JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

AN OVERVIEW ON MUCOADHESIVE GEL IN BUCCAL DRUG DELIVERY SYSTEM

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ABSTRACT:

This article focuses on the administration of medicinal agents through the mucosa. Because the mucosal membranes are generally porous, medication can be swiftly absorbed into the systemic circulation and avoided by avoiding first-pass digestion. This makes the mucoadhesive drug delivery method one of the more attractive and inventive drug delivery technological advancements.

Mucoadhesive drug delivery systems extend the length of the dosage form's residency at the absorption site by interacting with mucin molecules and the mucus layer covering the mucosal epithelial surface. This medication delivery method's main benefit is that it prolongs the dosage form's residence time at the application site. The buccal cavity's plentiful blood supply and relatively high mucosal permeability make it the perfect site for both local and systemic drug delivery. This review has covered the anatomy and composition of the mucosal membrane, mucoadhesion mechanism, permeation enhancers, and different evaluation techniques, in addition to providing a quick summary of the various theories and delivery system compositions. Furthermore, a literature review of the buccal mucoadhesive drug delivery system and the factors influencing it have also been covered.

Though it acts as a barrier to shield underlying tissue, the buccal mucosa is more permeable than other possible passageways like the skin. Nevertheless, mucoadhesive research is still in its infancy, and more development is required before the idea can be successfully used to control medication delivery. To gather literature scientific data and information on the subject, several online search engines and scientific publications were used.

KEYWORDS: Mucoadhesion, Buccal drug delivery system, Mucoadhesive, Mucoadhesive gels, Buccal Route, Mucus membrane

INTRODUCTION

Mucoadhesion, sometimes referred to as mucosal adhesion, is the state that determines how long two materials cling together. Adhesion occurs when two materials take advantage of the tensions between them; this phenomenon, known as bio adhesion, occurs when two materials cling to one another biologically. The duration of the dosage form's residency at the application or absorption site is increased by mucoadhesive drug delivery methods. They facilitate tight contact between the dosage form and the underlying absorption surface, hence improving the therapeutic efficacy of the medicine. With the intention of achieving both systemic and local effects, many of these mucoadhesive drug delivery systems have been developed recently for use in the oral, buccal, nasal, rectal, and vaginal routes. Mucoadhesive materials can be used as therapeutic agents because they act as lubricants or wrap and shield wounded tissues. Mucoadhesion is the result of the polymer and mucus gel layer becoming physically entangled with one another or forming noncovalent bonds and ionic interactions. [1]

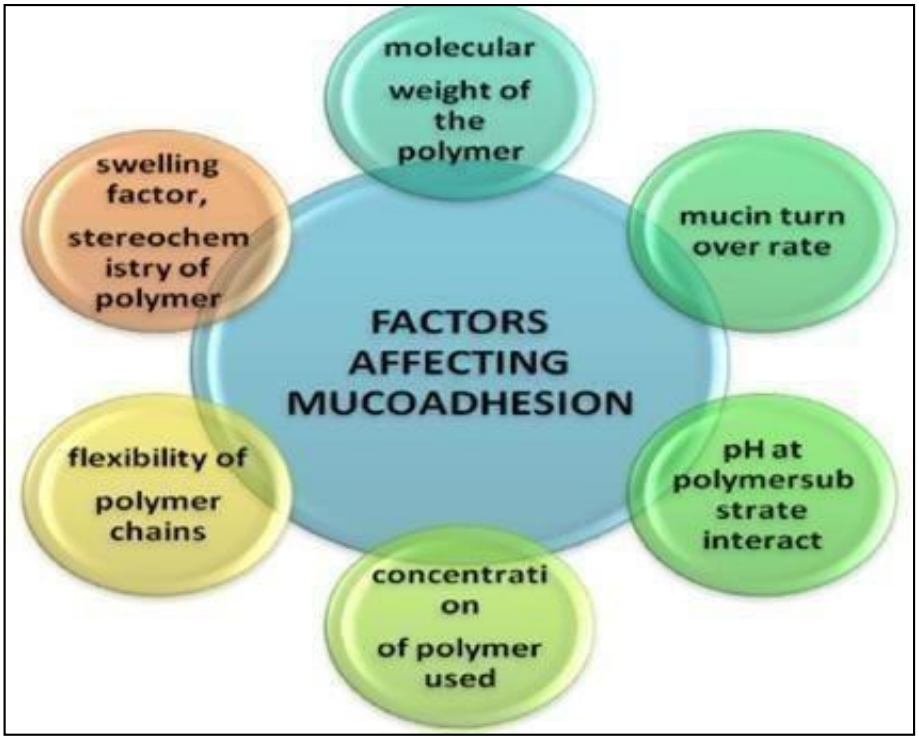

Fig. 1. Factors affecting Mucoadhesion [5]

Aims and Objectives:

Aim: To study the Buccal Drug Delivery method for the use of mucoadhesive gels because of its quick absorption and high bioavailability.

Objective :

1.To perform a review of the literature on mucoadhesive gel in buccal medication delivery systems.
2. Researching different medications and excipients for administration via the buccal route.
3. To ascertain the process for creating and assessing mucoadhesive gel.

BUCCAL MUCOADHESIVE DRUG DELIVERY SYSTEM [2]

Three unique delivery methods can be differentiated within the mucoadhesive drug delivery system occurring in the oral cavity's mucosal membrane:

•Delivery in sublingual
•Delivery via Buccal
•Delivery locally

The buccal mucoadhesive drug delivery method is useful for the local or systemic distribution of several drugs. Buccal mucoadhesive dosage forms are simpler to use and apply than other sticky dosage forms. The buccal route has the advantage of avoiding first pass metabolism and gastrointestinal drug breakdown. It also has strong blood flow, which guarantees systemic medication absorption.
Buccal mucoadhesive dose forms are easier to use than other sticky dosage forms. improved adherence from patients who use injectables. For focused therapy, it is the most popular method of drug delivery, allowing for a wide range of mucoadhesive formulations. Buccal formulations are used to treat both systemic and local disorders; they are inserted in the mouth between the cheek and the upper gingival (gums). The inner cheek is lined with the buccal mucosa. The buccal route is one of the conceivable delivery methods for hydrophilic, substantial, and unstable proteins, oligonucleotides, polysaccharides, and conventionally very small medicinal molecules.

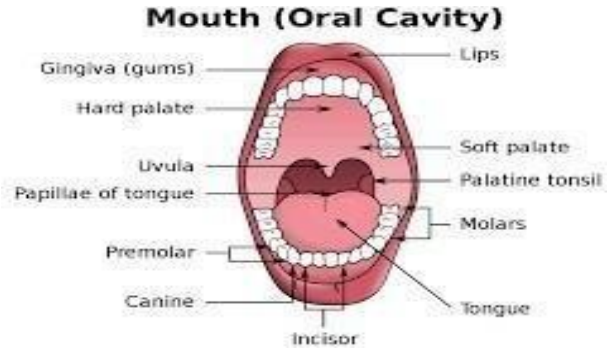

Fig. 2. Structure of Mouth (Oral Cavity)

COMPOSITION OF BUCCAL MUCOSAL DRUG DELIVERY SYSTEM[3]:

The formulation of the buccal mucosal medication delivery system is as follows because it offers improved administration and bioavailability:

A) Active Ingredient

B) Bio-adhesive Polymers

C) Sweetening Agents

D) Flavouring Agents

E)Permeation Enhancer

F) Plasticizers

A)Active Ingredient

When choosing a medication material, it is important to evaluate its pharmacokinetic properties or the right active pharmaceutical ingredient.

The following characteristics of the drug should be present:

• Drugs with first-pass metabolism that are delivered buccally can avoid first-pass metabolism.

• The medication must be reasonably priced, effective, and have a low single dosage (less than 25 mg).

B)Bio-adhesive materials

The use of bio-adhesive polymer affects the drug delivery device's thickness, mucoadhesive strength, residence period, and in-vitro release. High molecular weight polymers are commonly utilized due to their ability to effectively regulate the release rate. HEC, HPC, polyvinyl alcohol (PVA),carbapol, and polyvinyl pyrrolidone (PVP) are a few types of mucoadhesive polymers.

C)Sweetening Agents

These chemicals are meant to improve patient compliance by covering up the disagreeable taste of prescription drugs and other pharmaceutical ingredients.
Mannitol, aspartame, and sugar are a few examples.

D)Plasticizer

Plasticizers improve the folding endurance of the delivery device mechanism. These allow the dose form to be as flexible as necessary to improve patient acceptance and compliance.
Propylene glycol, dibutyl phthalate, and PEG-400 are a few examples.

E) Improver of Permeation

It is an essential part of the composition of the buccal mucosal medication delivery mechanism. It helps to increase skin permeability and change how the skin functions as a barrier. It makes the site of the active ingredient visible and helps the skin absorb a drug or pharmaceutical substance. Using a permeation enhancer facilitates the drug's penetration and increases its bioavailability and effectiveness. The mucus becomes less viscous and the lipid bilayer membrane becomes more fluid as a result of its actions.
Ex- cyanoacrylate.

F) Tasting Substances

For the objective of increasing patient compliance, these sorts of compounds have been employed to mask the taste of the drug entity and therapeutic substances by the inclusion of flavors.
Examples: vannilin, menthol, and clove oil.

MECHANISM OF MUCOADHESION: [8, 9]

Mucoadhesion is how two materials—one artificial, like a mucoadhesive polymer, and the other, like the mucin layer of the mucosal tissue—are kept together by an interfacial force of attraction.

An artificial material that may interact with mucous membranes and stick to them or hold them together for a lengthy period is called a mucoadhesive. The first stage is distinguished by the interaction between the mucoadhesive and the mucous membrane, causing the formulation to expand and swell and initiate to make a deep connection with the mucus layer.

There are two different phases in the adhesion process, which are listed below.

1. Contact Stage

2. Consolidation Stage

CONTACT STAGE:

The first step is defined by the formulation dispersing and swelling as it comes into contact with the mucous membrane and the mucoadhesive, thereby establishing deep interaction with the mucus layer. At this point, an intimate wetting happens between the mucoadhesive substance and the mucus membrane when they come into touch. The mucus in the mucosal membrane generates this wetting of the mucoadhesive.

CONSOLIDATION PHASE:

Utilizing multiple physiochemical forces of attraction, particularly hydrogen bonding, electrostatic forces, and Vander Waals forces. The forces in the mucoadhesive substance adhere to the membrane of the mouth and result in a long-lasting mucoadhesion stage termed consolidation. The mucoadhesion process concluded after these two phases.

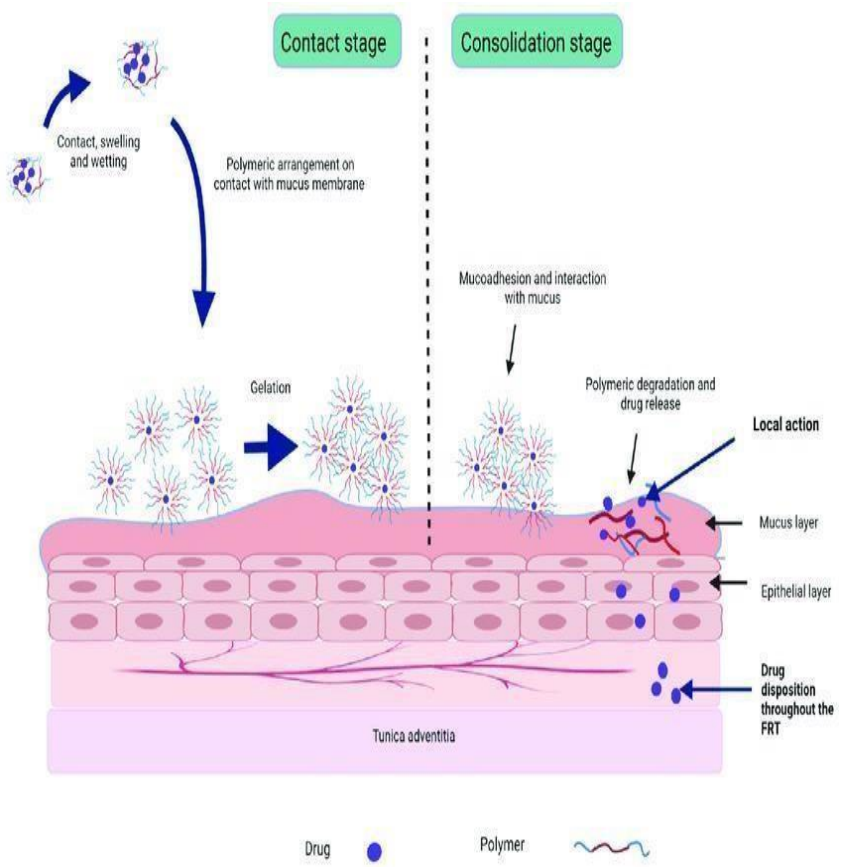

Fig.3Mechanism of Mucoadhesion[10]

ADVANTAGES AND DISADVANTAGES OF BUCCAL DRUG DELIVERY SYSTEM

ADVANTAGES [4] :

1) Hepatic first-pass metabolism is overcome.

2) The above technique can be used to administer medications that are unstable in an acidic environment and are broken down in an alkaline or enzymatic environment in the the intestines

3) It can be administered to a patient who's currently unconscious.

4)Quick start of action.

5)More patient compliance develops.

6)Dosage form ease of administration.

7) operates using a passive drug absorption system that doesn't need to be triggered

Disadvantages: [15]

1) The buccal membrane exhibits low permeability, especially in comparison to the sublingual membrane.

2) The involuntary removal of the dosage form may result from swallowing saliva, which may also cause the loss of dissolved or suspended drug.

3) Saliva secretion (0.5-2 l/day) is continual and causes the medication to be diluted later.

CHARACTERIZATION

EVALUATION PARAMETER OF MUCOADHESIVE GELS:

1) Thickness:

Employing a screw gauge, the thickness of five selected at random patches was assessed.[6, 14]

2) Surface pH study:

The surface pH can be evaluated to assess the potential for any in vivo detrimental outcomes since an acidic or alkaline pH may irritate the buccal mucosa. The recognized technique is used to determine the surface pH of the bioadhesive formulation. In addition, a glass electrode is used in this procedure. If the pill is left in 1 mL of distilled water (pH 6.5 ± 0.05) for two hours, it will swell at room temperature. Place the electrode in touch with the surface to measure the pH, then let it a minute to acclimate to the surroundings.[10]

3) Residence time:

The fundamental goal of the in vitro residence duration is to determine the mucoadhesive performance that will be maintained at the application site. To measure this period, a modified disintegration device might be used. For halfway disintegration, 800 milliliters of pH 6.75 isotonic buffer solution can be used. A glass slide with a 3 cm-long rabbit mucosa attached to it has been affixed vertically to the side arm. Before the mucoadhesive tablet was put in mucosal contact, one surface was hydrated with 15 milliliters of isotonic phosphate buffer solution. To attain complete submersion, the glass slide was permitted to oscillate in elevation. Then, it is possible to investigate the precise instant at which the tablet detaches from the mucosal surface.[7]

4) Spredability :

After 1 min, the spreadability of the gels ranged from 10.73 ± 0.01 mm to 23.75 ± 0.03 mm. Because Carbopol 934 was used to make the gel formulations, they showed excellent extrudability and spreadability.

5) Drug Content Uniformity :

All formulations had a drug concentration ranging from 0.2 ± 0.01% mg/g to 32.77 ± 0.20% mg/g. The amount of medication in each gel was the same. [11]

6) Stability :

The gels did not exhibit any physiological alterations, such as color changes or fluid exudate segregation, following a six-month stability study. All of the gels had the same pH, which varied from 6.5 ± 0.03 to 7.0 ± 0.06. Following a half-year, the drug's concentration varied between 0.17 ± 0.19 and 28.00 ± 0.004% mg/g. The mean ± SD is used to express the data, with n = 3 and SD standing for standard deviation.[13]

FUTURE TRENDS/SCOPE:

The development of buccal adhesive dosage forms and boosting the bioavailability of medications that are not as bioavailable when taken orally have been the focus of pharmaceutical professionals in recent years.

Considerable promise has been observed for the second generation muco adhesive polymer. An entirely novel kind of buccal adhesive delivery system has emerged, in which the local oral environment is taken into consideration while targeting drug distribution towards the buccal mucosa. Patients now days take commercially well liquids, gels, and solid dose forms assigned to the oral cavity.

Because they protect therapeutic entities and result in better absorption due to increased contact time provided by the bioadhesive component, microparticulate or nanoparticulate bioadhesive systems are particularly interesting at the present time.

CONCLUSION:

By focusing on the anatomical characteristics of the mucosa, the mechanism of mucoadhesion, and the many theories of mucoadhesion, the present article offers an in- depth examination of oral mucosal medication transport. The effective design of innovative mucoadhesive drug delivery systems might profit from this overview of mucoadhesive dosage forms. The mucoadhesive dosage forms have the potential to be a worthwhile instrument in the research and development of innovative mucoadhesive delivery systems for drugs.

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