl, ramifentanyl, midazolam, ketamine, propofol have been used for conscious sedation during AFOI, most of them have respiratory depressant effect in higher doses. Hence there is a need for an ideal sedative agent for AFOI that will not cause respiratory depression, also minimize undue discomfort and anxiety. The purpose of this study was to compare the effectiveness of Dexmeditomidine with propofol for conscious sedation during awakefibreopticnasotracheal intubation. *Methods:* Eighty patients with ASA (American society of anaesthesiology) physical status I and II, with age group between 18 to 55 years, were randomly divided into Dexmeditomidine (D) and Propofol (P)group. Patients with Group D were given intravenous Dexmeditomidine (n=40) 1µg /kg infusion over 10 mins. Group P were given propofol (n=40) 70 µg /kg min over 10 mins. Airway prepared by topical anaesthetic and airway blocks. Effectiveness of Dexmeditomidine and Propofol for patient's intubating conditions , patient's tolerance as graded by a scoring system, and hemodynamic changes were evaluated . *Results:* AFOI was successful in all patients. The patient's comfort score was better in dexmditomodine group. The dexmeditomidine group experienced fewer airway events and less heart rate response to intubation than the propofol group. *Conclusion:* Dexmeditomidine group allows better tolerance, more stable hemodynamic status and preserves a patent airway.

Keywords: Fibre-optic Intubation; Airway Blocks; Dexmeditomidine; Propofol.

Introduction

The most common cause of mortality and serious morbidity due to anaesthesia is from airway problems. It is estimated that about one-third of all anaesthetic deaths are because of failure to intubate and to ventilate. The Flexible fiberoptic endoscope is the most valuable single tool available for the anaesthesiologist to manage the difficult airway. In 1967, Dr. P. Murphy was the first to use a fiberoptic instrument for the control of airway when he performed a nasal intubation under general anaesthesia [1]. Fibreoptic broncoscope is a flexible, long,thin plastic tube enclosing a fibreoptic system that attaches to a light source and transmit views from the distal piece to an eyepiece. Eyepiece can attach to the camera and video system. Event hough AFOI (Awake Fibre-Optic Intubation) is an effective technique for the difficult airway management, inadequate preparation of patient's airway can cause airway trauma, coughing, bronchospasam and oxygen desaturation. With airway preparation, it is necessary to use an ideal sedative drug to minimise undue complications like discomfort, anxiety, and sympathetic surge. Many agents like fentanyl, ramifentanyl, midazolam, ketamine, propofol have been used for conscious sedation during AFOI, but most of these have respiratory depressant effect in higher doses. That is a challenge to the anaesthetist to provide adequate sedation while maintaining a patent airway without

Corresponding Author: Sanyogita V. Naik, Professor, Department of Anaesthesia, BJ Government Medical College, Pune, Maharashtra 411001, India.
E-mail: sanyogitanaik@yahoo.co.in

Received on 03.02.2018, **Accepted on** 26.02.2018

respiratory depression Dexmeditomodine is a highly selective, specific and potent α2 adrenergic receptor agonist,having several clinical actions like sedation, analgesia, anxiolysis, sympatholysis without respiratory depression. Locus ceruleus of the brainstem is the principal site for the sedation action of dexmeditomidine and spinal cord is the principal site for its analgesic action,as it activates α2-adrenergic receptor of spinal cord reducing transmission of nociceptive signals like substance P. As its ability to provide conscious sedation without respiratory depression, it has become popular sedative agent during surgical procedure and in intensive care unit. Dexmeditomidine having some side effects like bradicardia, hypotension, dryness of mouth,nausea, vomiting.

Propofol is most commonly used anaesthetic drug. It is used for induction and maintenance of anaesthesia and for sedation during surgical procedure and patients receiving mechanical ventilation in intensive care unit. Propofol has antiemetic action, so it prevents post operative nausea and vomiting (PONV). Most common side effects of propofolis pain on injection and hypotension.

Uses and Doses of Intravenous Propofol

Induction of general anesthesia	1-2.5 mg/kg IV dose reduced with increasing age
Maintenance of general anesthesia	50-150 µg/kg/min IV combined with N_2O or an opiate
Sedation	25-75 µg/kg/min IV
Antiemetic	10-20 mg IV, can repeat every 5-10 min or start infusion of 10 µg/kg/min

In this study, eighty patients for elective surgery were enrolled for fibre-optic nasal intubation and randomly allocated into the dexmedetomidine group D (1.0µg.kg^{-1} over 10 min) or the propofol infusion group P (70µg/kg /min, over 10 min.).

The objective of this study was

1. To compare the effectiveness of inj Dexmeditomidine verses inj. Propofol for conscious sedation, patient's intubating conditions, patient's tolerance, as graded by a scoring system.
2. To study the haemodynamic response
3. To observe any adverse effects or complications during peri operative period.

Material and Methods

After approval from the Ethics committee and written informed consent was taken from the patients, total 80 patients aged between 18 years to 55 years belonging to either sex with American Society Of Anesthesiologist (ASA) physical status I and II undergoing elective surgeries under general anaesthesia. In this prospective, randomized,double –blind study, patients with any major systemic illness, sever bradycardia, any type ofatrio-ventricular block on ECG, thrombocytopenia or coagulopathy, any nasal deformity, and emergency surgery were excluded. The patients were explained about the procedure in detail. Patients were fasted for 6-8 hours prior to procedure.

Patients were randomized in 2 groups

1. Group D(n=40): Patients received Dexmedetomidine 1µg/kg over 10 min.
2. Group P (n=40): Patients received Propofol 70 µg/kg/min over 10 min.

Patients were premedicated with Injection glycopyrrolate 0.5 µg/kg intramuscular 30min. prior the procedure. IV Injection Ondensentron:0.08 mg/kg, IV Injection Pentazocine0.3 mg/kg, and IV Injection midazolam 0.03 mg /kg, 10 mins.after airway preparation and before starting infusion of study drugs. Nasal Oxygen by prongs:6ltr/min.

Patients Preparation

Patients were prepared by anesthetizing the airway. The patient's nasal passages should be treated with a topical vasoconstrictor to shrink the nasal mucosa to minimize the risk of bleeding. The nasal mucosa can be anesthetized and vasoconstricted with a mixture oflidocaine and phenylephrine. The topical anesthetic/vasoconstrictor solution is applied with cotton-patty put into each nostrils.

Fig. 1: Nasal preparation with lignocaine soaked cotton patty for intubation

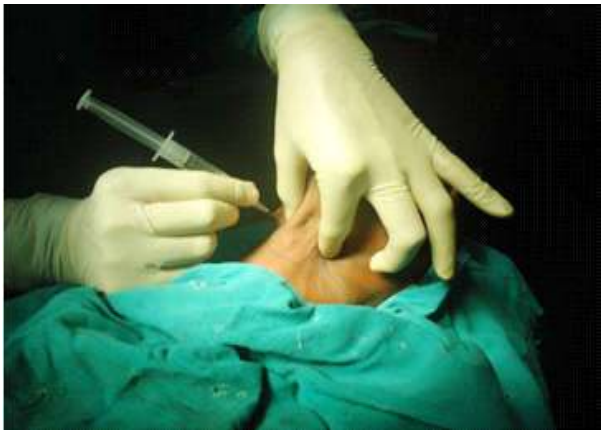

Fig. 2:

Superior Laryngeal Nerve Block

The superior laryngeal nerve, a branch of the vagus nerve, provides sensory innervation to the epiglottis, arytenoids, and vocal cords. It can be blocked as it passes into the larynx through the thyrohyoid membrane. The skin of the neck is retracted caudad over the thyroid cartilage. The needle is inserted until it rests on the lateral portion of the hyoid bone. It is then withdrawn slightly and walked off the hyoid bone in an inferior direction. The needle is then advanced and passed through the thyrohyoid membrane, which should be felt as a slight resistance. The syringe is then aspirated, and the lidocaine 2% -2.5 ml is injected. The procedure should be repeated on the opposite side.

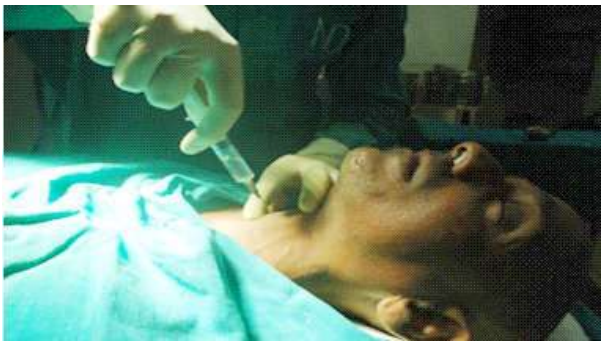

Fig. 3:

Transtracheal Block

The transtracheal block provides rapid anesthesia of the entire trachea between the carina and the vocal cords. Complications of the transtracheal block include bleeding, tracheal injury, and subcutaneous emphysema. The cricothyroid membrane is identified, and the syringe is directed posteriorly, perpendicular to the floor. The needle is in the trachea when a sudden loss of resistance is felt. The position of the needle is confirmed by aspirating air through the syringe. 3 ml of 2% lidocaine is then injected rapidly, and the needle withdrawn. The patient will cough, drawing the local anesthetic down to the carina, and then spraying it over the entire trachea, up to the vocal cords.

After preparation of airway, infusion of study drug started.Fibreoptic intubation was done after 10 min. or appropriate sedation can occur after IV infusion of dexmedetomidineor propofol . A fibreoptic scope was loaded with a 7.5-mm tracheal tube for male patients or 7.0-mm tube for females. Following infusion of study drug, the *patient's conscious level* was evaluated. *Vital signs* such as heart rate, arterial blood pressure, arterial oxygen saturation were recorded at base line and then every 5 min thereafter. *Intubation conditions* were graded by the consultant anaesthetist who performed the fibreoptic procedure.

Fiberoptic Intubation

The patients in supine position and the anesthesiologist may face or work from behind the patient. Equipment preparation includes checking the optics, cleaning, anti fogging of the distal lens, and lubrication of the insertion cord withlignocaine jelly. Fiberoptic scope was inserted into either nare after satisfactory sedation. The Fiberoptic scope is advanced while keeping the target in the center of the image as the Fiberoptic scope moves toward the epiglottis, vocal cords, tracheal rings and muscle, and carina. The Fiberoptic scope is passed into the distal portion of the trachea and visualization of carina, the tracheal tube then passed over it into the trachea. Tracheal intubation is confirmed by chest auscultation for bilateral air entry,and expire CO_2 graph on capnogram.

The primary outcome measurements were

1. Intubation scores during fiberoptic nasotracheal intubation as assessed by

A. Vocal cord movement score

1. open vocal cord
2. moving of vocal cord,
3. closing of vocal cord,
4. closed vocal cord.

B. Limb movement score

1. none limb movement,
2. slight limb movement,
3. moderate limb movement,
4. severe limb movement.

C. Patient tolerance as assessed by

*5-point fibreoptic intubation comfort score

1. No reaction,
2. Slight grimacing,
3. Heavy grimacing
4. Verbal objection
5. Defensive movement of head or hands

*3-points Patient's co-operation score assessed immediately after fiberopticnasotrachealintubation

1. Cooperative,
2. Restless/minimal resistance,
3. Severe resistance/general anaesthesia required immediately.

Once tracheal intubation was confirmed and secured, general anaesthesia was administrated..

2. Haemodynamic changes (heart rate and mean arterial blood pressure) were compared between thetwo groups at three points.

- During pre-anaesthetic preparation (baseline);
- At the end of dexmedetomidine or propofol infusions
- Immediately after tracheal intubation

A postoperative visit was undertaken the day after operation during which any adverse events like hoarseness, sore throat as well as satisfaction score[15] was assessed. Stastical analysis was carried out by using two independent sample t-test for numerical data and Mann-Whitney U-test for ordinal data, p-value < 0.05 were considered statistically significant.

Result

In the present study, 80 adult patients belonging to ASA physical status I and II underwent tracheal intubation for elective surgery were included. They were assigned in two group each group contains 40 adult patients. Group (D); Received iv. dexmedetomidine (1μg.kg^{-1}) Group (P); Received.i.v. propofol 70μg/ kg/min.infused over 10 min.

Discussion

The primary outcomes of this study shows that both dexmedetomidine and propofol infusion provide satisfactory conditions for fibreoptic intubation with limited adverse effects in almost 95% of the patients. Dexmedetomidine has been shown to offer adequate conscious sedation for the fibreoptic intubation of patients with anticipated difficult airways [9,10,12,13]. Abdelmalak et al. [9] reported a series of successful awake fibreoptic intubations using dexmedetomidine for sedation in patients with difficult airways caused by a subglottic mass, a thyroid tumour causing tracheal compression, and a nasopharyngeal tumour causing obstructive sleep apnoea. Dexmedetomidine can be used as either the sole agent or an adjuvant to facilitate awake intubation in patients with anticipated difficult airways [10,12,13].

However, there are limited double-blind randomised controlled trials comparing the drug's effectiveness with other techniques. Propofol is widely used in anaesthetic practice to facilitate tracheal intubation and recent developments in propofol delivery using TCI offer reliable techniques for providing safe sedation. Simple I.V. infusion delivery systemis used in our study. Hence this study aimed to compare the effectiveness of sedation provided by either dexmedetomidine or propofol infusion.

In the present study, 80 adult patients belonging to ASA physical status I and II undergoing tracheal intubation for elective surgery were included. They were assigned in two group, each group contains 40 adult patients received either Dexmeditomidine or propofol .

Table 1 shows gender wise, age wise and weight wise distribution of patients in two group by using two sample proportion test where p- value is more than 0.05, statistically not significant hence two group were comparable with respective to gender. Age and weight.

Table 1: Gender wise, Age wise and Weight wise distribution of patients in group D and group P

	Group D	Group P	P Value
Gender			
Male	28	25	0.871
Female	12	15	
Age (Mean ± SD)	40.35±6.85	39.50±7.04	0.586
Weight(kg) (Mean ± SD)	59.74±6.61	60.23±7.11	0.756

Conclusion: By using 2 sample proportion test p-value > 0.05 therefore there is no significant difference between proportion of gender, age and weight in group A and group B.

Table 2 shows comparision of heart rate at baseline, at infusion and immediately after nasotracheal intubation, in group (D) and group (P). By using two independent sample t-test p-value 0.166, there is no significance difference between two group at baseline, hence two groups were comparable.

At infusion, p-value is 0.001, there is stastically difference between two group. Compared with baseline, the heart rate decreased significantly in the dexmedetomidine group at the end of the drug infusion [mean baseline heart rate (82.50) and infusion heart rate (71.20)] it decreased by 11.6 this was not seen in the propofol group.

At time of Intubation - mean increase in heart rate is 1.7 and 11 beats. min^{-1} in the dexmedetomidine group and the propofol group respectively ($p< 0.001$). Hence heart rate indexmeditomidine group is more stable duringfiberopticnasotracheal intubation than propofol group.

A study by Ebert TJ, et al. in 2000 and Lawrence CJ, Delange et al. in 1997 there studies are used for comparision with our study , they shows Dexmedetomidine infusion may cause adverse effects such as hypotension, hypertension, nausea, bradycardia, atrial fibrillation, and hypoxia [20, 21]. In our study, dexmedetomidine infusion induced bradycardia in two patients. Bradycardia were easily managed with atropine, None of the patients developed hypotesion, atrial arrhythmia or hypoxia.

Table 3 comparison of mean arterial blood pressureat baseline, at infusion and intubation between two group. By using two independent sample t-test p-value at baseline 0.189 there is no significance difference between two group, hence baseline mean arterial blood pressure is comparable between two group.

At the end infusion p-value is, 0.149 there is stastically no difference between two group, hence mean arterial blood pressure significantly decrease in dexmeditomidine and propofol group .

At the intubation time p-value is 0.107 there is no significance difference between two group. Mean arterial blood pressure decreased by 2.88 mm of Hg in dexmeditomidine group and decrease by 1.97 mm of Hg in propofol group from baseline arterial blood pressure.

With respect to haemodynamic stability, dexmedetomidine showed more favourable characteristics than propofol in our study. There was no significant difference in the change of mean arterial pressures during intubation for both the dexmedetomidine and propofol groups.

A study by Yavacauglu B, Kaya, et al. 2008 is comparision with our study,in this study they shows Dexmedetomidine has to prevent the haemodynamic responses to tracheal intubation more effectively than esmolol .

A study by Bloor BC et al. in 1992[14] is also used for comparison with our study, dexmeditomidine use was associated with a decrease in blood pressure and heart rate which might result from a decrease in noradrenaline release, a decrease in centrally

Table 2: Heart Rate

HR at	Number of patients	Group		p-value
		Group D	Group P	
Baseline	40	82.80 ± 5.06	81.30 ± 4.52	0.166
At infusion	40	71.20 ± 7.30	76.10 ± 5.12	0.001
At intubation	40	84.50 ± 6.02	90.30 ± 4.31	< 0.001

Conclusion: By using 2 independent sample t-test p-value < 0.05 therefore there is significant difference between meanHeart rate in group D and group P *atinfusion and intubation.*

Table 3: Comparison of mean arterial pressure (MAP) at baseline, at infusion and at intubationin group D and group P.

MAP at	Number of patients	Group		p-value
		Group D	Group P	
Baseline	40	94.35 ± 6.87	92.50 ± 5.54	0.189
At infusion	40	82.03 ± 6.72	80.23 ± 5.61	0.149
At intubation	40	92.60 ± 7.10	90.53 ± 5.54	0.107

Conclusion: By using 2 independent sample t-test p-value > 0.05 therefore there is no significant difference between mean MAP in group D and group P atinfusion, intubation.

mediated sympathetic tone and an increase in vagal activity.

A study by Kumkum Gupta, Manish Jain, et al.[19] use for comparision of our study, they observed that the fiberoptic intubation was successful with satisfactory endoscopic and intubating condition in all patients. Dexmedetomidine premedication has provided satisfactory conditions for fiberoptic intubation and attenuated the hemodynamic response of fiberoptic intubation than the propofol group.

Table and graph 4 shows comparision of intubation score assissed by vocal cord movement in two group, by using score Mann-Whitney U-test p-value 0.003 and median 1 [.cord open] in dexmeditomidine group, 2 [moving of vocal cord] in propofol group. There is significant difference between D and P group hence dexmeditomidine group more favourable intubation scores for vocal cord opening than propofol group. Table 5 shows comparision of limb movement score in group D and group P, by using Mann- Whitney U-test p-value 0.014 and median 1 [none], 2 [slight limb movement] group D and group P respectively. Threre is significance difference between two group, hence dexmeditomidine group more favourable than propofol group.

All patients underwent successful fiberoptic nasotracheal intubation. The dexmeditomidine group had more favourable intubation score for vocal cord movement and limb movement than propofol group. Two patient in the propofol group showed severe movement during the procedure and suffered from upper airway obstruction, these patient developed transient hypoxia, with the lowest recorded oxygen saturation 80% (baseline 97%). Face-mask ventilation with 100% oxygen rapidly resolved the situation. Another two patient, in the dexmedetomidine group, exhibited gross limb movement during the procedure, but this was not associated with any airway obstruction. Administration of a 30-mg propofol bolus was used to rescue the situation. Both underwent successful intubation and recovered uneventfully. Satisfactory intubation scores (without severe limb movement) were observed in the remaining 38 of the 40 patients in each group.

Our results, propofol infusion aiming for a concentration at effect site of 70µg./kg/min. provided conditions for fibreoptic intubation that

Table 4: Comparison of intubation score of vocal cord movement in group D and group P.

Intubation score of vocal cord movement	Group Group D	Total Group P	
1	30	19	49
2	10	12	22
3	0	9	9
4	0	0	0
Total	40	40	80

	Median	p-value
Group D	1	0.003
Group P	2	

Conclusion: By using Mann-Whitney U test p-value < 0.05 therefore there is significant different between intubation score of vocal cord movement.

Table 5: Comparison of intubation score of limb movement in group D and group P

Intubation score of limb movement	Group Group D	Group P	Total
1	25	13	38
2	10	18	28
3	3	7	10
4	2	2	4
Total	40	40	80

	Median	p-value
Group D	1	0.012
Group P	2	

Conclusion: By using Mann-Whitney U test p-value < 0.05 therefore there is significant different between intubation score of limb movement

were comparable with those provided using dexmedetomidine but with less favourable patient tolerance and a higher degree of airway obstruction.

A study by Lallo et al 2009. [2]comparision with our study they reported that both propofol TCI (C_e = 3.9 μg.ml^{-1}) and remifentanil TCI (C_e = 2.4 ng.ml^{-1}) provided good intubating conditions and patient comfort. Aiming for a lower concentration at effect site usingpropofol TCI can result in worse intubating conditions than those provided using remifentanil. A study by Rai et al. 2008 [3] also use for comparision with our study they reported that remifentanil TCI (C_e = 3.2 ng.ml^{-1}) provided better conditions for fibreoptic intubation when compared with propofol TCI (C_e = 1.3 μg.ml^{-1})

Table 6 shows comparision of patients tolerance as assessed by 5-points fiberopticnasotracheal intubation score. By using Mann-Whitney U test p-value is 0.012. median 1=no reaction in dexmeditomidine group, 2=slight gramacing in propofol group. There is stastically significance difference between two group, hence dexmeditomidine group more favourable in comfort for fiberopticintubation than propofol group Patient comfort is also an important issue during fibreoptic intubation. When placing the tracheal tube, patients should be relaxed and comfortable in orderthe anaesthetist can confirm the tube's position and perform general anaesthesia under controlled conditions. In our study, patients in the dexmedetomidine group showed better tolerance as assessed by less limb movement during fibreoptic intubation. Most patients in the dexmedetomidine group were cooperative and able to open their eyes to command immediately after nasotracheal intubation. Not surprisingly, none of the patients in the propofol group could respond to command, and all of them needed general anaesthesia immediately after nasotracheal intubation.

A study by C.J. Tsai et al. 2010 [15] use to compare with our study they shows both dexmeditomidine and propofol TCI infusion provided satisfactory intubating conditions and patients satisfaction in majority of patients undergoing fiberoptic nasal intubation. Dexmeditomidine appeared to offer better patients tolerance, better preservation of a patent airway and spontaneous ventilation, and reduced haemodynamic response to intubation.

In our study sedation was deeper in the propofol group at intubation compared to the dexmedetomidine group. Airway obstruction occurred more frequently in the propofol group than in the dexmedetomidine group. There were no episodes of airway obstruction or hypoxia in the dexmedetomidine

Table 6: Comparison of patients tolerance comfort score in group D and group P

Patient tolerance score	Group		Total
	Group D	Group P	
1	21	12	33
2	17	19	36
3	2	8	10
4	0	1	1
Total	40	40	80

	Median	p-value
Group D	1	0.001
Group P	1	

Conclusion: By using Mann-Whitney U test p-value < 0.05 therefore there is significant different between median patient tolerance comfort score.

Table 7: Comparison of patients tolerance score after intubation in group D and group P

Patient tolerance score after intubation	Group		Total
	Group D	Group P	
1	35	22	57
2	5	16	21
3	0	2	2
Total	40	40	80

	Median	p-value
Group D	1	< 0.001
Group P	1	

Conclusion: By using Mann-Whitney U test p-value < 0.05 therefore there is significant different between median patient tolerance score after intubation

group. During management of the difficult airway, it is safest to keep patients breathing spontaneously until an alternative artificial airway is established.

A study by Venn RM et al. 1999 and study of Belleville JP et al. 1992 use to comparision with our study they shows,.dexmedetomidine activates the postsynaptic α_2-adrenergic receptors in the locus coeruleus, and induces sedation by activation of the endogenous sleep-promoting pathway. Moreover, it has sedative, analgesic, anxiolytic, and anti-sialagogue properties without predisposing to airway obstruction and respiratory depression.

Table 8 shows, comparision of satisfaction score during fiberoptic intubation in two group. By using Mann-Whitney U-test median 2 [6/32/2] in dexmeditomidine group, 2 [4/28/8] in propofol group and p-value is 0.075. There is no significance difference between two group, hence satisfaction is comparable between two group, but dexmeditomidine group having better satisfaction as compare to propofol group.

Table 8: Comparison of patient satisfaction score in group D and group P.

Patients satisfaction score	Group		Total
	Group D	Group P	
1	6	4	10
2	32	28	60
3	2	8	10
Total	40	40	80

	Median	p-value
Group D	2	0.075
Group P	2	

Conclusion: By using Mann-Whitney U test p-value < 0.05 therefore there is no significant different between median patients satisfaction score.

Side effects like hoarseness–3 patients in (D) group and 5 patients in (P) group Sore throat in 5 patients with (D) group and 7 patients with (P) group.

Conclusion

In this study 80 patients were divided into two group. 40 patients in D group and 40 patients in P group. All patients underwent successful fiberoptic nasotracheal intubation.

Both groups provided satisfactory intubating conditions and patients satisfaction in the majority of patients under went fibreoptic nasal intubation:

1. Dexmedetomidine allows better patient tolerance, conscious sedation during fiberoptic nasotracheal intubation than propofol
2. Dexmeditomidime is prevent the haemodynamic response to fiberoptic intubation more effectively than propofol
3. Dexmeditomidine is better preservation of a patent airway and spontaneous ventilation than propofol.

References

1. Ramesh D. Fiberoptic airway management in adult and children. Indian journal of anesthesia 2005;49(4); 293-99.
2. Lallo A, Billard V, Bourgain JL. A comparison of propofolandremifentanil target-controlled infusions to facilitatefiberopticnasotracheal intubation. Anesthesia and Analgesia 2009;108:852–7.
3. Rai MR, Parry TM, Dombrovskis A, Warner OJ. Remifentanil target-controlled infusion vspropofol target controlled infusion for conscious sedation for awakefibreoptic intubation: a double-blinded randomized controlled trial. British Journal of Anaesthesia 2008;100:125–30.
4. Stamenkovic DM, Hassid M. Dexmedetomidine for fiberoptic intubation of a patient with severe mental retardation and atlantoaxial instability. Acta Anaesthesiologica Scandinavica 2006;50:1314–5.
5. Machata AM, Gonano C, Holzer A, et al. Awake nasotrachealfiberoptic intubation: patient comfort, intubating conditions, and hemodynamic stability during conscious sedation with remifentanil. Anesthesia and Analgesia 2003;97:904–8.
6. Knolle E, Oehmke MJ, Gustorff B, Hellwagner K, Kress HG. Target-controlled infusion of propofol

for fibreoptic intubation. European Journal of Anaesthesiology 2003;20:565–9.

7. Kamibayashi T, Maze M. Clinical uses of alpha2–adrenergic agonists. Anesthesiology 2000;93:1345–9.
8. Hall JE, Uhrich TD, Barney JA, Arain SR, Ebert TJ. Sedative, amnestic, and analgesic properties of small-dose dexmedetomidine infusions. Anesthesia and Analgesia 2000;90:699–705.
9. Abdelmalak B, Makary L, Hoban J, Doyle DJ. Dexmedetomidine as sole sedative for awake intubation in management of the critical airway. Journal of Clinical Anesthesia 2007;19:370–3.
10. Maroof M, Khan RM, Jain D, Ashraf M. Dexmedetomidine is a useful adjunct for awake intubation. Canadian Journal of Anaesthesia 2005;52:776–7.
11. Jooste EH, Ohkawa S, Sun LS. Fiberoptic intubation with dexmedetomidine in two children with spinal cord impingements.Anesthesia and Analgesia 2005; 101:1248.
12. Chu KS, Wang FY, Hsu HT, Lu IC, Wang HM, Tsai CJ. The effectiveness of dexmedetomidine infusion for sedating oral cancer patients undergoing awake fibreoptic nasal intubation.European Journal of Anaesthesiology 2010;27:36–40.
13. Bergese SD, Khabiri B, Roberts WD, Howie MB, McSweeney TD, Gerhardt MA. Dexmedetomidine for conscious sedation in difficult awake fiberoptic intubation cases.Journal of Clinical Anesthesia 2007;19:141–4.
14. Bloor BC, Ward DS, Belleville JP, Maze M. Effects of intravenous dexmedetomidine in humans. II. Hemodynamic changes. Anesthesiology 1992;77: 1134–42.
15. C.J. Tsai, K.-S.Chu, T.I. Chen, D.V. Lu, H.M. Wang.; Acoparision of the effectiveness of Dexmedetomidine versus propofol target controlled infusion for sedation during Fibreoptic nasotracheal intubation. Anaesthesia, 2010;65:254–59
16. S.A. Grant, D.S. Breslin, D.B. MacLeod, D. Gleason, and G. Martin. Dexmedetomidine infusion for sedation during fiberoptic intubation: a report of three cases. Journal of Clinical Anesthesia, 2004;16(2): 124–126.
17. S.R. Arain and T.J. Ebert. The efficacy, side effects, and recovery characteristics of dexmedetomidine versus propofol when used for intraoperative sedation. Anesthesia and Analgesia, 2002;95;2: 461–466.
18. Bergese SD, Patrick Bender S, Mc Sweeney, Sege K. A comparative study of dexmedetomidine with midazolam and midazolam alone for sedation during elective awake fiberoptic intubation. Journal of clinical anaesthesia 2010;22(1):35-40.
19. Kumkum Gupta, Manish Jain, Pra shant K. Gupta, Bhavna Rastogi. Dexmedetominepremedication for fiberoptic intubation in patients of temporomandibular joint ankylosis: A randomized clinical trial. Saudi journal of anesthesia, 2012;6(3):219-23.
20. Domino KB, Posner KL, Caplan RA, Cheney FW. Airway injury during anesthesia: A closed claims analysis. Anesthesiology 1999;91:1703-11.