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COMPARISON BETWEEN NEEDLE-LESS INJECTION SYSTEM AND CONVENTIONAL INJECTION TECHNIQUE TO PERFORM ANESTHESIA IN CHILDREN: A RANDOMIZED CLINICAL TRIAL

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ABSTRACT

Background: Needle-free injection technology was developed to reduce the pain. A comprehensive literature review was completed regarding needle-free injection technology and its applications, advantages over needle injections. This review describes needle-free injection technology involving the generation of force by using compressed gas in order to deliver anesthesia at very high speed through a nozzle. This review also describes injection methods that use a spring load jet injector. An overview of marketed products, recent trends and other needleless delivery systems is given. Needle-free injection technology is growing and has the potential to make the administration of anesthesia more efficient, safe and convenient

Methods: Thirty patients recorded using a facial pain scale-revised (FPS-R)

Results: The results indicated patients treated with needless injection system had less postoperative pain compared to patients treated with the conventional injection technique.

Conclusion: needless injection system procedure would always be more accepted with minimal postoperative pain by the children patients than the conventional one.

INTRODUCTION

Needle-free injection systems are novel ways to introduce various anesthesias into patients without piercing the mucosa with a conventional needle. Needle-free systems were first described by Marshall Lockhart in 1936 in his patent jet injection. Then in the early 1940's Higson and others developed high pressure "guns" using a fine jet of liquid to Pierce the mucosa and deposit the *anesthesia* in the underlying tissue. [1,2]

Advantages of needle-free injection

1. Elimination of needle phobia.
2. Imparts fast *anesthesia* delivery and better reproducibility as compared to invasive *anesthesia* delivery systems

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Disadvantage of needle-less injection

1. Need for doctor training and maintenance.

The method is complex and expensive. [3]

This device has an injection ampoule having an orifice of 0.18 mm. From this orifice, the drug is fired under dosed pressure into the submucosa. The system offers administration of local anesthesia. The ampoule must be placed on the attached gingiva at an angle of 90° directly above the tooth to be anaesthetized. The local anesthetic volume that can be administered is about 0.3 mL. [4, 5]

It is possible to inject the local analgesic solution into oral tissues without using a needle by using an instrument that propels solution at high velocity through a fine orifice. Such instruments were first used to inject through the skin and later became available for oral use. Early jet injection instruments were investigated by **stephens & Kramer** (1964) [6]

A more satisfactory instrument is the syrijet (mizzy inc., new york). This incorporates a compressible spring which generates a pressure of 290 kpa (2000 pounds per square inch) when released, injecting solution through mucous membrane and into the bone to a depth of about 1 cm. the instrument accepts standard 1.8 ml cartridges and is calibrated to deliver volumes of between 0.05 and 0.2 ml. **Young (1968)** [7]

Jet injection may be used not only to provide excellent soft tissue analgesia for dental procedures for which infiltrations are normally used. Blocks of the greater palatine, nasopalatine, long buccal and mental nerves also may be achieved, but not of the inferior dental, posterior superior alveolar or incisive nerves (**Bennett & monheim** 1961). [8]

Trauma to the mucosa is minimal when the injection is given into attached gingiva. The risk of causing slight injury is greater when injecting into loose tissue; if this is done at all not more than 0.5ml should be injected

Jet injection is particularly useful for producing soft tissue analgesia before those needle injections that normally tend to be painful even after application of topical analgesic; for example, infiltration in the maxillary incisor region, and palatal injections.it also useful for producing analgesia for extractions of loose primary teeth, minor oral surgery, and the application of rubber dam clamps.

Unlike some previous jet injection instruments, the syrijet, when fired, is quiet and has little perceptible recoil. However, it is inevitable that patients should feel at least a sudden tap at the moment of injection, which may be considered slightly painful. Therefore, jet injection offers no advantage when painless needle injections can be given (for example, to produce analgesia of maxillary premolars), except with a patient who has a phobia of the needle. However, when using jet injection prior to potentially painful needle injection, it may be anticipated that the minor discomfort caused by the jet injection, followed by a painless needle injection, followed by a painless needle injection, will be accepted better than a needle injection alone. Despite its potentially useful applications in pediatric dentistry, the syrijet has not been widely used and is no longer available in the UK. No doubt its high cost has been a factor in limiting its use.

The aim of this study

Comparison Between needless injection system and Conventional injection Technique to Perform anesthesia In Children

SUBJECTS AND METHODS

Thirty children patients 13 female, 17 male were included in this study selected from outpatient clinic of the department of pedodontics and oral health, (Faculty of Dental Medicine, Al- Azhar University).

Fig. (1) Application of needleless injection system device in the mouth of the child

Fig. (2) The activator for needleless injection system device.

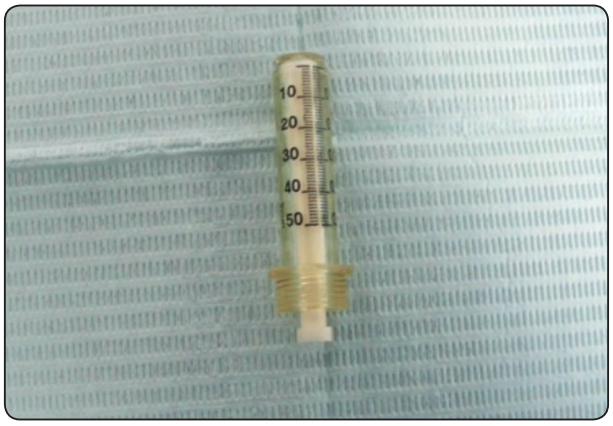

Fig. (3) The ampoule of needleless injection system

Fig. (4) The device needleless injection system loading with anesthesia and ready for application

Pain measurement

Assessment of pain was done by using the Facial pain scale -Revised,7 the severity of pain was assessed using Scores that chosen the faces **0**, **1**, **2**, **3**, **4,** or **5**, counting left to right, so "0" = "no pain" and "5" = "very much pain".

RESULTS

30 patients, 13 were females and 17 were males with mean age of 9 and they are randomly divided into two equal groups . The analysis showed that FPS-R score of pain on day 1 was significantly lower in the needleless injection system group as compared to the conventional injection Group. The difference was statistically significant as shown in table (1).

TABLE (1) Analysis of FPS-R

	needless injection system **group**	Conventional injection **group**
Mean of FPS-R on first day	2.73 ± 0.96	1.13 ± 0.92
Statistical significance (*P value*)	0.001	0.004

DISCUSSION

Despite advances in dental equipment in contemporary dentistry, anxiety associated with dental practice and fear of pain related to dentistry remain common [9]. Marya et al., showed that 73% to 79% of individuals have at least some dental anxiety [10].

Individuals who have high levels of dental fear have poorer oral function and a higher frequency of oral diseases. There are longer intervals between dental visits for these persons [11]. Schuller et al., reported that patients who had high fear visit the dentist less often and these individuals have more decayed and more missing teeth [12]. Another study showed the relationship between dental fear and less frequent dental visits [13]. Similar findings have been reported in other researches [14,15].

The clinical effect of dental fear on dental issues such as caries and periodontitis has been reported in previous studies [16]. In the present study, there were significant differences between the use of needleless injection system and conventional needle

There was a positive correlation between dental anxiety and oral health status in various studies. Schuller et al., found that people with high fear visit the dentist less often and have more decayed and more missing teeth [14,12]. Patients with high dental fear have dental problems such as a toothache or bleeding gums and report a need for dental care. Similarly, Locker and Liddell reported that individuals with dental anxiety are more likely to perceive a need for dental care, to rate their oral health as poor, and to report problems with chewing [17].

The findings of this research show that females demonstrate higher levels of dental fear than males. Consistent with the results in our paper, Liu et al., reported that the prevalence of dental fear is significantly higher in females [18]. Psychological disorders such as stress, depression, fear, social phobia and panic are more common in women, and dental anxiety may be associated with such disorders [19,20]. This conclusion is supported by studies which show that women have higher levels of neuroticism (tendency to experience negative emotional states) than men and that anxiety is positively related to neuroticism [10,21]. Our result is similar to most previous studies that have shown that women tend to be more anxious than men [13,22].

Another generally reported variable associated with dental fear is age. Although findings from some studies showed that the relationship between age and dental fear are conflicting, younger individuals have commonly been shown to be more anxious than older individuals [23]. Also, the high anxiety level in young patients could be due to an insufficient experience in dental treatment equipment, such as the needle, handpiece, or any other fear-invoking equipment [18].

LIMITATION

Some limitations of this study are that the participants were selected from only one center. In future studies, other psychiatric variables should be taken into consideration when patients are assessed, as general psychiatric status assessable by a psychiatrist could have clinical implications.

CONCLUSION

Needless injection system procedure would always be more accepted with minimal postoperative pain by the children patients than the conventional one In conclusion, dental fear is a widespread problem both for dentists and for patients. Elimination of dental fear is very important and should be treated according to a patient-centered assessment. . The study subjects were informed about dental treatment procedures, so their anxiety was eliminated. Patients with a high level of dental fear can be given psychiatric support so they can be comfortable with the treatment procedure.

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