# Physiologic and Clinical Characteristics of PDL Anesthesia Delivered by a High Pressure Syringe and a Computerized Device

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***"Use of C-CLAD with the STA System is non-stressful and results in lower pain. The efficacy is high, using fewer injection sites and less anesthesia compared to intraligamentary injections."***

The effectiveness of intraligamentary anesthesia has been demonstrated by three studies that collectively involved 474 primary and permanent teeth in children and adults, ranging from 79% for vital pulpotomy to 95% extractions with consistently higher effectiveness rates across all studies for extractions. By comparison, computer-controlled local anesthesia delivery (C-CLAD) using an intrasulcular injection technique with the *STA System* has been found to be 89% effective in a study of 159 first and second primary molars for which this technique was applied. This anesthesia was obtained using 0.9mL of anesthetic solution per root that was injected mesiolingually, mesiobuccally, distolingually and distobuccally.

Dr. Ashkenazi and her colleagues are currently conducting studies on single tooth anesthesia using C-CLAD technology. Based on preliminary data, its effectiveness in the study was 98% for first and second primary molars (N=131) and 79% for permanent molars and premolars (N=29), using only a quarter or one-third of a carpule per root administered lingually. It was also found that the effectiveness of single tooth anesthesia is related neither to the age of the patient nor to the location of the treated teeth.

**Efficacy of anesthesia**

| *Treatment* | *CDS-IS - %* | *STA - %* |
|---|---|---|
| Restoration | 97 (93/96) | 91 (92/102) |
| Pre-formed crown | 92 (24/26) | 92 (12/13) |
| Extraction | 63 (10/16) | 91 (10/11) |
| Pulpal therapy | 71 (15/21) | 71 (5/7) |
| Total | 89 (142/159) | 90 (119/133) |

**Comparative effectiveness: Study vs. meta-analysis**

| *Treatment* | *IS-CDA and STA* | *Infiltration* | *HP-IL* |
|---|---|---|---|
| Restoration | 93% (237) | 65-95 %(120) | 85 % (193) |
| Extraction | 74% (27) | 75% (4) | 95% (22) |
| Pulpal therapy | 71% (28) | 47-61.5 % (28) | 79-81% (120) |
| Total | 89% (292) | 74% (152) | 84 % (335) |

Other areas of investigation have included the incidence of anesthesia in adjacent teeth, the role of vasoconstrictors, the potential impact of the use of single tooth anesthesia on developing tooth buds, and the presence or absence of pain during and following use of C-CLAD techniques.

### *Anesthesia of Adjacent Teeth*

Using an intraligamentary injection technique with an anesthetic solution containing 2% lidocaine with epinephrine has been reported to anesthetize 45% and 78% of teeth mesial and distal to injection sites, respectively. In contrast, the effectiveness of anesthesia of adjacent teeth using C-CLAD with the *STA System* has been demonstrated to be in the range of 88% to 86% for primary school molars and first permanent molars adjacent to teeth receiving single tooth anesthesia.

### *The Use of Vasoconstrictors*

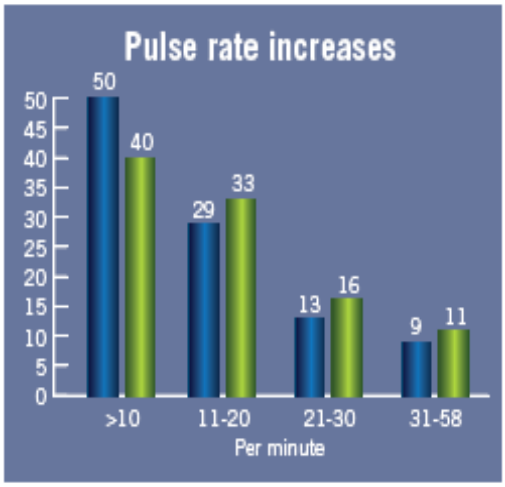
It is well known from the literature that effectiveness of the intraligamentary injection technique is related to the use of vasoconstrictors, with reported efficacy in the permanent dentition of 81% to 87% with the use of vasoconstrictors, but just 8% to 42% without their use.

Dr. Ashkenazi and Dr. Ram have studied the use of mepivacaine without vasoconstrictors, finding a 39.5% efficacy rate for anesthesia of primary molars in 48 children. They have concluded that a vasoconstrictor is required for efficacy of both intraligamentary and single tooth anesthesia.

In approximately 10% of subjects in one group, the pulse rate increased by between 31 and 58 beats per minute during the administration of local anesthesia; while in another group, roughly 15% experienced increases of around 21 to 30 beats per minute.

## Pulse rate changes with infiltration and intrasulcular techniques

| | With epinephrine | | Without epinephrine | |
|---|---|---|---|---|
| Pulse rate | CDS-INF | CDS-IS | CDS-INF | CDS-IS |
| Basic pulse | 95.3±11.8 | 95.7±13.8 | 95.6±11.9 | 91.4±13.5 |
| During injection | 101.4±13.9 | 101.6±11.8 | 96.8±13.0 | 94.3±14.0 |
| Mean increase | 5.1% | 5.6% | 4.8% | 5.0% |
| Range of increase | -11 to +45 | -5 to +58 | -10 to 12 | -10 to 20 |
| Range of % increase | -10% to 52% | -5% to 69% | -10% to 13% | -11% to 22% |




Interestingly, changing the site of the intrasulcular injection resulted in an almost immediate decrease in the pulse rate, suggesting that the increase in pulse rates experienced at the first site had possibly been due to injection of the anesthetic solution into small blood vessels at the site. No statistical correlation was found between changes in pulse rates and age, gender, or the presence or absence of a vasoconstrictor in the local anesthetic solution administered.

### *The Developing Tooth Bud*

In a new study on intrasulcular injections of 76 first and 90 second primary molars in 78 subjects, Dr. Ashkenazi, Dr. Blumer and Dr. Eli concluded that intrasulcular anesthesia does not induce damage to the underlying dental bud. One child in the test group presented later with hypomineralization of the first permanent lower premolar, and two children in the control group presented with hypoplastic enamel defects in the permanent control premolars. This was in contrast to an earlier study on monkeys in 1984, in which Brännstöm found that administering high pressure intraligamentary injections for primary molars was capable of damaging the underlying developing tooth buds if an anesthetic containing a vasoconstrictor was used.

### *Lack of Pain with STA*

Studies have produced conflicting reports on the presence of pain during high pressure intraligamentary injections, possibly due to differences in technique. In addition, the use of traditional intraligamentary injections have been reported to result in post-injection discomfort in 88% of subjects. In one study, pain was experienced by some subjects for up to 48 hours after the anesthetic had been administered. Use of C-CLAD with the *STA System*, however, has been reported to be relatively non-stressful and to result in less or no pain.

Dr. Ashkenazi reported that over more than eight years of clinical use, she had only two patients who complained of discomfort with use of *The Wand/STA System*.

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Dr. Malka Ashkenazi graduated dental studies at the Hebrew University in Jerusalem in 1979. In 1987, she completed her specialization in pediatric dentistry at Tel Aviv University, followed by three years of postdoctoral education in Houston, TX. Between 1999 and 2000, she studied medical hypnosis at Tel Aviv University. Dr. Ashkenazi has been a clinical instructor and lecturer for dental students and post-graduate students in pediatric dentistry since then. She is a mentor for students completing their DMD theses and for basic research by postgraduate students. Dr. Ashkenazi serves as a member of the Committee of Receipt of Specialization to the post graduate program, and since 1993 has been a member of the National Examinations Committee for Specializations in the fields of pediatric dentistry and orthodontics. In 2007, she was distinguished as a Senior Lecturer in pediatric dentistry. Since 2004, she has served as Chairperson of the Inspection Committee of the Israel Society of Pediatric Dentistry. She has delivered abstracts at many international conferences and serves as a reviewer in several international journals on pediatric dentistry.