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"ADMINISTRATION OF PLATELET RICH PLASMA- A SHIFT IN ACCELERATED ORTHODONTICS– A REVIEW "

Orthodontology

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ABSTRACT

Increasing awareness towards self-appearance and aesthetics has led to increase in overall patients willing to undergo orthodontic treatment. Various surgical and non surgical methods have been tried to reduce the overall orthodontic treatment time. Painless, non invasive procedures are preferred over the traumatic methods. Platelet Rich Plasma (PRP) injection has recently gained popularity due to its safe , relatively painless and economical alternative in accelerating the tooth movement. This article briefs on the researches done in animal and human population so far using PRP and their cumulative effects on tooth movement.

KEYWORDS

PRP. Accelerated Orthodontics, Rate of tooth movement

INTRODUCTION:

Prolonged treatment time has always been an area of concern for both patient and orthodontists. In spite of the fact of losing interest and motivation to treatment, it also has various adverse effects like enamel demineralization[1], dental caries[2], periodontitis[3], and orthodontically induced external root resorption[4] due to prolonged inflammatory reaction and poor oral hygiene.

The average resorption rate of human osteoclasts is ~0.6mm/mo[5] theoretically and clinically it is only 0.34 mm/mo[6]. Hence the osteoclasts plays an important role in orthodontic tooth movement[7]. Various procedures have been attempted in inducing inflammation by increased insult to bone by surgical techniques like corticotomy[8], periodontal ligament distraction[9], periodontically accelerated osteogenic orthodontics(PAOO)[10] ,surgery first approach[11], micro osteo-perforation[12] etc. Other non-surgical methods like local injection of cytokine or growth factors like prostaglandin E[13], misoprostol[14], Vitamin D[15], PTH[16], VEGF[17], PDGF[18] etc. were tried to mimic the body's inflammatory response . The limitations of these biomodulators are that these may need multiple administration and their efficacy in human population is yet to be proved.

Platelet rich plasma (PRP) :

Platelet rich plasma (PRP) is the concentration of autologous platelets suspended in the plasma. The baseline platelet count in any individual will be around 200,000 ± 75000/µL in whole blood and a prepared PRP must contain at least 1 million/µL PRP in a 6 ml aliquot to have a "therapeutic value"[19]. Hence the working definition of PRP according to Marx[19,20] is that it must contain 5 folds increase in platelet counts than the whole blood i.e the baseline counts.

Classification :

PRP can be classified as Pure PRP (without leukocytes) or Leukocyte rich PRP (With leukocytes and small amount RBC's)[21]. Often Platelet concentrate is misunderstood as PRP but it is not PRP as it is devoid of plasma[22].

Processing of PRP:

Generally, PRP is prepared by "Double centrifugation method"[19]. The desired amount of blood is collected in a tube with an anticoagulant and subjected to the "Soft Spin", that sediments the RBC's at the bottom with the platelets and WBC's in the middle buffy coat layer and the Platelet poor plasma (PPP) at the top. The PPP along with the buffy coat is pipetted out and transferred to a new tube and the RBC's are discarded. The tube is resubjected to the "Hard Spin" to obtain platelets pelleted down in the PPP with small amount of RBC's and reasonable amounts of WBC's. The excess PPP is removed and platelet pellets are suspended in the small amount of plasma to get the PRP. The dilution can be altered to get the desired concentration of PRP.

According to the protocol documented by Liou[23] , 60ml of blood was used to obtain PRP with 9.5 to 12.5 times the baseline count . Other studies have documented PRP preparation from only 5ml of blood. For orthodontic purposes freshly prepared PRP is used and it is found to be sterile for almost 8 hours with viable growth factors[19,21,22]. It is used either in activated or non-activated forms. Once activated using thrombin or calcium the PRP increases into a highly viscous gel platelet gel and releases a bolus of growth factors immediately. Studies suggests that almost 70 % of growth factors are released in 10 minutes and 95% of growth factors(GF) are released in one hour[24]. Amount of calcium used, the source of thrombin and the method of activation determine their properties to an extent. Lacoste[25] revealed that the higher concentration of calcium inhibits the GF release. The source of thrombin if bovine may lead to spongiform encephalopathy, bleeding complications and even anaphylactic shock[26].While non-activated platelets tend to release growth factors in a more consistent manner during their life span of 5-7 days as they come in contact with soluble type 1 collagen[27].

Route of Injection:

PRP can be injected through various routes including intra-ligamentary[28], submucosally in the buccal and lingual mucosa and gingiva[23], and into the buccal vestibule[29]. Smaller area , technique sensitivity ,lack of proper landmarks and high resistance offered during injection are few drawbacks of intra-ligamentary approach but when administered correctly it is the most effective route[30].

Advantages :

PRP is advantageous as it is simple, safe and cost effective. They are autologous in origin and hence has no fear of immune reaction or disease transmission and hypersensitivity sequelae[31]. It has an antibacterial effect due to the presence of leukocytes hence limits post surgical inflammation[32]. The antibacterial activity may be due to high pH of 6.5 -6.7[20]. In dentistry PRP is used more locally in minimal quantities hence systemic uptake related complications are minimal.

Limitations:

Highly variable platelet counts in every individual with a lack of single protocol that yields similar levels is not yet formulated. The other variables for uncertain yield of platelets are centrifugation speed, time, initial platelet counts, centrifugation kit (Manual /Automatic), FDA approved machinery availability, efficiency in pipetting, preservation and viability of platelets[20].

PRP in Dentistry:

The use of PRP as an Autologous Fibrin Adhesive was reported as early as 1994 by Tayapongsak[19] in mandibular reconstruction and by Whitman in 1997[33]. The positive response propelled the research of PRP due to its effects on cellular proliferation. PRP consists of various growth factors like, VEGF, TGF β_1, TGF β_2, IGF-1, FGF, PDGF AA, PDGF AB, PDGF BB, PDEGF[20], PF- 4,RANTES[32] in their alpha granules along with other proteases, anti-proteases, and inflammatory mediators. Platelets have pro-inflammatory and anti-inflammatory action which is dose –dependent[19,20,22].

PRP in Orthodontics : Animal Studies:

Author	Sample	Sample Size	PRP concentration	Outcome
Gulec et al[29] (AJODO)	Sprague Dawley rats	81	High PRP- 5 times the baseline	High PRP- 1.7 times increased
			Moderate PRP – 2 the baseline	Moderate PRP – 1.4 times increased
Rashid et al[28] (Orthodontics and Craniofacial Research)	Mongrel Dogs	6	Levels not mentioned	Tooth movement increased by two times PRP group
Erliera et al[34] (Advances in health sciences in research)	Guinea pigs	24	Twice the baseline counts	No significant tooth movement in PRP group
Nakornnoi[35] et al (KJO)	White Rabbits	23	7.5 times the baseline counts approximately	The rate of tooth movement increased the first 14 days but not significant after 14 days
Akbulut et al[36] (AJODO)	Wistar male albino rats	48	5 times the baseline count	No significant tooth movement in PRP group

Human Studies:

Author	Sample size	Follow up	PRP concentration	Outcome
El Timamy[37] (Angle Orthod)	16 female patients	3 months	Not specified	15% increased rate in First month and 5% increased in Second month Rate in PRP side decreased by 40% in third month
Ahmad S,[38] Hassan H (IJAR)	28 patients	3 months	Not Specified	PRP side was 1 times faster in first month and 0.5 times faster in second month

CONCLUSION:

Literature suggests that PRP may have a transient acceleratory effect on the rate of tooth movement but only for a short period of duration and may need repeated administration to sustain the accelerating potential. Hence studies with uniform protocol and increased sample size are needed to support the judicious use of PRP in the future.

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