Effect of conscious sedation use on anxiety reduction, and patient and surgeon satisfaction in dental implant surgeries: A systematic review and meta-analysis

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Abstract

Demand for dental implants has increased in recent years and the use of conscious sedation for this type of surgery can be of great benefit. Therefore, the aim of this systematic review was to evaluate the scientific literature related to the effect of conscious sedation on the reduction of anxiety, and patient and surgeon satisfaction.

The Embase, PubMed, ProQuest, Scopus, Ovid, and Cochrane databases were searched without limitations. According to the inclusion and exclusion criteria determined for the study, 10 articles were selected for the final review after several screening stages. These studies were reviewed in their full-text form by the research team and the intended data was extracted. The risk of bias was assessed for each of the selected articles.

Five studies were ultimately included. Two of the them compared local anesthesia and conscious sedation, while the others compared the consequences of different types of conscious sedation. The anxiety reduction and patient and surgeon satisfaction data was collated. Midazolam was the most frequently used agent.

After a thorough review of the final articles extracted based on the study protocol, it was concluded that the use of conscious sedation during implant surgery reduces patient anxiety, and also increases the satisfaction of the patient and the surgeon.

Keywords: dental implant, conscious sedation, hemodynamic, satisfaction, anxiety, systematic review

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Introduction

Oral surgery, including implant surgery, is usually performed with local anesthesia, either local infiltration or block anesthesia. While local anesthesia can provide adequate analgesia, the time required for extensive and complicated treatment (up to 3 hours' duration) may make it unpleasant for the patient, who is completely aware of the procedure and must remain relatively still with their mouth open for most of the time.[1] When a complicated and long implant surgery is anticipated, intravenous conscious sedation (IVCS) has become a logical and viable option.[2] Conscious sedation is a drug-induced condition in which the conscious patient is rendered free of fear, anxiety and apprehension while remaining comfortably relaxed.[3] When administering intravenous sedation, the operator aims to achieve a predetermined goal, namely an adequate level of sedation, which enables dental treatment to be carried out safely and with the minimum amount of distress for the patient.[1] Conscious sedation is not a method of pain control,[3] but it can result in better patient anxiety control and an increase in cooperation, facilitating the intervention for the patient and the surgeon.[4]

Anxiety is defined as a state of apprehension and physical tension combined with the activation of the autonomic nervous system. It is a common emotional reaction to fear experienced by patients before dental treatment or the application of a local anesthetic.[1] Anxiety control before and during dental procedures is important to ensure safety, and to promote overall patient and surgeon satisfaction.[4,5] Unfortunately, the amount of research investigating the effect of IVCS on anxiety in patients undergoing dental implant surgery, as well as on patient and surgeon satisfaction, is still limited.[2,6,7]

Therefore, the aim of this systematic review was to review the literature regarding the effect of conscious sedation on the reduction of anxiety, and patient and surgeon satisfaction in dental implant surgery.

Methods

Study design

A comprehensive literature review of research databases, including Embase, PubMed, ProQuest, Scopus, and Ovid, was conducted. The first author (RP), assisted by a research librarian, generated a literature search strategy and searched the databases. The literature searches were carried out from February 2018 to May 2019. On May 27, 2019, a final search update was made in all databases. The search strategy included a combination of MeSH (Medical Subject Headings) and free keywords.

Inclusion and exclusion criteria

The study selection process used the Population, Intervention (or Exposure), Comparison, and Outcome (PICO) framework to clarify the search.[8]

Population: Patients with implant surgeries (healthy patients aged ≥18 years) participating in randomized controlled trials (RCTs).

Intervention: IVCS.

Comparison: Local anesthesia.

Outcome: Anxiety, patient and surgeon satisfaction.

The search, selection and assessment processes were performed in 4 steps according to the PRISMA (Preferred Reporting Items for Systematic reviews and Meta-Analyses) flow diagram shown in Fig. 1. The steps were as follows: systematic literature search; removal of duplicates; identification of potentially relevant articles based on the title and abstract; and full-text screening. The first and second authors (RP and NG), assisted by a librarian, prepared the search string for the electronic search. For more precise results, a manual search was performed among the references of the gathered articles. Also, the research team contacted study authors to obtain additional information, if necessary. The first author (RP) screened the titles and abstracts, and the first and second authors (RP and NG) separately read the full text of the remaining articles for inclusion or exclusion in the review. The selected articles were appraised based on Cochrane's tool for assessing the risk of bias in randomized trials.[9] The articles were appraised by two members of the research team, and a third arbitrator was consulted when there were points of disagreement. The included studies were reviewed and the intended data was extracted by two

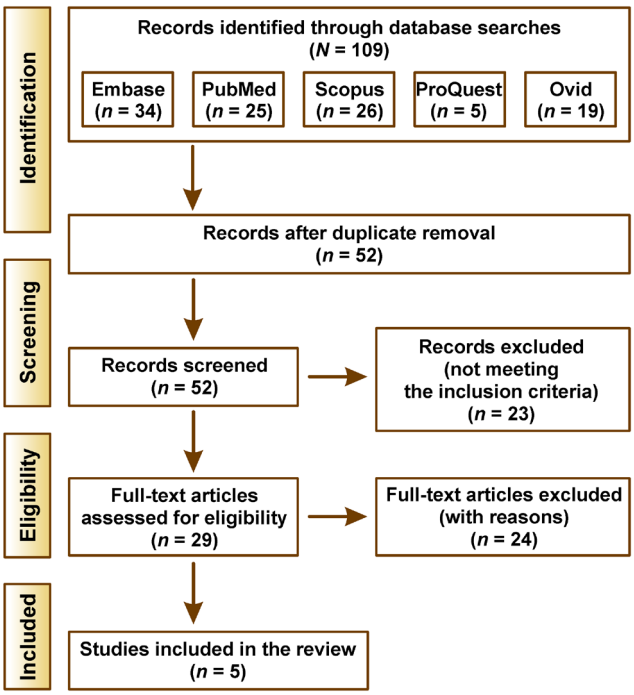

Fig. 1. PRISMA (Preferred Reporting Items for Systematic reviews and Meta-Analyses) flow diagram of the study

reviewers independently, using a standardized data extraction tool. The results were reported as percentages and as mean ± standard deviation (*M* ±*SD*).

Results

The PRISMA[10] flow chart summarizes the selection of articles included in the systematic review (Fig. 1); 109 articles were found through the searches in the databases. Once duplicates were removed, 52 articles remained. After screening the titles and abstracts, 23 articles were excluded based on the inclusion criteria from PICO and 29 articles remained. After full-text screening, 5 studies were left for inclusion in the systematic review. The reasons for the exclusion of the 24 articles during full-text screening were as follows: 5 of the articles were not written in English; the full text of 3 articles was not accessible electronically; 4 articles assessed oral or inhalation sedation instead of intravenous sedation; 5 of the articles included patients assigned to class 2 or upper according to the American Society of Anesthesiologists (ASA) physical status classification[11]; and the outcome of 7 studies did not fulfill the criteria listed in PICO.

Anxiety

Four studies[2,4,6,12] evaluated anxiety in patients undergoing IVCS. The descriptive data of the included studies for anxiety reduction is shown in Table 1. Midazolam and fentanyl were used for sedation in 2 cases,[4,6] while midazolam only was used in 1 study.[2] Kaviani and Ghoreishain compared 2 groups (midazolam and fentanyl vs. midazolam and ketamine).[12] Three of the studies reported anxiety as high, moderate or low.[4,6,12] One study reported only high anxiety.[2] Table 2 and Fig. 2 depict the pooled adjusted estimates of the association between IVCS and the anxiety levels.

High anxiety

Four studies that evaluated high anxiety in patients with IVCS were assigned to meta-analysis; a total of 473 patients from the eligible studies were analyzed. The heterogeneity between the studies was statistically significant

Table 1. Descriptive data of the included studies regarding anxiety reduction

Study	Sample size	Sedation protocol	Anxiety %			Preoperative anxiety score *M* ±*SD*
			low	moderate	high	
McCrea[2] 2015	173	midazolam	–	–	44	M (*n* = 64): 9.19 ±4.21 F (*n* = 109): 11.86 ±5.76
Gonzáles-Lemmonier et al.[4] 2010	90	midazolam (0.05 mg/kg) + fentanyl (1 µg/kg)	27.8	50.0	22.2	high in F
Bovaira et al.[6] 2017	180	midazolam (0.05 mg/kg) + fentanyl (1 mg/kg)	27.8	56.1	16.1	M (*n* = 104): 9.73 ±3.37 F (*n* = 76): 8.51 ±3.65
Kaviani and Ghoreishain[12] 2014	group A: 15 group B: 15	group A: midazolam (1 mg) + fentanyl (50 µg) group B: midazolam (1 mg) + ketamine (50 mg)	group A: 20.0 group B: 40.0	group A: 60.0 group B: 46.7	group A: 20.0 group B: 13.3	–

M – mean; *SD* – standard deviation; M – male; F – female.

Table 2. Pooled adjusted estimates of the association between intravenous conscious sedation (IVCS) and the anxiety levels

Anxiety	Model	Number of studies	Effect size and 95% *CI*			Null-hypothesis two-tailed test		Heterogeneity			
			point estimate	lower limit	upper limit	*Z*-value	*p*-value	*Q*-value	df (*Q*)	*p*-value	I^2
High	random-effects	4	0.250	0.128	0.430	–2.632	0.008*	34.61	3	<0.001*	91.33
Moderate	fixed-effects	3	0.544	0.485	0.601	1.469	0.142	1.10	2	0.577	0.00
Low	fixed-effects	3	0.274	0.226	0.329	–7.318	0.000*	0.43	2	0.807	0.00

CI – confidence interval; df – degrees of freedom; * statistically significant.

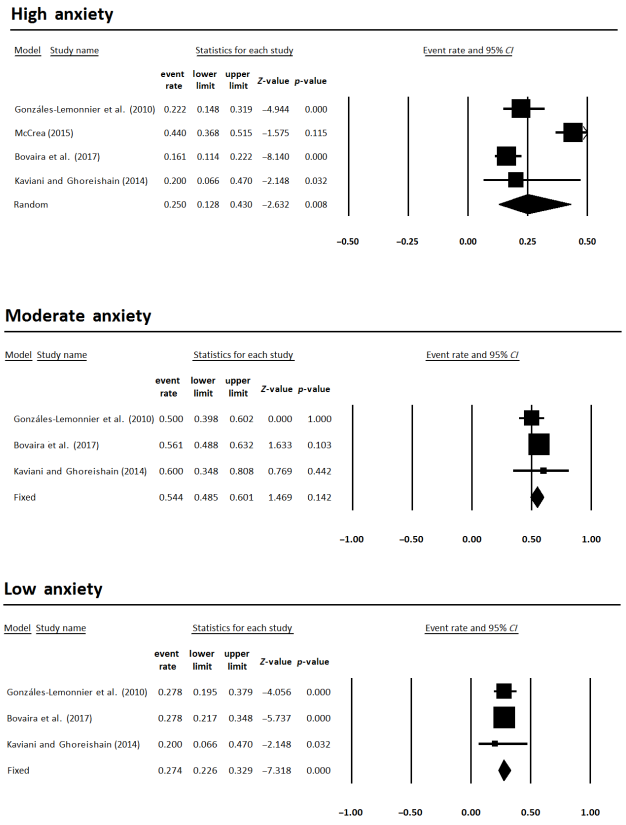

Fig. 2. Pooled adjusted estimates of the association between intravenous conscious sedation (IVCS) and the anxiety levels

(Q = 34.61; p < 0.001; I^2 = 91.33). The meta-analysis results with the random-effects model indicated a high anxiety score of 25.0%, which was statistically significant (pooled event rate: 0.250; 95% *CI* (confidence interval): 0.128–0.430; p = 0.008).

Moderate anxiety

Three studies that evaluated moderate anxiety in patients with IVCS were assigned to meta-analysis; a total of 300 patients from the eligible studies were analyzed. The heterogeneity between the studies was not statistically significant (Q = 1.10; p = 0.577; I^2 = 0.00). The meta-analysis results with the fixed-effects model indicated a moderate anxiety score of 54.4%, which was not statistically significant (pooled event rate: 0.544; 95% *CI*: 0.485–0.601; p = 0.142).

Low anxiety

Three studies that evaluated low anxiety in patients with IVCS were assigned to meta-analysis; a total of 300 patients from the eligible studies were analyzed. The heterogeneity between the studies was not statistically significant (Q = 0.43; p = 0.807; I^2 = 0.00). The meta-analysis results with the fixed-effects model indicated a low anxiety score of 27.4%, which was statistically significant (pooled event rate: 0.274; 95% *CI*: 0.226–0.329; p = 0.000).

Table 3. Descriptive data of the included studies regarding patient and surgeon satisfaction

Study	Sample size	Sedation protocol	Patient satisfaction %					Surgeon satisfaction %
			comfortable	neither comfortable nor uncomfortable	slightly uncomfortable	unpleasant	traumatic	
McCrea[2] 2015	173	midazolam (the titration method, no fixed dose)	–	–	–	–	–	100.0
Gonzáles-Lemmonier et al.[4] 2010	90	midazolam (0.05 mg/kg) + fentanyl (1 µg/kg)	23.3	28.9	36.7	10.0	0	87.8
Bovaira et al.[6] 2017	180	midazolam (0.05 mg/kg) + fentanyl (1 mg/kg)	34.4	26.7	29.4	7.8	1.7	90.0
Kaviani and Ghoreishain[12] 2014	group A: 15 group B: 15	group A: midazolam (1 mg) + fentanyl (50 µg) group B: midazolam (1 mg) + ketamin (50 mg)	group A: 80.0 group B: 73.3	group A: 20.0 group B: 26.7	–	–	–	group A: 100.0 group B: 86.7
Juodzbalys et al.[13] 2005	group A: 67 group B: 20	group A: midazolam (0.1 mg/kg) + ketorolac (60 mg) group B: articaine (4%) + epinehrine	group A: 97.0 group B: 0	group A: 3.0 group B: 20.0	group A: 0 group B: 70.0	group A: 0 group B: 10.0	–	–

Surgeon and patient satisfaction

In the eligible studies, patient satisfaction was reported as comfortable, neither comfortable nor uncomfortable, slightly uncomfortable, unpleasant, or traumatic. Surgeon satisfaction was evaluated as well. The descriptive data of the related included studies is shown in Table 3. Table 4, as well as Fig. 3 and Fig. 4 present the pooled adjusted estimates of the association between IVCS and patient and surgeon satisfaction, respectively.

Patient satisfaction

Comfortable

The 4 included studies[4,6,12,13] were statistically heterogenic (Q = 47.57; p = 0.000; I^2 = 93.69). According to the pooled adjusted estimates (Fig. 3), the meta-analysis results with the random-effects model indicated that 63.3% of the patients were comfortable during surgery, which was not statistically significant (pooled event rate: 0.633; 95% *CI*: 0.322–0.862; p = 0.407).

Neither comfortable nor uncomfortable

The 4 included studies[4,6,12,13] were statistically heterogenic (Q = 12.10; p = 0.007; I^2 = 75.21). According to the pooled adjusted estimates (Fig. 3), the meta-analysis results with the random-effects model indicated that 19.8% of the patients were neither comfortable nor uncomfortable during surgery, which was statistically significant (pooled event rate: 0.198; 95% *CI*: 0.112–0.326; p = 0.000).

Slightly uncomfortable

The 4 included studies[4,6,12,13] were statistically heterogenic (Q = 13.29; p = 0.004; I^2 = 77.42). According to the pooled adjusted estimates (Fig. 3), the meta-analysis results with the random-effects model indicated that 23.0% of the patients were slightly uncomfortable during surgery, which was statistically significant (pooled event rate: 0.230; 95% *CI*: 0.117–0.402; p = 0.004).

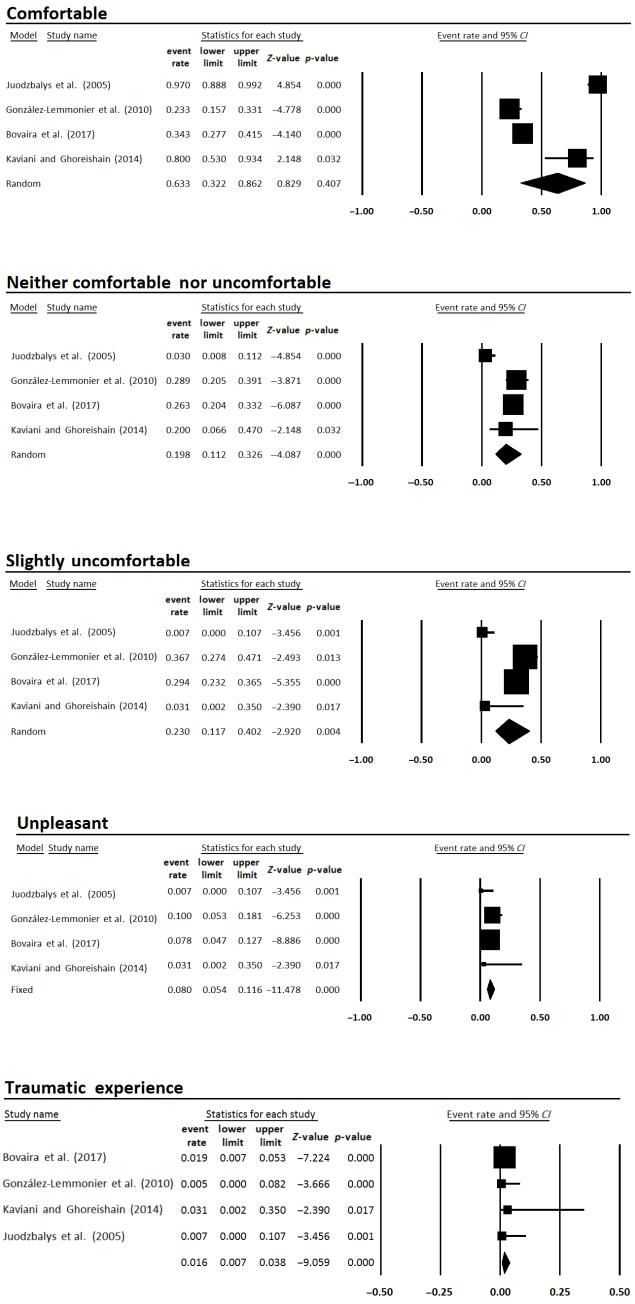

Fig. 3. Pooled adjusted estimates of the association between intravenous conscious sedation (IVCS) and patient satisfaction

Table 4. Pooled adjusted estimates of the association between intravenous conscious sedation (IVCS) and patient and surgeon satisfaction

Satisfaction	Number of studies	Effect size and 95% *CI*			Null-hypothesis two-tailed test		Heterogeneity			
		point estimate	lower limit	upper limit	*Z*-value	*p*-value	*Q*-value	df (*Q*)	*p*-value	I^2
Comfortable	4	0.633	0.322	0.862	0.829	0.407	47.57	3	0.000*	93.69
Neither comfortable nor uncomfortable	4	0.198	0.112	0.326	–4.087	0.000*	12.10	3	0.007*	75.21
Slightly uncomfortable	4	0.230	0.117	0.402	–2.920	0.004*	13.29	3	0.004*	77.42
Unpleasant	4	0.080	0.054	0.116	–11.478	0.000*	3.98	3	0.263	24.68
Traumatic experience	4	0.016	0.007	0.038	–9.059	0.000*	1.22	3	0.749	0.00
Surgeon satisfaction	4	0.922	0.833	0.965	5.635	0.000*	8.27	3	0.041*	63.73

* statistically significant.

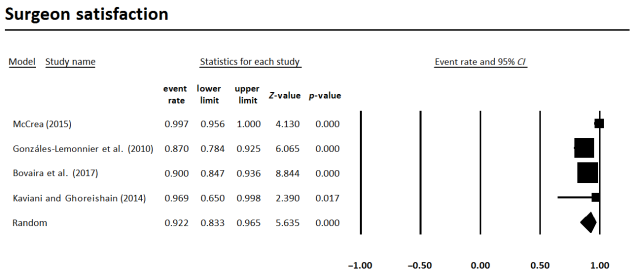

Fig. 4. Pooled adjusted estimates of the association between intravenous conscious sedation (IVCS) and surgeon satisfaction

Unpleasant

The 4 included studies[4,6,12,13] were not statistically heterogenic (Q = 3.98; p = 0.263; I^2 = 24.68). According to the pooled adjusted estimates (Fig. 3), the meta-analysis results with the fixed-effects model indicated that 8.0% of the patients felt unpleasant during surgery, which was statistically significant (pooled event rate: 0.080; 95% *CI*: 0.054–0.116; p = 0.000).

Traumatic experience

The 4 included studies[4,6,12,13] were not statistically heterogenic (Q = 1.22; p = 0.749; I^2 = 0.00). According to the pooled adjusted estimates (Fig. 3), the meta-analysis results indicated that 1.6% of the patients felt their experience was traumatic, which was statistically significant (pooled event rate: 0.016; 95% *CI*: 0.007–0.038; p = 0.000).

Surgeon satisfaction

The 4 included studies[2,4,6,12] were statistically heterogenic (Q = 8.27; p = 0.041; I^2 = 63.73). According to the pooled adjusted estimates (Fig. 4), the meta-analysis results with the random-effects model indicated that the surgeon satisfaction rate with IVCS was 92.2%, which was statistically significant (pooled event rate: 0.922; 95% *CI*: 0.833–0.965; p = 0.000).

Discussion

Like every dental surgery, dental implant surgery has the potential to cause pain, anxiety, systemic sequelae, and even life-threatening situations.[14] All of these factors may affect patient and surgeon satisfaction, surgical outcome, and even the duration of the healing period.[15,16] Anxiety control during and before dental procedures is essential to ensure the safety of the procedure, and to promote overall patient and surgeon satisfaction.[4,5] Focusing on this objective, psychological or pharmacological techniques are frequently used in the dental office,[7] especially in patients undergoing oral surgery, including dental implant surgery.[2] Digital photographs and wrapped cone-beam computed tomography (CBCT) photographs can be used to plan a more precise surgery with shorter duration, resulting in fewer postoperative complications and greater patient satisfaction.[17] Another technique is the use of sedation, which has emerged as a popular topic in the literature.[4,5,18]

Depending on the duration and difficulty of the surgery, different sedation techniques, such as inhalation or intravenous sedation, can be selected.[19] According to the results of this systematic review and meta-analysis, surgeons were highly satisfied with IVCS in dental implant surgeries (92.2%). Bovaira et al.[6] and González-Lemonnier et al.[4] used a combination of midazolam and fentanyl for IVCS. Kaviani and Goreishain compared midazolam/fentanyl with midazolam/ketamine.[12] McCrea used midazolam alone.[2] The surgeon satisfaction rate with midazolam only and midazolam/fentanyl regimes for IVCS was 100%. Midazolam/ketamine was associated with the lowest surgeon satisfaction rate.

From the patient satisfaction point of view, midazolam/fentanyl was associated with the highest degree of satisfaction.

Patient anxiety was assessed and meta-analyzed based on the data extracted from 4 studies.[2,4,6,12] Low anxiety with regard to IVCS was associated with the use of midazolam/ketamine, whereas high anxiety was reported with the use of midazolam only.

Bovaira et al. identified a significant negative relationship between the level of preoperative anxiety and patient satisfaction – the greater the preoperative anxiety, the lower the postoperative satisfaction.[6] However, the preoperative anxiety had no influence on surgeon satisfaction. A higher number of women found the experience agreeable, experiencing lower levels of preoperative anxiety as well, as compared to men. The surgeon reported an adequate level of satisfaction with the anesthesia, while most patients remained relaxed, collaborative and calm, knowing that a specialist was overseeing the surgical and sedation procedures, and understanding any possible complications that might arise.[6]

According to González-Lemonnier et al., 72.2% of patients showed moderate and high anxiety.[4] They reported a significant negative relationship between anxiety and patient satisfaction; however, patient anxiety did not affect surgeon satisfaction. In contrast with Bovaira et al.,[6] González-Lemonnier et al. reported higher anxiety in women as compared to men.[4]

Kaviani and Goreishain reported that even in low doses, both the midazolam/fentanyl and midazolam/ketamine regimes ensured proper working conditions, appropriate comfort for the patient, adequate patient and surgeon satisfaction, and short recovery time.[12] In a study by McCrea, 44% of patients declared they

experienced high anxiety and fear before surgery.[2] However, this anxiety did not affect surgeon satisfaction. The surgeon was satisfied in 100% of cases, and 99.40% of patients declared that they would prefer to use IVCS during their next implant surgery.[2] The results of the present study also indicated that the use of IVCS resulted in better working conditions, as well as better patient and surgeon satisfaction in implant surgery.

Conclusions

After a thorough review of the final articles extracted based on the study protocol, it can be concluded that the use of IVCS for implant surgery reduces patient anxiety, and also increases patient and surgeon satisfaction.

Ethics approval and consent to participate

Not applicable.

Data availability

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

Consent for publication

Not applicable.

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