Comfort of Intraosseous Computerized Injection Systems (SOAN & SleeperOne) versus Conventional Infiltration Anesthesia in Pediatric Dental Patients

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ABSTRACT

Background: Achieving pain-free local anesthesia and reducing anxiety remain persistent challenges in pediatric dentistry. Fear of conventional dental syringes and needles is a common contributor to anxiety and avoidance of dental care. Conventional infiltration anesthesia may also result in unnecessary soft-tissue numbness of the lips and cheeks, increasing the risk of post-operative lip or cheek biting, particularly in younger or special-needs pediatric patients.

Computer-controlled intraosseous injection systems have been developed to improve patient comfort by providing precise control over the rate and pressure of anesthetic delivery while minimizing the visual threat of conventional syringes. Previous studies suggest that these devices may reduce pain perception, anxiety, and post-anesthesia side effects.

Objectives: To evaluate whether the SOAN intraosseous computerized injection system improves patient comfort during local anesthesia administration and post-operative comfort when compared with infiltration anesthesia delivered using a conventional dental syringe.

MATERIALS and METHODS

This pilot study used a split-mouth (sextant-level) design in which each pediatric patient served as their own control. Patients aged 6–12 years with ASA physical status I or II were eligible if they required elective dental treatment in at least two sextants within the same arch. Treatment indications included caries, hypoplastic or hypomineralized enamel, irreversible pulpitis without radiographic periapical or furcal pathology, or orthodontic extraction in primary or permanent teeth. Patients with contraindications to local anesthesia, nitrous oxide, or nasal breathing were excluded.

Following informed parental consent and patient assent, nitrous oxide/oxygen inhalation sedation was administered at concentrations not exceeding 50% nitrous oxide. Local anesthesia was delivered to one sextant using a conventional dental syringe and to the contralateral sextant using the SOAN intraosseous computerized injection system. During anesthetic administration, patients completed a Visual Analog Scale (VAS) to assess injection-related pain. Dental treatment was then completed on both anesthetized sextants.

After treatment, patients received 100% oxygen for five minutes and completed a second VAS assessing post-treatment pain. Patients and parents also completed a post-treatment survey evaluating pre-treatment anxiety, perceived pain during injection, visual fear associated with each anesthetic modality, residual numbness, patient mood after treatment, and parental preference for future appointments.

RESULTS

Data were obtained from three patients and are reported descriptively rather than as statistical aggregates. Individual post-treatment survey responses are summarized in Figure 1, and Visual Analog Scale (VAS) data are displayed in Figures 2–5.

All patients reported that the SOAN intraosseous injection system was less visually "scary" than the conventional dental syringe, and all parents indicated a preference for SOAN for future visits (Figure 1). During anesthetic administration, none of the patients reported greater pain with SOAN compared to the conventional syringe. Immediately following injection, all patients reported higher VAS pain scores for the conventional syringe than for SOAN, with variable magnitude across individuals (Figures 2 and 4).

Post-treatment VAS scores demonstrated some inter-patient variability; however, overall trends continued to favor improved comfort in sextants anesthetized with SOAN compared with conventional infiltration (Figures 2 and 5). Survey item definitions and VAS scoring criteria are shown in Figure 3, and a blank VAS used in the study is provided in Figure 6.

PtID	DentalAnxiety	TradInjectionH	SoanInjectionI	LessScary	ResidualNumbnesss	PostTreatme	Preference
1	Okay	It hurt a little	It was okay	Soan	Yes	Okay	No preferenc
2	Happy	It was okay	No pain	Soan	N/A	Okay	Soan
3	A little nervous	No pain	No pain	Soan	Not answered	Happy	No preferenc

Figure 1 – Post-Treatment Surveys

VASTrad	VASSoan	Diff	VASTradPost	VASSoanPost	DiffPost
70	35	35			
25	22	3	23	28	-5
28	8	20	10	2	8

Figure 2 – VAS Surveys (During Injection and Post-Treatment)

	Description	Values
PtID		Patient ID
DentalAnxiety	patient-reported description of how they feel prior to the dental procedure	Happy, okay, a little nervous, very scared
TradInjectionHurt	patient-reported sensation of pain during administration of conventional anesthesia	No pain, it was okay, it hurt a little, it hurt a lot
SoanInjectionHurt	patient-reported sensation of pain during administration of Soan anesthesia	No pain, it was okay, it hurt a little, it hurt a lot
LessScary	patient-reported selection of which method (conventional vs Soan) is "less scary-looking"	Traditional, Soan
ResidualNumbnesss	patient-reported description of numbness "longer than they would like"	No, yes (specify where), not sure
PostTreatment	patient-reported description of how they feel after the dental procedure	Happy, okay, a little nervous, very scared
Preference	parent-reported selection of which anesthesia method they would prefer for future procedure	Soan, SleeperOne, conventional injection, no preference
VASTrad	patient-reported VAS of their sensation of pain during administration of conventional anesthe	in mm out of 100
VASSoan	patient-reported VAS of their sensation of pain during administration of Soan anesthesia imm	in mm out of 100
Diff	difference in VAS scores for conventional vs Soan anesthesia immediately post-injection	in mm out of 100
VASTrad	patient-reported VAS of their sensation of pain during administration of conventional anesthe	in mm out of 100
VASSoan	patient-reported VAS of their sensation of pain during administration of Soan anesthesia post	in mm out of 100
Diff	difference in VAS scores for conventional vs Soan anesthesia post-completion of treatment	in mm out of 100

Figure 3 – Data Dictionary

RESULTS *(cont.)*

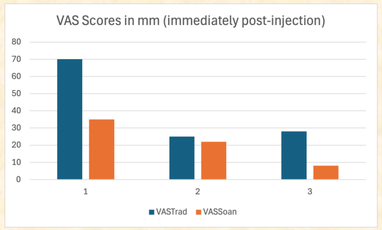

Figure 4 – Bar Chart Depicting Differences in VAS Scores for Conventional Syringe vs. Soan (During Injection)

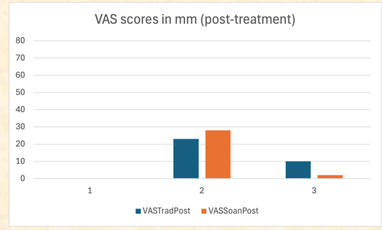

Figure 5 -- Bar Chart Depicting Differences in VAS Scores for Conventional Syringe vs. Soan (Post-Treatment)

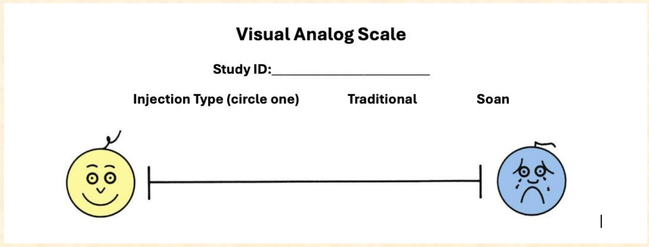

Figure 6 – Visual Analog Scale (VAS)

CONCLUSION

- In this pilot study, pediatric patients perceived the SOAN intraosseous injection system as less visually intimidating than a conventional dental syringe.
- Patient-reported pain during injection was consistently lower with SOAN compared to conventional infiltration anesthesia.
- Due to the very small sample size, statistically significant conclusions cannot be drawn.
- This ongoing study will continue with future residents to further evaluate outcomes as enrollment increases.

LIMITATIONS

- Very small sample size limits statistical analysis and generalizability.
- Some eligible patients could not be enrolled due to behavioral limitations or parental concerns regarding study participation.

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