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INFLUENCE OF PRF AND LOW LEVEL LASER THERAPY ON ERUPTION OF SUCCADANEOUS TOOTH - A PILOT STUDY

Dental Science

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KEYWORDS

Succadaneous Tooth, Low Level Laser Therapy, Platelet Rich FIBRIN

INTRODUCTION

Tooth eruption is a unique, complex and tightly regulated process and the eruption path is determined by genetic and local environmental factors. The process is accompanied by multiple tissue changes, such as resorption and apposition of the alveolar bone, and development of the root and periodontium. [1]

Change of any kind in the microenvironment of the PDL may initiate chemical signals which elicit a chain of biochemical events leading to the activation of osteoclasts and osteoblasts. And these are the principle cells responsible for osseous modeling and remodeling that occur as teeth move from one position to the next within bone.

Researchers have tried various modalities to increase tooth movement including chemical, surgical and mechano-surgical methods. Majority of these procedures causes irritation to bone which initiates inflammation cascade causing increased osteoclastogenesis.[2]

Platelet-rich plasma(PRP) injection creates a regional acceleratory phenomenon-like effect which forms the basis of rapid tooth movement.[3] PRF has been reported to gradually release autologous growth factors and expressed stronger and more durable effect on the cellular proliferation and differentiation than PRP in vitro.[4] It has been reported that platelet rich fibrin (PRF) has the ability to enhance tissue regeneration, accelerate wound healing and inducing stem cells differentiation through its growth factors (GFs).[5]

Low-level laser therapy produces photobiomodulation effects, and these potential effects of laser stimulate the velocity of tooth movement and thereby facilities the tooth movement. Low Level Laser Therapy (LLLT) causes tissue biostimulation due to the cellular absorption of laser light by the target tissue which leads to the activation of intracellular signaling cascades, which increases cellular metabolism, and anti-inflammatory changes of soft and hard oral tissues, and specific wavelengths with specific energy densities have been purposed for application in bone remodelling.

Some studies have demonstrated that low-level laser therapy accelerates tooth movement via the receptor activator of the nuclear factor kappa B (RANK), RANK ligand (RANKL), and macrophage-colony stimulating factor along with its receptor (c-fms).[6]

Studies have investigated the efficacy of LLLT and effect of PRF on accelerating orthodontic tooth movement of human maxilla or mandible canine. Considering the simultaneous positive effect of these modalities the current study was conducted to evaluate if PRF and LLLT can also accelerate the eruption of the succedaneous tooth ,when used in extraction socket . To the best of our knowledge, this is the first study on the efficacy of PRF and LLLT on acceleration of tooth eruption.

MATERIAL AND METHOD

Study Design And Ethical Approval

This split-mouth clinical trial evaluated the efficacy of application of PRF and LLLT in extraction sockets for acceleration of Succadenous tooth eruption in pediatric patients requiring extraction of primary molar. Ethical approval for the study was obtained from the Institutional Ethical Committee (IEC), and the study was carried out from december 2019 to february 2020. Informed consent was obtained from the parents of children before their final recruitment into the study

Sample size was calculated to be twenty extraction sockets (n=5 in each group)i.e10 patients

Participants And Randomization

Participants were selected from patients referred to the Department of Pediatric and Preventive Dentistry. Male and female pediatric patients 7 -10 years with extraction as treatment plan who met the following inclusion criteria were included healthy patients requiring bilateral extraction , presence of Bone between succedaneous tooth and alveolar crest. The exclusion criteria were uncooperative patients, history of any bleeding or clotting disorder, syndromic patients, or medication intake such as nonsteroidal anti-inflammatory drugs, which would interfere with tooth movement and whose parents were not willing for signing the informed consent were excluded. Using simple random sampling patients were randomly divided into two groups (n=10 extraction socket in each group) which was further subdivided into two subgroups(n=5)extraction socket in each group.

In first group (1) one quadrant of each jaw, the extraction socket was preserved by immediate placement of PRF as the experimental group (1A) while the other side served as the control group for secondary healing (1B).In second group (2) low level laser therapy on extraction socket was performed (2A) while the other side served as the control group (2B).

Preparation Of PRF

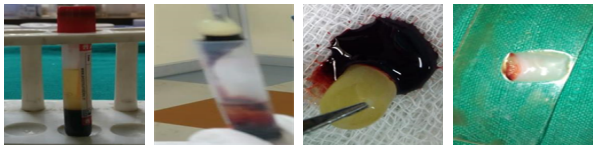
5 ml whole venous blood collected from the brachial vein using a 10 mL syringe and transferred into sterile tubes without anticoagulant ,tubes were placed symmetrically into the centrifuge device and the tubes were immediately centrifuged (PCO2 Process) at 2700 rpm for 12 min .Three layers formed in which upper layer was straw-colored cellular plasma, the middle fraction consists the fibrin clot and platelets while, bottom layer consisted red blood cells .The middle fraction was carefully held using tissue holding forcep and was then placed on a clean glass slides. PRF was then placed between two slides and pressed lightly

In PRF Group socket was preserved by immediate placement of PRF on one side and extraction socket on other side served as control.

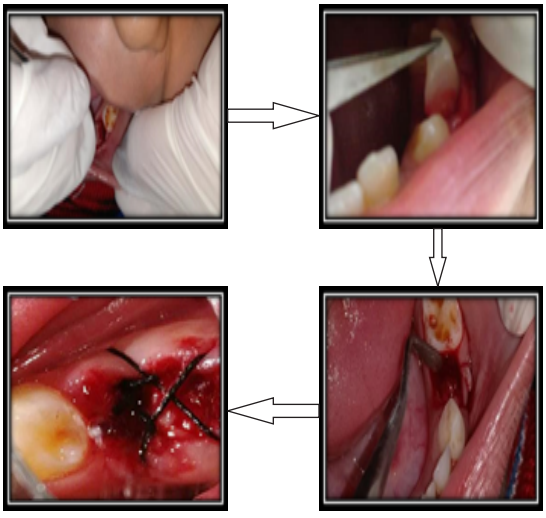
In LLLT group one side was irradiated using 940nm diode laser and other side served as control group for secondary healing.

Suitable space maintainer in all the groups to avoid any space loss Measurements were made using IOPA film with grid after 3weeks, 9weeks and 12weeks.Analysis was done to compare the eruption rate between experimental groups and control group.

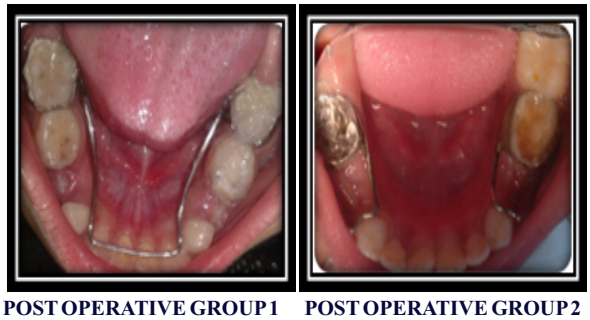
PREPARATION OF PRF



PRF Placement After Extraction In Group 1A

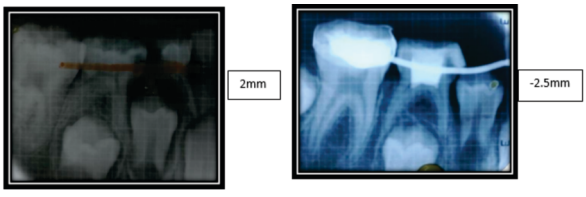


CLINICAL PICTURES



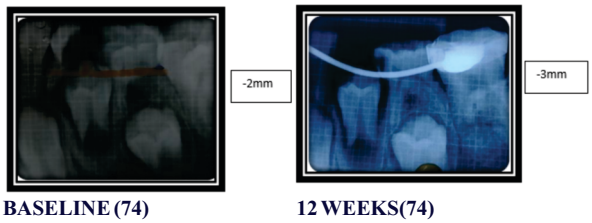
POST OPERATIVE GROUP 1 **POST OPERATIVE GROUP 2**

RADIOGRAPHS (GROUP 1A)



BASELINE(84) **12 WEEKS(84)**

RADIOGRAPHS (GROUP1B)



BASELINE (74) **12 WEEKS(74)**

RESULTS

Table 1 shows significant difference in tooth movement in PRF group when compared to control group measured between baseline and 12 weeks but there was no significant difference in tooth movement in LLLT group when compared to control group measured between baseline and 12 weeks (Table 2).

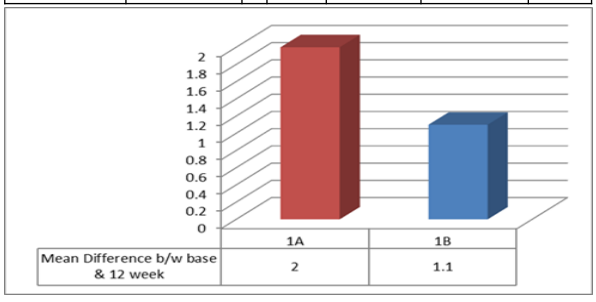
Graph 1, represents mean difference in tooth movement in PRF group and control group measured at baseline and 12 weeks while Graph 2 represents mean difference in tooth movement in LLLT group and control group measured at baseline and 12 weeks

Table 1: Intragroup Comparison Of Difference In Tooth Movement In PRF Group And Control Group Measured At Baseline And 12 Weeks

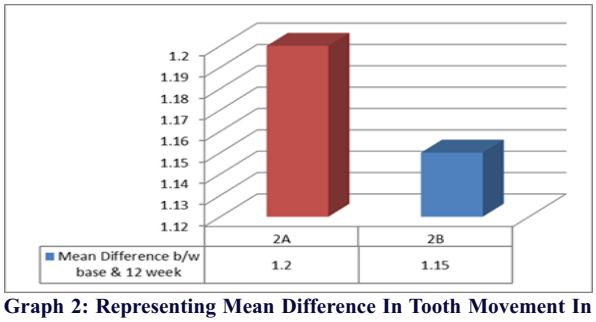
Duration	Groups	N	Mean	Std Deviation	Mean Difference	P Value
Difference at baseline and 12 weeks	Group 2A	5	2.000	.61237	.8000	.70
	Group 2B	5	1.200	.59687		

Table 2: Intragroup Comparison Of Difference In Tooth Movement In LLLT Group And Control Group Measured At Baseline And 12 Weeks

Duration	Groups	N	Mean	Std Deviation	Mean Difference	P Value
Difference at baseline and 12 weeks	Group 1A	5	2.000	.61237	.9000	.027
	Group 1B	5	1.100	.41833		



Graph 1: Representing Mean Difference In Tooth Movement In PRF Group And Control Group Measured At Baseline And 12 Weeks



Graph 2: Representing Mean Difference In Tooth Movement In LLLT Group And Control Group Measured At Baseline And 12 Weeks

DISCUSSION

Exfoliation of primary tooth followed by eruption of succedaneous permanent tooth is a normal physiological phenomena, but this transition is of paramount importance in timely management of malocclusion. Premature loss of primary teeth often leads to loss of arch circumference, crowding, drifting of the adjacent tooth, midline shift, and subsequent impairment of function and to avoid these dental conditions, a space maintainer is advocated .Various kind of fixed and removable space maintainer can be used but these space maintainers come with its own shortcomings .

Space maintenance has always been a challenge so, in case of premature loss of primary teeth acceleratory eruptive tooth movement of succedaneous tooth may wipe out the need of space maintainence.

Various modalities like surgical, nonsurgical, and pharmacological methods have been proposed by researchers to enhance Orthodontic Tooth Movement which includes corticotomy, alveolar decortication, distraction, resonance vibration, ultrasound waves, electric current, low level laser therapy, local injection of prostaglandins,1,25(OH) 2D3 (active form of Vitamin D), PRF treated socket, parathyroid hormone and osteocalcin.[7] Therefore , considering the simultaneous positive effect of non invasive modalities like LLLT and PRF on bone healing, socket preservation, and acceleration of orthodontic tooth movement this preliminary clinical trial was conducted to evaluate if these modalities could also be resorted to accelerate eruptive tooth movement.

Tooth eruption is a complex and is accomplished by fundamental biological processes, osteoclastogenesis and osteogenesis.

Platelet-rich fibrin (PRF) and LLLT are easy to use and have been reported to scamper tooth movement by stimulation bone remodeling. According to literature LLLT accelerate tooth movement by biostimulation at cellular level, in which the light energy is absorbed by the cellular photoreceptors and converted into adenosine triphosphate by mitochondria which subsequently increases the cellular activities such as DNA, RNA, and protein synthesis.[8] Studies have shown that low-energy laser irradiation may spur the proliferation and activation of both osteoblasts and osteoclasts by the expression of RANK and RANKL, accelerating the remodeling of bone and eventually increasing the velocity of tooth movement.[6,9]

PRF have demonstrated unremitting release of growth factors from the fine and flexible fibrin matrix in their structure.[10,11] PRF plays a crucial role in enhanced release of some crucial growth factors such as transforming growth factor-beta 1 , insulin-like growth factor , which enriches the blood clot formed in the extraction socket and many cytokines such as tissue necrosis factors.[12]

In the present study extraction socket in which PRF was placed showed accelerated tooth movement when compared to control group that is 1B which might have resulted due to aggravation of the inflammatory response by cytokines such as tissue necrosis factors present in PRF . Another contributing factor for accelerated eruptive tooth movement in group 1A may be due to stimulatory effect of PRF on resorptive remodeling which usually occur following tooth extraction.

Wise et al suggested that the dental follicle regulates the bone resorption during tooth eruption by supplying a population of mononulear cells that either become osteoclast or influence their function by the release of cytokines and growth factors.[13]

The result of the present study also demonstrated no change in the rate of eruptive tooth movement although extraction socket irradiated with low level Laser showed less postoperative pain and faster healing ,when LLLT group (2A)was compared with control group 2B.

According to Karu et al cellular response at lased side is enhanced when redox potential of cell is low, whereas it is diminished when potential is normal.[14] Various human and animal studies have been carried out to determine the effect of LLLT on orthodontic tooth movement and have concluded accelerated OTM[15] which is in contrast to result of present study which might be attributed to normal redox potential at cellular as there is absence of continuous micro trauma which is generally observed in case of OTM .

Considering the lack of available evidence on the effect of PRF and LLLT on the rate of eruptive tooth movement of permanent tooth, our result is not comparable to the findings of other studies in this field. However, inconvenience related to the need for venipuncture and blood-drawing procedure for preparation of PRF in children should be considered before clinical application of this method.

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