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Research Paper

Evaluation Of Inflammatory Response Elicited By Three Cordless Gingival Displacement Systems

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ABSTRACT*-Success of any prosthetic treatment depends on maximum esthetic and functional outcome with minimal invasion of tooth and adjacent tissues. However, some stages of treatment procedure, especially fixed dental prosthesis (FDP) treatment, might cause undesirable injury to the adjacent tissues leading to periodontal issues. The present study intended to evaluate and compare the inflammatory response produced by the three cordless retraction systems- Traxodent Hemodent paste, Hemostop Gingival Retraction and Hemostatic gel and 3M Astringent Retraction Paste by estimating the Tumour Necrosis Factor-alpha (TNF-Alpha) inflammatory marker in the gingival crevicular fluid using ELISA test.*
KEY WORDS*- Gingival retraction; Fixed Prosthesis; gingival margin.*

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I. INTRODUCTION

The long term clinical success of any fixed dental prostheses often depends on the marginal adaptation of the prostheses [1]. An accurate adaptation is only possible when preparation margins are recorded accurately in the impression [2] and [3]. For these reasons gingival retraction is necessary.

Though retraction cords are the most commonly used materials for the gingival retraction, many cordless techniques and materials have been recently introduced such as expanding polymers and expanding paste-like gingival displacement materials which save time and also enhance patient comfort while being minimally invasive at the same time.

Though many advances have been made, the introduction of the gingival retraction paste into the gingival sulcus might still cause breakage of the gingival fiber system leading to gingival recession and periodontal injury leading to discomfort, pain, inflammation, and even infection in certain cases. Many pro-inflammatory cytokine mediators such as Tumour Necrosis factor- Alpha (TNF-Alpha), Prostaglandin- E_2(PG-E_2), and Interleukin-1Beta(IL-1Beta) play a significant role in detecting the inflammatory process and can be used as diagnostic biomarkers in assessing the periodontal inflammatory process [4],[5] and [6].

The present study intended to evaluate and compare the inflammatory response produced by the three cordless retraction systems- Traxodent Hemodent paste, Hemostop Gingival Retraction and Hemostatic gel and 3M Astringent Retraction Paste by estimating the Tumour Necrosis Factor-alpha (TNF-Alpha) inflammatory marker in the gingival crevicular fluid using ELISA (Enzyme-Linked Immuno Sorbent Assay) test.

II. MATERIALS AND METHOD

The study was conducted in the Department of Prosthodontics and Crown & Bridge and Implantology, Coorg Institute of Dental Sciences, Virajpet and it comprised a total of 18 subjects, both male and female. The patients were selected based on the inclusion and exclusion criteria.

INCLUSION CRITERIA
1. Subjects who are within the age of 18-30years.
2. Subjects in need of single metallic/ metal-ceramic/ all-ceramic crown.
3. Subjects with healthy periodontal status.

EXCLUSION CRITERIA
1. Subjects with a history of any allergic or adverse reaction to the materials to be used in the study.
2. Subjects in need of master impressions for FPD or implant-supported prosthesis.
3. Subjects with any systemic disease.
4. Pregnant or lactating women.

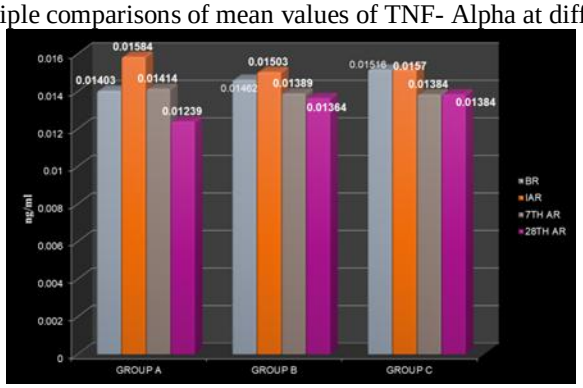
The proposed study was explained to each of the selected patients and a written consent was obtained before the study and the selected patients were randomized into three groups based on the cordless retraction system used.
Group A- Subjects on whom expanding topical gingival displacement paste with a haemostatic agent was used. (Traxodent Hemodent paste) (n=6)
Group B- Subjects on whom Thermo-gelifiable gel with 25% aluminium chloride is was used. (Hemostop Gingival Retraction and Hemostatic gel) (n=6)
Group C- Subjects on whom Astringent Retraction Paste was used. (3M Astringent Retraction Paste) (n=6)
Prior to tooth preparation, Gingival Crevicular Fluid (GCF) samples were collected in micropipettes upto 2 millilitres to estimate the baseline values and stored in eppendorf tubes containing phosphate buffer solution. After the tooth preparation, the prepared teeth were retracted following the manufacturer's instruction of the cordless retraction system and GCF samples were collected in the similar manner to estimate the immediate post retraction values. The same procedure of GCF collection was followed on the 7th and 28th day.
All the tooth preparations and sample collections were made by a single examiner. All collected samples were aliquoted and stored frozen at –20°C to avoid loss of any bioactive human Tumour Necrosis Factor-Alpha (TNF-Alpha). Before the samples were used, they were brought to room temperature.

Biochemical assay to estimate TNF-Alpha levels

The levels of TNF-Alpha were assayed using a high-sensitivity ELISA kit (HU TNF A HS COATED ELISA, 96T, Thermo Fisher Scientific, Waltham, Massachusetts, United States) with recombinant TNF-Alpha monoclonal antibody as a standard. All procedures of estimating followed the manufacturer's instructions. The microwell strips were washed twice with Wash Buffer and standard dilution was prepared on the microwell plate. The conjugate, substrate, amplifier, and stop solutions were added to each sample as per the manufacturer's instructions. The microwell reader was blanked and the absorbance of the samples was measured by measuring the colour intensity at 450 nm. TNF-Alpha was then quantified to ng/ml using a known standard curve for optical density. A comparison was then made to determine which gingival retraction system produced the most inflammatory response in the gingiva and also healing of the gingival tissues after 28days.

III. RESULTS

Figure 1- Multiple comparisons of mean values of TNF- Alpha at different intervals.



The comparison of mean values of TNF- Alpha at different time intervals of Group A, B and C revealed that the highest mean value at Immediately Post retraction was seen in Group A(0.015845) than Group C (0.015178) and Group B (0.015038). The 7th day post retraction values were again high in the Group A (0.014142) than Group C (0.013840) and Group B (0.013894) but significant reduction of mean value was seen in Group A (0.012497) on 28th day Post Retraction than Group C (0.013843) and Group B (0.013645).

IV. DISCUSSION

Gingival displacement includes bending gingival margin far from the tooth surface providing adequate horizontal and vertical space between the prepared finish line and gingiva to inject sufficient amounts of impression material to record the details accurately[7] and [8]. A study by Van der Velden and De Vries in 1978 has shown that the epithelial attachment sustains injuries at a force of 1 N/mm^2, while it ruptures at 2.5 N/mm^2.The pressure applied by the retraction cord in this region is between 5 and 10 N/mm^2, to avoid any

damage to the epithelial attachment, gingival retraction should be accomplished under a pressure between 0.1 and 1 N/mm^2[9].

Cordless systems on the other hand are the newly introduced mechanical retraction materials to overcome certain drawbacks of retraction cord systems. They are stated to be non-traumatic to the ginigival tissues while also being easy to use and time saving[10].According to a study done by Kazemi et al (2009), it was found that cordless systems showed less injury to underlying epithelium than the impregnated cord [11].

Generally Gingival Crevicular Fluid (GCF) contains a large repertoire of serum proteins, inflammatory mediators, host cell degradation products and microbial metabolites which can be collected at the orifice or from within the gingival sulcus. Inflammatory mediators, such as Tumour Necrosis factor-alpha (TNF-Alpha), Interleukin – 1beta (IL-1β) and Prostaglandin E-2 (PGE-2) play a critical role in the pathogenesis of periodontal disease and are used as markers in diagnosis and assessment any inflammatory activity. TNF-Alpha, a pro inflammatory cytokine produced primarily by monocytes/macrophages, has been identified as a lethal mediator of acute and chronic infection[4] and [12].

According to the study, the obtained data revealed levels of TNF-Alpha in the pre retraction/baseline values. According to Page RC, The role of cytokines in normal sites may be related to the physiological activities. The presence of low number of macrophages and mononuclear cells in the gingival tissues and neutrophils in Gingival Crevicular Fluid in clinically normal tissues could also account for the presence of TNF-Alpha. In a study conducted by Stashenko and Jandinski, they demonstrated TNF- Alpha positive staining cells werein normal gingival tissues, but are much lesser than that found in the inflamed tissues by immunofluorescent technique[12],[13] and [14].

Following gingival retraction, there was increase in TNF- Alpha levels than the baseline values among all the three groups and the highest levels was seen in Traxodent Hemodent paste (Group A). This can be attributed to the pressure induced by the Traxodent Hemodent paste (Group A) is more when compared to Hemostop Gingival Retraction and Hemostatic gel (Group B) and 3M Astringent paste (Group C)[15] and [16]. The 7th day post retraction values showed further decrease in TNF- Alpha levels and among the three groups, Traxodent Hemodent paste still had the highest value but the 28th day post retraction values revealed reduction in TNF- Alpha levels than 7th day post retraction values, but Traxodent Hemodent paste shoed the least value than Hemostop Gingival Retraction and Hemostatic gel and 3M Astringent paste. The TNF-Alpha titres showed reduction in the levels over the course of 28days with 28th day value being less than the baseline value. Since much literature pertaining to the inflammatory response produced by cordless retraction systems by biochemical estimation of inflammatory markers is lacking, this study examines the effects produced by cordless retraction systems (Traxodent Hemodent paste, Hemostop Gingival Retraction and Hemostatic gel and 3M Astringent paste) on the gingiva by estimation of an inflammatory marker (TNF-Alpha) and also compares the inflammatory response produced between the systems. Further research is therefore needed in understanding the factors which might be responsible for changes in the intercrevicular cytokine levels, thus providing better strategies for more predictable fixed prosthodontic procedures.

V. CONCLUSION

Traxodent Hemodent paste produced maximum inflammatory response immediately after retraction than Hemostop Gingival Retraction and Hemostatic gel and 3M Astringent paste but showed better healing after 28 days than the other two systems.

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