

Review Article

HYALURONIC ACID A REVIEW

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ABSTRACT:

Hyaluronic acid is a naturally occurring linear polysaccharide which is synthesized by body's own cells and is present in the extracellular matrix of the connective tissue and synovial fluid. Due to its antiinflammmatory properties it is used in the field of orthopaedics, dermatology and ophthalmology. Currently its ant-bacterial and tissue healing properties are widely being used in the treatment of periodontal diseases as an adjunct to mechanical therapy. The aim of this article is to present a comprehensive review on the various properties and uses of hyaluronic acid in aesthetic dentistry.

KEY WORDS: Hyaluronic acid, connective tissue, dentistry, synovial fluid, dermal fillers, black triangle.

INTRODUCTION

The main goal of periodontal treatment is limiting the disease and regeneration of the lost tissues.1 Periodontal tissue destruction is caused by micro-organisms present in the subgingival plaque. Hyaluronic acid being one such agent with anti-inflammatory, anti-oedematous, anti-oxidant and bacteriostatic effects has shown marked results in treating this periodontal disease.2 Hyaluronic acid is a linear polymer containing glucuronic acid N-acetyl glucosamine disaccharide which is synthesized in most of the living cells of the body. It is a universal component of the extracellular matrix of the body tissues and is

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also available commercially.3Hyaluronic acid also has a good role in tissue healing as well as in soft tissue regeneration and augmentation such as in treatment of "black triangle" which is formed by the loss of the interdental papillae, thus hampering the aesthetics of the patient.

Historical Background-

Karl Meyer and John Palmer extracted a chemical substance from the vitreous jelly substance from the cow's eyes and named it hyaluronic acid in the year 1934. The name Hyaluronic acid was coined so because hyaloid meant vitreous and uronic acid was one of the two sugar molecules. In 1942 EndreBalazs used hyaluronic acid commercially as a subatitute for egg white in bakery products.4

Structure of Hyaluronic acid-

Hyaluonic acid is a linear polymer containing repeated units of d-glucuronic acid and Nacetyl d-glucosamine. These monosaccharide units are linked to each other by β 1,3and β 1,4glycosidic bonds.²



Fig 1- Structure of Hyaluronic Acid

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Properties of Hyaluronic Acid-



Fig 2- Properties of Hyaluronic Acid

1. Hygroscopic nature- Due to the ability of Hyaluronic Acid to bind with water (H_2O) molecules with hydrogen bonding, it is one of the most hygroscopic molecules in nature.²



Fig 3- Cross linking of water and hyaluronic acid creates a stable water insoluble gel

- 2. Viscoelastic properties- Its viscoelastic nature helps it in maintaining spaces in periodontal regeneration procedures and impedes the penetration of virus and bacteria into the tissue surface.²
- 3. Bacteriostatic effect- It has bacteriostatic effect on AggregatibacterActinomycetemcomitans, Prevotellaoris, Staphylococcus aureus (which are common in oral gingival lesions) due to their low molecular weight and high concentration of the medium.⁵



- 4. Biocompatible- Hyaluronic Acid has been used successfully in joint fluid supplementation in arthritis, eyes and periodontal regenerative surgeries.. This is due to its high biocompatibility.²
- 5. Anti-inflammatory- It helps in cellular proliferation and differentiation, enhanced proinflammatory cytokine production by inflammatory cells ⁵ and scavenging the Matrixmetalloproteinases and prostaglandins.²
- 6. Anti-oedematous- It has an osmotic activity which makes it an anti-oedematous substance.²
- 7. Anti oxidant- It removes the Reactive oxygen species produced during inflammation by scavenging them thus acting as an anti oxidant.⁵

Receptors of Hyaluronic acid-

The receptors for hyaluronic acid are located in the cell surface, cytoplasm, nucleus of the cell and extracellular matrix. They are called as hyaladherins. They help in the binding of hyaluronic acid to the cell. Cluster of differentiation (CD44) is the most prominent transmembrane glycoprotein receptor.⁶

Degradation of Hyaluronic acid-

Hyaluronic acid can be degraded enzymatically by hyaluronidase enzyme and nonenzymatically by reducing agents such as ascorbic acid, ferrous or thiols. It has a half life of 3-5 mins in blood and 1-3 weeks in cartilage.⁶

Commercially available products of Hyaluronic acid are-

- Genigel
- AC Hyal
- Dermaline
- JUVEDERM volume XC
- JUVEDERM ultra XC
- HylanRofilan Gel
- Hyalaform
- Zyplast
- Restylane
- Perlane
- Reviderm Intra

Techniques of injection of Hyaluronic Acid-

Hyaluronic Acid is injected using 30 gauge needle. The needle is placed at an angle of 30°-60° mid to deep dermis in the treatment area.

Following are the injection techniques-

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1. Linear threading technique-The needle is inserted entirely in the treatment area and the substance is released slowly while withdrawing the needle on the same time. This is done to unsure that the substance is placed evenly throughout the length of the treatment area.⁴



Fig 4- Linear threading technique

2. Serial puncture technique –This procedure includes multiple puncture in a linear line which are closely located on the area to be treated. This is done so that the hyaluronic acid molecules are able to merge together and form a continuous line thus obliterating the wrinkle.⁴



Fig 5- Serial Puncture Technique

3. Fanning technique- The needle is injected in the same way as in linear threading technique. After the injection is complete in one direction, the direction is changed and the procedure is repeated unless the entire area to be treated is covered.



Fig 6- Fanning technique

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4. Cross-hatching technique- The injection technique is the same as linear threading technique. Following injection of the gel, the needle is withdrawn from the skin completely and inserted 5-10 mm away from the first puncture site. This procedure is repeated by injecting the needle at right angle to the previous lines.



Fig 7- Cross-hatching technique

Clinical implications in Periodontology-

- 1. Prato P P G et al (2003) conducted a case series by using autologous cell hyaluronic acid graft for gingival augmentation in mucogingival surgery. On the basis of the results, they concluded that gingival augmentation using autologous cell hyaluronic acid graft provides an increase in gingival volume with fully keratinized tissue in very short time.⁷
- 2. Park J K et al(2009) conducted a study on bone regeneration in rats using poly (lactic co-glycolic acid) grafted with hyaluronic acid bi-layer films as a novel periodontal barrier membrane for guided bone regeneration and found successful results as hyaluronic acid has good biocompatibility, osteoconductivity and angiogenicity.⁸
- 3. VandenBogaerde (2009) evaluated the efficacy of hyaluronic acid by using it in the treatment of intrabony defects. He found positive results of the treatment, as there was significant increase in clinical attachment level and decrease in the pocket depth.⁹
- 4. Pi S et al (2017)conducted a study to treat black triangles in rat models by injecting hyaluronic acid filler to augment the interdental papilla. At the end of the study they concluded that hyaluronic acid fillers may be used as a minimally invasive procedure to augment interdental papillaand obliterate the open gingival embrasures.¹⁰



BLACK TRIANGLE-

Deficient interdental papilla leading to open gingival embrasures in tooth with interdental contact point is termed as black triangle.

Reason for black triangle-

- 1. Age
- 2. Loss of gingival volume
- 3. Faulty restoration
- 4. Gingivitis
- 5. Periodontitis
- 6. Post surgery
- 7. Mechanical pressure

Classification of Interdental papilla-¹¹

Normal- the interdental papilla covers the entire embrasure space.

Class I- The tip of the interdental papilla lies between the CEJ and the interdental contact point.

Class II- The tip of the interdental papilla becomes blunt and lies at or apical to the interproximal CEJ.

Class III- the tip of the interdental papilla recedes and lies at or apical to facial CEJ.

MANAGEMENT-

Hyaluronic acid based dermal fillers such as JUVEDERM ultra XC / JUVEDERM volume XC help in restoring the lost volume of the gingiva in such areas. The effect of the treatment lasts from 6 months to 18 months.¹²

CONCLUSION-

Hence, it is evident that hyaluronic acid has a good regenerative and healing potential in the periodontal tissues. However further long term studies are needed to be carried out to test the efficacy of the different forms, concentration and quantity of appilications.

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