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PDL injection in dentistry: An adjunct or alternative: Systematic review of literature

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Abstract--Pain management is the most important prerequisite in performing invasive dental procedures. In situations where block injections fail then supplemental injections provide sufficient analgesia. PDL injection is a supplemental injection technique regaining its popularity in recent days. With the advent of newer anaesthetic molecules and newer PDL injection delivery systems, PDL injection is able to achieve predictable success rates to provide adequate dental anaesthesia. The aim of this article is to provide an insight on PDL injection technique and its efficacy in field of dentistry.

Keywords---anaesthesia, dental, PDL injection, supplemental.

Introduction

Achieving profound local anaesthesia is of utmost importance in performing invasive dental procedures such as root canal treatment and extractions. Local infiltration, block injections and supplemental injections and their combinations are routinely administered to achieve adequate anaesthesia for performing dental procedures. Various supplemental injections include PDL, intraseptal, intraosseous dental injections are being used. The term infiltration has been in common usage in dentistry to define an injection in which the local anaesthetic solution is deposited at or above the apex of the tooth to be treated. Local anaesthetic is deposited close to a main nerve trunk, usually at a distance from the site of operative intervention. Field block and nerve block may be distinguished by the extent of anaesthesia achieved. In general, field blocks are more circumscribed, involving tissues in and around one or two teeth, whereas nerve blocks affect a larger area.¹

Disadvantage of block injections include technique sensitivity, being more painful, transient or permanent damage to surrounding nerves and accidental injection into blood vessel nearby leads to hematoma, muscular injury, increased duration of soft tissue anaesthesia.^{1M}Supplemental injections however has lower rate of complications when compared to block injections. These were frequently used to supplement failed or partially successful traditional block injections.^[1] Among supplemental injection techniques Intraosseous injections are proved to be most efficient followed by periodontal ligament injection, but the disadvantages.²

PDL injections is also called as peridental or intraligamentary injection. It is frequently used to supplement failed or only partially successful traditional injection techniques. Previously the main drawback of PDL injection was pain due to injection. In recent years there is increased interest in PDL injections mainly due to availability of newer mechanical (Example:- Peripress, ligmaject and computer controlled delivery systems (Example:- STA wand). The main benefit of successful PDL injection is it can provide pulpal and soft tissue anaesthesia in localised area (one tooth) without producing soft tissue anaesthesia. PDL injection is safe to periodontium. The anaesthetic solution deposited diffuses through the marrow spaces in the intraseptal bone.¹

Indications of PDL injection being treatment of isolated teeth requiring only pulpal anaesthesia without soft tissue anaesthesia and situations where regional block injections failed or contraindicated. Infection, inflammation, in tissue site is the relative contraindication for PDL injection. Reported postinjection complications include prolonged ischemia of interdental papilla, mild discomfort and sensitivity to biting and percussion for 2 to 3 days.¹

Technique

27 or 30 gauge needle is recommended and needle is inserted parallel to long axis of tooth at the interdental papilla with the bevel facing towards root.¹

PDL injection - Maxilla vs mandible

PDL injections are usually recommended in mandibular arch more than in maxillary arch. Reason being availability of other highly effective atraumatic techniques such as supraperiosteal (infiltration) injections.¹

PDL injection – Manual vs Mechanical vs Computer controlled

Ferrari et al compared conventional dental syringe, high pressure mechanical syringe and STA computer controlled syringe and reported that computer controlled system was more superior and more comfortable.³

PDL injection as an adjunct to block injection

The risk of anaesthetic failure is highest in mandibular molars followed by mandibular and maxillary premolars, mandibular anterior teeth.^{4,5} Success rate of IANB in mandibular teeth with irreversible pulpitis is very less i.e, approximately 19-56%.⁶ One of the most common supplemental anaesthesia approaches is the periodontal ligament (PDL) injection. Reported success rates for PDL injection are as high as 95% when combined with IANB blocks.^{6,7} One study reported that when IANB fails, supplemental buccal injection is better than supplemental PDL injection in mandibular first molar. The reason might be due to usage of articaine instead of lignocaine. Studies reveal that articaine has better bone diffusion ability.⁸

PDL injection as alternative to block injections

Berlin et al reported that efficacy of 4% articaine with 1:100,000 epinephrine was similar to the efficacy of 2% lidocaine with 1:100,000 epinephrine for intraligamentary injections when computer controlled delivery system was used.⁹

PDL injection as alternative to block injections for primary teeth pulpotomy

Few studies report that there is no significant difference in the effectiveness of PDL injections and inferior alveolar nerve block in primary teeth in children undergoing pulpotomy. Results showed that PDL injection can be used as an alternative to nerve block in pulpotomy of the mandibular primary molars.^{10,11} Study by Alamoudi et al., reported that there is no significant difference in the anaesthetic quality between IANB with CCLAD, IANB with traditional and PDL injection with CCLAD.¹² Pain due to PDL injection is more than infiltration in primary teeth. Whereas the present study found PDL and Supraperiosteal to perform similarly for pulpotomies and restorative treatment in primary molars.¹³

PDL injection as alternative to block injections for primary teeth extraction

It was previously reported that PDL injections were contraindicated in primary tooth because of the reason that it might cause damage to the underlying permanent tooth bud.¹⁴ A recent study by Ashkenazi and co-workers reported that no apparent damage to permanent tooth bud occurred when PDL injection was administered using computer controlled syringe.¹⁵ However, the authors still

warned against the use of both traditional and high-pressure syringes and recommended usage of computer controlled delivery systems for PDL anaesthesia delivery to primary molars.¹⁶ Zhao et al., found children had lower pain scores at injection with CCDS than with a conventional syringe.¹⁷

Permanent teeth- Restorative treatment

Kämmerer PW et al., reported that among PDL injection delivery systems. Mechanical pressure syringe was better than computer controlled PDL delivery system in anaesthesia quality for restorative treatment of posterior mandible.¹⁸

Permanent teeth- Root canal treatment

Kämmerer et al., compared intraligamentary anaesthesia and inferior alveolar nerve block for extraction of posterior mandibular teeth and reported that ILA had significant lower pain of injection, shorter latency time and shorter duration of local numbness and required lesser amount of local anesthetic solution together with similar anesthetic quality ($p=0.082$) compared to IANB. ILA fulfils the requirements of a minimal invasive and patient-friendly local anesthetic technique. In accordance, it represents a safe and reliable alternative to IANB for extraction of mandibular posterior teeth.¹⁹ Jing et al based on their study reported that computer controlled PDL injections are successful in providing pulpal anaesthesia adequate for access preparation in permanent posterior teeth with irreversible pulpitis, however it was more successful in premolars and second molars than in first molar.²⁰

Pain of injection IANB vs PDL

The injections in cases of ILA were significantly less painful to the patients than those in cases of IANB in both evaluation groups. This result is in accordance with that in previous studies and a systematic review.²¹ PDL was reported to be more painful than supra-periosteal injection. Pain due to PDL injection EMLA cream reduced the discomfort associated with intraligamentary injections better than lignocaine.²²

Duration of injection IANB vs PDL

ILA had a duration of ≤ 30 min, whereas IANB showed a duration of 2-4h.²¹

Conclusion

With the advent of newer delivery systems, PDL injections is safe and predictable for achieving single tooth anaesthesia without extensive soft tissue anaesthesia thereby bypassing the complications and side effects of block anaesthesia.

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