

An Orthodontist's Quandary - Photobiomodulation Or Platelet-Rich Plasma

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ABSTRACT

Orthodontic tooth movement(OTM) is the result of a biological response to an interference in the physiological equilibrium in the dentofacial complex by an externally applied force.

Over the years, many modalities have emerged in the field of orthodontics that aid in enhancing the rate of orthodontic treatment owing to the growing need among patients for faster results. We as clinicians often face the dilemma while deciding upon which modality will take us onto the right path and prove beneficial to our patients.

This study is a review of the available literature on PRP and photobiomodulation therapy on OTM highlighting their potential in accelerating tooth movement. Thus helping the clinician to make an informed decision.

KEYWORDS: Platelet Rich Plasma (Prp), Photobiomodulation & Review Of Literature- Prp.

INTRODUCTION

Orthodontics is an effective method for treating health and cosmetic problems caused by misaligned teeth. As orthodontic treatment advances, more and more people seek orthodontic treatment. According to published literature, traditional fixed orthodontic methods can last from 12 to 30 months. For years, orthodontists and their patients have been frustrated with lengthy orthodontic treatments. Long-term orthodontic treatment can interfere with day to day activities. For orthodontists, a longer treatment period predisposes to a higher risk of root resorption, tooth decay, and periodontal problems.

Techniques to enhance the speed of tooth movement and reduce orthodontic treatment time have been studied for quite some time. Many methods of accelerating tooth movement have been shown to be effective, including injection of various biological agents around the tooth socket, surgery, and electrical stimulation. Even though there is ample evidence of the effectiveness of the methods mentioned, they cause discomfort and pain for the patient. Moreover, the equipment needed for these invasive procedures is not typically available in standard orthodontic clinics. Clinicians are always looking for a non-invasive and full proof method to decrease treatment time .(1)

To increase orthodontic tooth movement, photobiomodulation(PBM) therapy was introduced into orthodontics as a non-invasive procedure.

Pharmacological approaches to accelerate orthodontic tooth movement in humans have been studied since the 1980s. Pharmacological approaches, if proven clinically effective, may be preferable to other methods due to their less invasive nature, lower cost, and greater control. However, the concern lies in the potential for concurrent side effects, particularly when the drug is administered systemically.(2)

Platelet-rich plasma (PRP) is a recently used local agent for accelerating the rate of OTM. While several studies have suggested that one method of accelerating tooth movement is superior to others, conflicting evidence remains for each technique.(2)

MATERIALS AND METHODS

We have used full text articles available on Google Scholar, PubMed, and SpringerLink with the keywords “photobiomodulation”, “platelet rich plasma”, “accelerated orthodontic tooth movement”, “low-level laser therapy” in the English language.

PLATELET RICH PLASMA (PRP)

It is a concentrated solution of autologous platelets in a small volume of plasma. In platelets, the most secretory granules are alpha granules. They contain a range of proteins, including growth factors and chemokines, both crucial for primary hemostasis and wound healing.(2)

PRP was developed in the 1970s and was first utilized in cardiothoracic surgery by Ferrari in 1987. From the mid-1990s onward, its use expanded into various medical fields, including general surgery, dental surgery, sports medicine, and cosmetic surgery. In 1998, Robert Marx introduced PRP to dentistry for mandibular reconstructive procedures, aiming to enhance the maturation rate of bone grafts.(3)

PHOTOBIMODULATION

Photobiomodulation is a non-invasive technique that generates a biological response by using Low level lasers (LLLs) or LEDs 600 to 1000 nanometer wavelengths. The distinction between these two types of light is LLLs is coherent, whereas LED is incoherent. PBM is effective in intervening to activate several cellular biological processes including cell regeneration, metabolism in mitochondria, and, generation of new blood vessels, resulting in increased healing of wounds and regenerating skin, bone, and nerve tissue.

Several animal studies concluded that PBM can increase the rate of OTM by increasing RANKL expression and stimulating the remodeling of bone. In clinical studies on patients, photobiomodulation was found to have a considerable effect on increasing the rate of OTM.(4)

REVIEW OF LITERATURE- PRP

Angel et al discovered that the OTM increased by 35% in the 1st month (2.060.36 millimetre versus 1.340.28 millimetre) and 14% in the 2nd month after PRP injection (1.120.32 millimetre versus. 0.960.2 millimetre)(5)

Joy et al discovered that tooth movement rate in the Platelet rich plasma group was 1.24 times more than that in the control (0.870.12 millimetre/month vs. 0.70.13 millim/month).(6)

According to El-Timamy, the canine retraction was faster in the first month, but slower at the month on the experiment side. Therefore, the overall movement for the four months of the study was the same.(2)

Zeitounlouian et al discovered that the experimental side's canine retraction rate with PRF in was only higher in 2nd month compared to the non experimental side, and there was not much significance between the two.(7)

Pacheco et al discovered that using a PRF membrane reduced canine distalisation rate by 0.67 millimeter and 0.90 millimeter /month on the experimental and control sides, respectively.

REVIEW OF LITERATURE -PHOTOBIMODULATION

Cruz D. and Da Silva S investigated dental retraction with 780 nanometer wavelength, a power of 20 microW, and 5 J/cm² energy density.(8)

Cruz D observed a 34% reduction in treatment time over 2 months with LLL application, while Da Silva S

noted that the speed of retraction increased to less than half the time compared to the control over a 4-month period.(9)

Genc G et al used 800 to 820 nm, and reported increased OTM from 14 to 100%(10)

Dominguez used LED(intraoral) device with a 670 nm wavelength, 200 mW power, 108J energy density in a split-mouth study on 10 subjects for retraction. The LLL group had greater total retraction after 45 days.(10,11)

Limpanichkul (12), Dalaie (13), and Yassaei reported no considerable changes in tooth movement with LLL. They used high wavelengths(890nm). (13)

DISCUSSION

Due to their enhanced properties as platelet reservoirs and scaffolds, WBCs, GFs, and cytokines, platelet-rich concentrates such as PRP and PRF have demonstrated significant promise in regenerative medicine. Several recent studies have been conducted to investigate their effectiveness in different aspects of orthodontics, such as stabilization, RME, resorption of root , TMJ problems and CL/CP. However, their true impact on OTM needs to be determined.(14)

Questionable conclusions have been presented based on the included studies. 3 studies showed an increase in orthodontic tooth movement by PRP or PRF, while the other 2 showed the opposite.

According to Zeitounlouian.(7), PRF had no effect on OTM, and Pacheco claimed that PRP slowed canine distalisation. Various intervention procedures used in dosage, delivery, concentrate presentation, and observation periods could be attributed to these contentious findings.

It is not in our best interest to draw conclusions by only summarizing the final conclusions of each study due to their different trial periods. However, we can analyse the data presented. over time in each study to provide more convincing results.

PRP appears to be useful in increasing OTM within first three months, with the increased accelerated movement around the second monthly interval. Few studies ,during the first three months supported PRP's accelerating effect on OTM. Whereas, some studies found that the difference in OTM rate was greatest in the second month after PRP , implying that PRP had the most influence on OTM after the 1st month.

Low-level lasers have a number of biological effects, producing a temporary enhancement of energetic processes that stimulate vascular remodeling, epithelialization and collagen synthesis,that induce analgesia, bioregulatory and anti-inflammatory effects(15)

Two of the included studies did not show any change in OTM when low energy densities were used; however, two other studies found positive results for the acceleration of OTM as the energy density used increased.

This implies that the speed of movement may be affected in part by high density along with a long wavelength of LLL.

Limpanichkul W(12), Dalaie K(13) , and Yassaei S found no significant difference between the control and LLL groups; however, both studies had short LLL application durations. To accurately assess the impact of various interventions on orthodontic movement, randomized controlled trials with different wavelengths, power levels, and application times for LLL are needed.

CONCLUSION

Both photobiomodulation and PRP have come a long way since animal studies and now numerous human

clinical trials have shown their effectiveness in accelerating tooth movement. Albeit all of these studies there are contradicting results too which puts the orthodontist in a dilemma as to what modality to choose.

These two methods prove effective in their own ways and no solid comparison can be made between the two as such, owing to the lack of studies that compare both these methods simultaneously. A split mouth study comparing the two modalities would be advisable in order to gain more insight as to which has more potential in accelerating OTM.

This review provides an objective view that helps the clinician to make valid, sound decisions by going through clinically significant studies and gathering enough evidence regarding the pros and cons of both PRP and photobiomodulation.

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