



Mucoadhesive Buccal Drug Delivery System - An Unique Novel Drug Delivery System of the Modern Era

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ABSTRACT

With the current emergence of Novel Drug Delivery Systems, mucoadhesive drug delivery systems march out its significance as an unique novel drug delivery system in the present scenario. The term mucoadhesion in a simpler manner signifies the adhesion of two materials with each other where one of the materials is the mucosal surface. Certain investigations are on progress to find out an alternative route which can by-pass hepatic metabolism, reduce dose frequencies and prolong the drug action. In those cases, delivery of drugs through buccal cavity can be brought up into the real picture. The dosage forms of mucoadhesive drug delivery system include solids, semisolids and transparent drug loaded films. This when comes into contact with the buccal mucous membrane, drug tends to release at a sustained and controlled manner through the blood capillaries associated in the buccal cavity assuring maximum bioavailability and thereby increases the ease of drug administration, by-passes hepatic portal systems and gastrointestinal tract, increase in therapeutic efficacy, improves patient compliance and reduction in dose frequencies.

Keywords: Bioavailability, Mucoadhesive, Sustained and controlled release.

INTRODUCTION

The mucosal or mucoadhesive drug delivery system plays a key role as an innovative drug delivery system in the field of Novel Drug Delivery Systems. In simple words, mucoadhesion can be stated as the attachment of drug along with a suitable carrier that attaches to the mucous membrane. It also has significance in case of binding of drugs to the mucous membrane in the buccal cavity. In oral drug delivery, carriers such as lipids in the present era have achieved its new goal.¹ Bioadhesive formulations have a wide scope of application for both systemic and local effects of drug. Drug delivery through oral mucosa also helps in overcoming hepatic metabolism, controlled rate of drug release. Apart from inhalable, injectable, transdermal routes, buccal route of drug delivery is at the most. Buccal mucosa serves as a paracellular route for drug permeation.² Polymer related factors which influence the mucoadhesion are molecular weight, flexibility, hydrogen bonding, concentration, hydration etc. Environmental factors such as saliva also play a key role.

Unique Features of Mucoadhesive Drug Delivery System

- Promotes prolong retention at the site of application.
- It overcomes the first-pass metabolism.
- Promotes controlled rate of drug release.
- Reduction of dose frequency.
- Improved therapeutic outcome.
- Promotes instant drug release.

In General, Mucoadhesive Drug Delivery System Includes³

- ❖ Buccal drug delivery system.
- ❖ Ocular drug delivery system.
- ❖ Nasal drug delivery system.
- ❖ Rectal drug delivery system.
- ❖ Vaginal drug delivery system.

Highlights of the Dosage Forms for Drug Delivery through Buccal Cavity²

- ❖ **Category 1:** Multidirectional drug release with a monolayer device.
- ❖ **Category 2:** Consist of a bilayered device where a drug loaded bioadhesive layer is superimposed with an impermeable backing layer.
- ❖ **Category 3:** A unidirectional release device where the release of the drug occurs only from that particular side which is adhered to the buccal mucous membrane.

(A) Mucoadhesive Buccal Films

These are mainly referred to transparent drug loaded films which are intended to be placed in the buccal mucosa because of its adhesive character. Buccal films can be more preferred over other dosage forms because of its flexibility and comfortness. They are highly transparent and have immediate adhesion capacity with the buccal mucosa. Hydrophilic polymers, Hydrogels, Thiolated Lecithin based polymers can also be used as mucoadhesive polymers.⁴ An unique feature of buccal films are that they must not produce any irritation or allergies to patients.



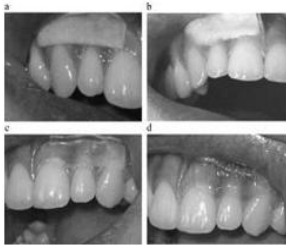


Figure 1



Figure 2

(B) Mucoadhesive Buccal Tablets

These are referred to those tablets which are intended to adhere with the buccal cavity and gets softened due to the production of saliva continuously in the mouth and which ensures the complete drug release in the systemic circulation through the blood capillaries in the buccal cavity and thereby by-passes the hepatic metabolism.



Figure 3



Figure 4

(C) Semisolid Mucoadhesive Buccal Dosage Forms

Gels and ointments as semisolid dosage form for mucoadhesive drug delivery marches out significant approaches throughout the oral mucosa. An disadvantage of using such gels is their poor retention at the site of application which can be overcome by adding certain polymers which possess bioadhesive properties which changes its phase from liquid to semisolid and thereby their viscosity is enhanced and promotes sustained and controlled drug delivery.



Figure 5

Basic Mechanisms underneath Mucoadhesivity

Mechanism which supports mucoadhesion includes:^{5,6}

- Intimate contact between a bioadhesive and a membrane (wetting or swelling phenomenon).
- Formation of bond between biological surfaces or the bond between synthetic or biological surface. Penetration of the bioadhesive into the tissue or the surface of the mucous membrane.

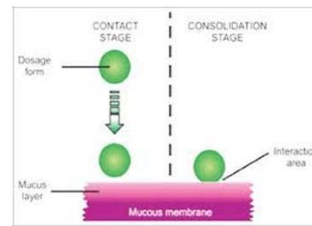


Figure 6

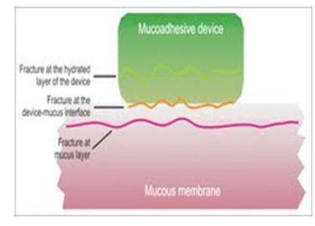


Figure 7

Structural Aspects of Mucoadhesive Dosage Forms

As per the structural aspects is concerned, it is subdivided into two forms, such as-

- ❖ **Matrix Forms:** In this form, the drug, additives, adhesive materials are all mixed together in an uniform manner.

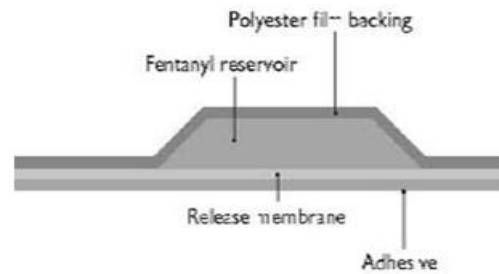


Figure 8

- ❖ **Reservoir Form:** In this type of form, there is a cavity for the drug as well as the additives separate from the adhesive where an impermeable backing force is applied to control the direction of drug delivery.

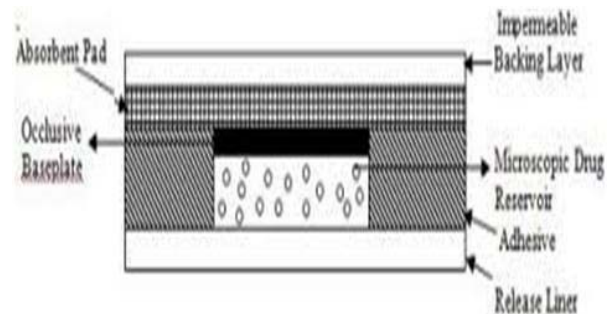


Figure 9

Characteristics of Mucoadhesive Polymers⁷

- ✓ The polymer as well as its degraded products should not be absorbed & must be non toxic.
- ✓ A strong non covalent bond must develop between the polymer and mucous tissues.
- ✓ It should possess quick adhering tendency with site specificity.
- ✓ On storage, the polymer should not undergo decomposition.
- ✓ The cost of the polymer should be bearable.

Natural Polymers Used In Mucoadhesive Buccal Patches Are⁸

1. Gelatin
2. Chitosan
3. Soluble starch
4. Xanthan gum
5. Tragacanth
6. Guar gum
7. Sodium alginate

Formulation background of mucoadhesive buccal dosage forms

Mucoadhesive buccal tablets and semisolid dosage forms constitutes the main ingredient that is API, excipients, polymers such as Carbopol, HPMC, natural polymers etc which serves to be important mucoadhesive polymers.

Mucoadhesive buccal films constitute the API, mucoadhesive polymers, solvents & plasticizers to give a effect of plasticity which promotes flexibility and easy adhesive nature with the buccal mucosa.

Their Preparations and Evaluation

- Solid dosage form for mucoadhesion are prepared by blending all the ingredients followed granulation and compression which can be evaluated by its friability, disintegration, hardness, weight variation etc.
- Semisolid dosage forms are prepared by dispersing polymers in the solvent followed by the addition of the API and continuous stirring until the formation of semisolid like consistency and are evaluated by its appearance, colour, odor, pH, spreadability, wash ability etc.
- Mucoadhesive buccal films are prepared by solvent casting techniques where the drug will be soluble in the solvent followed by the dispersion of polymers and freeze drying to remove air bubbles entrapped. They can be evaluated in terms of swelling index, folding endurance, surface pH studies etc.

Significance & Drawbacks Underneath

- Buccal drug delivery significantly promotes excellent accessibility, prevents degradation of drugs due to acid production in the GIT and ensures fast absorption due blood supply and its rate.
- Drawbacks underlying mucoadhesive drug delivery is due to local ulcerous effects because of prolonged

contact of the drug with the buccal mucous membrane and also in terms of taste and mouth feel as a part of patient's acceptability in certain cases.

Progress of mucoadhesive drug delivery system

Drug loaded with microspheres, nanoparticles, herbal drug extracts comes into the updated picture of NDDS. Certain kinds of mucoadhesive formulations are also being carried out with certain *in-vitro* and *in-vivo* activities with lesser doses with enhanced bioavailability of drugs.

CONCLUSION

Mucoadhesive drug delivery system proves to be a unique alternative to conventional drugs by virtue of its ability in overcoming hepatic metabolism, reduction in dose frequencies and enhancing bioavailability.

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