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ACCELERATION OF ORTHODONTIC TOOTH MOVEMENT FOR RETRACTION UPPER CANINE BY PLATELET RICH PLASMA PRP INJECTION IN ADULT FEMALE PATIENTS

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ABSTRACT:

A new method used to accelerate orthodontic tooth movement is the PRP injection. In this study, the effects of PRP injection on orthodontic tooth movement were investigated in humans. The purposes of this study were to identify the effect of the PRP injection technique on orthodontic tooth movement compared with the standard technique.

18 adult female patients(, aged 18 to 28 years, with a mean age (22,03±3,60) years were used in this study. By use of split-mouth design, at the time of premolars extraction, PRP injection was performed around the maxillary first premolar, randomly on one side of maxilla, and the other side was reserved as the control side.. The canines were distalized with nickel-titanium coil springs on both sides.

PRP injection were performed on the buccal side of the maxillary first premolars region in 20 patients The canines on the experimental side and on the other side were moved distally with a continuous force of 150g.

Results : The rate of canine retraction was significantly higher on the prp injection side than the control side by an average of 1.44 mm/month ($P < 0.001$)

Conclusion: Based on our results , prp injection can accelerates the rate of orthodontic tooth movement about 50% times faster than conventional orthodontics without any significant untoward effect on anchorage or canine rotation during rapid retraction.

Therefore PRP injection is a useful technique for accelerating orthodontic tooth movement

Key Words: Accelerated, orthodontics, PRP injection , canine retraction, tooth movement

INTRODUCTION:

Long orthodontic treatment duration can lead to many problem for patients and doctors , it may need 2 years of intervention and even more for extraction cases,thats way accelerating orthodontic treatment should be on top of the clinicians and research priorities[1].

Reduced treatment duration is also desirable that aesthetic concerns [2]

As a result, there is an increased number of researches focusing on methods that accelerate orthodontic tooth movemen numerous trails have been made to achieve a higher rate of tooth movement, both in vivo as well as in vitro. There are however, many questions about this methods till this day.

Non-invasive methods to accelerate orthodontic tooth movement can be classified into the following categories. 1.**Pharmacologic** approach, such as local injection of hormones 2.**Physiologic** approach (Physical/ Mechanical stimulation methods) such as direct electric current stimulation or low-

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level laser therapies (LLLTs)
3. **Surgery-simulated** approach, such as the submucosal injection of platelet-rich plasma (PRP)

our aim in this study identify the effect of the PRP INJECTION technique on orthodontic tooth movement compared with the standard technique.

Platelet rich plasma (PRP):

Platelets are one of the initiators both in the soft and hard tissue wound healing processes.

Platelet-rich plasma (PRP) is a processed by centrifuging blood autologous product derived from whole blood [6,7]. Platelet-rich plasma (PRP) is an easily accessible source of growth factors to support bone and soft-tissue healing by increasing cellular proliferation, matrix formation, osteoid production, connective tissue healing, angiogenesis, and collagen synthesis [7,8]. Platelet-rich plasma (PRP) has been well known specially in preparation for a dental implant or promoting an alveolar bone by periodontologist [9]

growth factors such as the platelet-derived growth factor,transforming growth factor, endothelium growth factor,and the others. These growth factors are critical in theregulation and stimulation of the wound healing process,and they play an important role in regulating cellularprocesses such as mitogenesis, chemotaxis, differentiation,and metabolism .

The submucosal injection of platelet rich plasma (PRP) is a new technique developed for accelerating orthodontic tooth movement by simulating the effects of bone insult without surgery and loss of alveolar bone.[3]

Liou EJ revealed clinically that submucosal injection of PRP accelerated the mandibular or maxillary alignment 1.7 folds faster in average, and the acceleration was dose-dependent when the PRP fold was <12.5. The optimal PRP fold for a more than 2-fold acceleration of orthodontic alignment ranged from 9.5 to 12.5 folds. On the other hand, the injection of PRP on the pressure side of *en masse* anterior retraction decreased 71–77% of alveolar bone loss, and this was dose-dependent. The pressure side of *en masse* anterior retraction had no alveolar bone loss when the PRP fold was higher than 11.0. The optimal PRP fold for the best performance in acceleration of orthodontic tooth movement and preservation of the pressure side alveolar bone is 11.0–12.5.[3.4]

The use of injectable PRP at a different stage of orthodontic treatment can improve the quality of the treatment outcome by influencing the bone quality and enhancing the rate of tooth movement.

The clinical usefulness of PRP remains controversial especially for orthodontic tooth movement [5]. There were still a few research mentioned about PRP effects to orthodontic tooth movement especially for human.

MATERIALS AND METHODS:

Study design and registration:

This study was a split-mouth design randomized trial . IT conducted at the Orthodontic and Dentofacial Orthopedics Department of University of Tishreen Dental School ,it was approved by the Local Ethics Committee of the University of Thishreen Dental School, Syria)

Sample size calculation:

The sample consisted of 18 adult female patients (mean age,22 years) requiring therapeutic extraction of the first maxillary premolars. These volunteers were selected from patients who referred to the Department of Orthodontics of tishreen University.

A split-mouth design was employed for the group where the prp injection was randomly allocated to one side and the other side served as a control side.

All patients fulfilled these inclusion criteria: Class II division I patients requiring first upper premolars extraction – the overjet greater than 10 mm

-mild to moderate skeletal class II malocclusion (ANB ≤ 7)

- age range between 18 and 28 years

- Absence of craniofacial syndromes, cleft lip/palate or previous dentofacial traumas

-Completion permanent dentition (except of third molars) - no previous orthodontic treatment

-healthy patients without systematic diseases -all patients with ,advanced or active periodontal disease, and poor oral hygiene were excluded from the study.

All patients were completely informed of the procedure and signed an informed consent. Since the split-mouth design was applied, the experimentaland control groups were the same and they were completely matched in the terms of age, sex, etc.

Randomization of the intervention side (split-mouth design):

Each patient was asked to pick an sealed envelope from a container to allocate the prp injection side. The containers included 9 envelopes with the letter ‘R’ indicating the right-hand side and 9 envelopes with the letter ‘L’.

Leveling and alignment:

All patients were treated with preadjusted fixed appliances, with a 0.022” X 0.028” slot brackets (ROTH prescription, American Orthodontics®,Sheboygan, WI, USA). A conventional anchorage protocol was employed (i.e. transpalatal arches soldered to the first upper molars bands).

The orthodontic treatment as well as the PRP injection was performed by the same principal researcher In the beginning, first upper premolars were extracted for all

patients, then leveling and alignment was performed with the following arch wires sequences: 0,014 in. NiTi or 0.016 in.NiTi (according to the amount of crowding), 0,016 ×0,022 in. NiTi, 0,017 × 0,025 in. NiTi, 0,019 × 0,025 in.

Steel which was considered the basal arch wire.

THE PREPARATION OF PLATELET RICH PLASMA FOR ORTHODONTIC PURPOSES

We use the same procedure the Liou et al mention in his paper[3]. The autologous PRP should be prepared under aseptic processing procedures as Liou et al mention in his paper [3].

Before the injection of PRP, local anesthesia should be injected at the target sites for the pain control,For each target site, 0.7 ml of PRP could be injected. fig1

Canines' retraction

Canine retraction was initiated immediately after the PRP injection. 0,019 × 0,025 in. steel wires were placed for all patients and nickel-titanium closed-coil springs which extended from canine brackets to first molars bands, with 150-g force were used to retract canines (Fig. 1), the generated force was checked using force gauge . Patients' follow-up appointments were every 2 weeks[16]

In each appointment, force was calibrated and readjustment when necessary in order to maintain it a 150-g level during the whole retraction phase. Fig3

Predictor and outcome variables

The predictor variable was the canine retraction technique (i.e. canine retraction with prp injection versus conventional sliding canine retraction). The primary outcome measure was the velocity of space closure during canine retraction,

(1) Velocity of space closure

Alginate impressions were taken 1 month (T1), 2 months (T2), and 3 months (T3) following the onset of canine retraction

Maxillary casts were photographed digitally with focal projection vertical to the occlusal plane and a metal millimeter ruler was placed in the same plane for the correction of magnification regarding the linear measurements.

The measurements were carried out on the digital photographs the method described by Ziegler and Ingervall [10].

the following variables were measured: (1) the distance between the medial end of third palatal ruga and the cusp tip of upper canine to evaluate the anterior-posterior canine movement, (2) the distance between medial end of third palatal ruga and the central fossa of maxillary first permanent molar to evaluate the anterior-posterior molar movement, and evaluate the anterior-posterior canine movement. Measurements were performed at

immediately following prp injection(T0), one month (T1), 2 month(T2), 3 months(T3),

These measurements were considered as an indicator of canine retraction speed taking into account that transpalatal arches were used for anchorage which should have resisted partially two possible molar movements, i.e. orthodontically-induced and physiological mesial drift.

Statistical analysis

Statistical analysis was conducted using SPSS version 20. Kolmogorov–Smirnov and paired-sample t-tests were employed to evaluate inter-group differences (at 0.05).

Error of the method

The error of the method was calculated for the distance of tooth movement based on double measurements on 12 randomly selected distances of tooth movement measurements and was estimated as $S = \sqrt{\sum}(d)2/2n$, where *n* = number of paired measurements and *d* = deviations between the 2 measurements.

The error of the method was 0.026 mm.

RESULTS:

The pH of the liquid medicaments ranged between 3.84 and 6.12. The lowest pH was seen in the cough syrup (Servil syrup) whereas the analgesic syrup (Calpol syrup) had the highest pH. Zones of inhibition were seen with Wymox syrup and Servil syrup. Wymox syrup showed zone of inhibitions in both the dilutions.(Table 1)

DISCUSSION:

orthodontic mechanical forces are known to have various effects on the alveolar process, such as cell deformation, , and circulatory disturbances [11], the longer the orthodontic treatment the more gets negative effects on root, alveolar and gingival embrasure resorption [12-14]. In this research the distance of teeth movement were significantly increased from base line. Every process on tooth movement conditions affecting cell differentiation, cell repair, and cell migration, and it is driven by numerous molecular and inflammatory mediators through the alveolar bone remodeling, periodontal ligament, cementum and gingiva [16-18]

This study was done to investigate the influence of PRP injection on tooth movement comparing with the Standard orthodontic techniques. Our results showed that the PRP injection technique significantly accelerated tooth movement. The rate of tooth movement in the PRP injection group was 2times faster than the Standar group.

tooth movement velocity on the experimental side was significantly faster than on the sham side at T0-1 and T1-2 approximately 2 times faster on the experimental side. Therefore, it is suggested that orthodontic tooth movement increased especially in the early stage after the PRP injection.

There were still a few research mentioned about PRP effects orthodontic tooth movement especially for human

But our results agree with those of *liou* et al, who reported significant acceleration of tooth movement in their study [3].

Some authors mentioned the growth factors should be triggered by the activation of platelets, which may be initiated the formation of PRP gel by a variety of substances or stimuli, such as thrombin, calcium chloride, collagen, thrombin or bovine thrombin to initiate [6,7,15] but other author said that the prolonged we need for growth factor to be active the more we should not need any activation before initiation of the PRP [3].

In this study ther is no activation for prp .Tooth movement began immediately after PRP injection.Non-steroid anti-inflammatory drugs were not allowed to be taken following the presedure.

Our results suggest that conventional orthodontic force would increase the velocity of orthodontic tooth movement, possibly by the acceleration of the bone turnover mechanism at an early stage after a PRP injection.

CONCLUSION:

On the basis of the current study the following points can be concluded: PRP injection seemed to be effective techniques for accelerating canine retraction; canine retraction was 1 times faster than the conventional retraction in the first month and 0.5 times faster in the second month.

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TABLES:

Table 1: Average velocity of tooth movement in two groups in the frst, second, and third months

Times	Group	**Mean±SD**	***P***
First month	Control	1±0.12	<0.000
	Experimental	1.7±0.32	<0.000
Second month	Control	0.9 ±0.13	<0.000
	Experimental	1.3±1.02	<0.000
Third month	Control	1.1±0.25	<0.000
	Experimental	1.2±0.12	<0.000
SD: Standard deviation			

FIGURES :

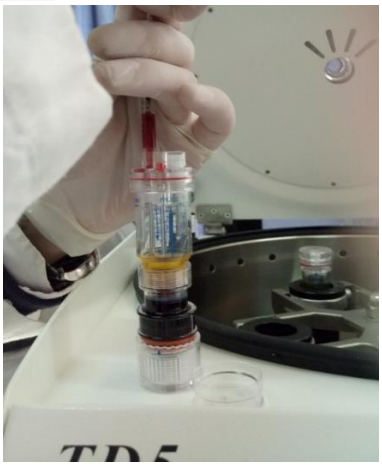

Fig 1: Platelet-Rich Plasma preparation

Fig 2: Platelet-Rich Plasma injection

Fig 3: Canines' retraction with 150 g force