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NOVEL BACKING MEMBRANE APPROACHES IN BUCCAL DRUG DELIVERY SYSTEM - A REVIEW

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ABSTRACT
Delivery via the buccal mucosa, primarily made up of the cheek lining, is known as buccal delivery. The buccal region of the oral cavity is an alternate target for the delivery of the drug of choice in order to overcome the deficiencies associated with the other route of administration, such as acidic medium instability, first pass metabolism, etc. When a medicine is administered by the buccal route, it enters the bloodstream without being metabolised by the liver and has a high bioavailability. This review discusses hypotheses, the nature of the buccal mucosa, and the transport of drugs via the buccal cavity.

KEYWORDS: Backing Membrane**,** Importantance, Buccoadhesive polymers, evaluation of Patches.

INTRODUCTION

Mucoadhesive: The adhesion between two materials, at least one of which is a mucosal surface. Pharmaceutical business has established itself as a Significant player and significant contributor to the healthcare sector. The pharmaceutical industry's advancements and improvements have profoundly impacted how diseases are treated, raising overall standards of living.[1] Medical professionals and manufacturers prefer oral delivery methods over all others. due to high patient acceptance, simplicity in use, capacity to reduce or eliminate pain, and adaptability.[2]

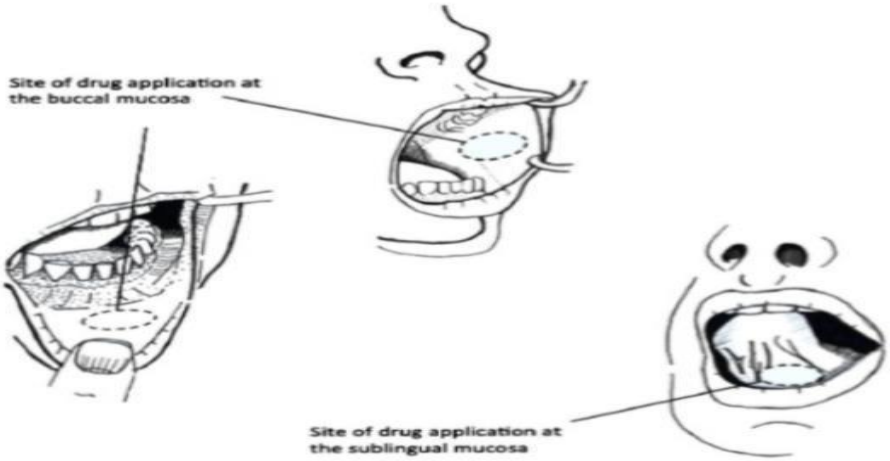
Delivery of Drugs can be categorised into three classes:

- Buccal delivery
- Sublingual delivery
- Local delivery

Buccal delivery: Drug administration through the buccal cavity is done over the cheeks' mucosal lining (buccal mucosa).

Sublingual delivery: Sublingual distribution is the systemic administration of medications through the mucosal membranes that cover the mouth's exterior.

Local delivery: Local delivery refers to oral cavity medicinal delivery.



OVERVIEW OF BUCCAL MUCOSA

1) Epithelium
2) Basement membrane and Connective tissues.

Epithelium

Epithelium is made up of between 40 and 50 layers of stratified squamous epithelial cells that range in thickness from 500 to 800 m. The oral mucosa's epithelium protects tissues by acting as a barrier to the admission of foreign substances and as a protective coating.

Basement membrane and Connective tissues

The basement membrane (BM) is a continuous layer of extracellular materials that separates the connective tissues from the bottom layer of the epithelium. Although these two regions may restrict the movement of specific macromolecules and complexes, connective tissue and basement membrane are not believed to affect the diffusion of the majority of drugs of interest.[3]

BACKING MEMBRANE

The backing membrane is crucial for the bioadhesive devices to adhere to the mucous membrane. The materials employed as the backing membrane should be inert, impermeable to the medicine, and penetration enhancing. Buccal bioadhesive patches with its impermeable barrier decrease drug loss and improve patient compliance.

Examples

- Carbopol
- Magnesium stearate,
- HPMC,(hydroxypropyl methyl cellulose)
- CMC (corboxy methyl cellulose)
- Polycarbophil etc.[4]

The ideal transmucosal buccal film design would feature an API-loaded layer that bonds directly to the buccal site, while a second outer backing layer erodes at a designated rate equal to the time it takes for the entire drug concentration to be delivered to the system. Unidirectional drug release provides optimal bioavailability and negligible loss of drug to the saliva and GI tract. The slower eroding backing layer would offer layer during eating, drinking, and exposure to saliva to prevent the API layer from dissolving into the oral cavity until completion of the desired drug infusion time.[5]

BUCCOADHESIVE POLYMERS USED IN THE BACKING MEMBRANE

The extension of the drug-containing device's stay in the oral cavity and the localization of pharmaceuticals in a specific area are the main benefits of bioadhesive systems. Theories related to electronics, adsorption, wetting, diffusion, and fracture have been used to explain the bioadhesion process.[6]

Strong hydrogen bonding groups, strong anionic or cationic charges, high molecular weight, chain flexibility, and surface energy features that encourage spreading over mucus layer are a few of the necessary structural elements for bioadhesive polymers.[7] general, Sources for sticky polymers should include both natural and manufactured, charged and uncharged, water-soluble and water insoluble polymers. The rapid turnover of the mucus layer has a significant impact on how long bioadhesion lasts.[8] Bioadhesion is also significantly influenced by factors like saliva secretion, dietary consumption, local pH, and the makeup of delivery systems.[6]

Criteria	Categories	Examples
Source	Semi-Natural/Natural	Agarose, chitosan, gelatin, Hyaluronic acid, Various gums (guar gum, xanthan, gellan, carrageenan, pectin and sodium alginate).
	Synthetic	Cellulose derivatives (CMC, thiolated CMC, NaCMC, HEC, HPC, HPMCMC.] Poly (acrylic acid)-based polymers: [CP. PC. PAA, polyacrylates, poly (methyl vinyl ethercomethacrylic acid), poly (2-hydroxy ethyl methacrylate), poly (acrylic acidcoethyl hexyl acrylate). (methacrylate), poly poly (isobutylcyanoacrylate), copolymer of Polymers. acrylic acid and PEG). Others: polyoxyethylene, PVA, PVP, thiolated Polymers.
Aqueous Solubility	Water soluble Water In-soluble	CP, HEC, HPC, HPMC (cold water), PAA, NaCMC, sodium alginate. Chitosan (soluble in dilute aqueous acids), EC, PC.
Charge	Cationic Anion Non-ionic	Aminodextran, Chitosan, (DEAE)- dextran,TMC. Chitosan-EDTA, CP, CMC, pectin, PAA. PC, sodium alginate, NaCMC, xanthan gum Hydroxy ethyl starch, HPC, poly(ethylene oxide), PVA.
Potential	Covalent Hydrogen bond	PVP, scleroglucan. Cyanoacrylate
Bioadhesive forces	Hydrogen bond	Acrylates[hydroxylated methacrylate.poly(methacrylic acid) , CP, PC, PVA, Chitosan.

IMPORTANCEE OF IMPERMEABLE BACKING MEMBRANE

The impermeable backing is used to avoid medication loss, limit patch deformation and disintegration while in the mouth, and control the direction of drug distribution. Buccal absorption.

Through the buccal mucosa, buccal absorption causes local or systemic effects.[9]

INVESTIGATIONS ON THE BUCCAL DRUG DELIVERY SYSTEMS

Many researchers have created a variety of buccal drug delivery systems in the lab, either for local or systemic activities. They are broadly classified into

(i) Solid buccal adhesive dosage forms
(ii) Semi-solid buccal adhesive dosage forms
(iii) Liquid buccal adhesive dosage forms.

On the basis of geometry, buccal mucoadhesive dosage forms can also be divided into three categories. A single layer device with multidirectional medication release is referred to as Type I. Due to swallowing, this sort of dosage form experiences high drug loss. With the type II devices, drug leakage from the top surface of the dosage form into the oral cavity is prevented by superimposing an impermeable backing layer on top of the drug-loaded bioadhesive layer.Since the medicine is released from the side next to the buccal mucosa, Type III is a unidirectional release device with low drug loss. The dosage form can be coated on all faces except the one that comes into contact with the buccal mucosa in order to achieve this.[10] To provide both a regulated or sustained medication release and an extended time of bioadhesion, the device should be constructed to maximise the bioadhesive polymer's swelling rate.

Solid Buccal adhesive dosage forms

Buccal tablets

In recent years, a number of formulations of bioadhesive buccal tablets using the direct compression approach have been created for either local or systemic drug delivery. They are intended to release the medication either in a single route by concentrating on the buccal mucosa or in multiple directions into the saliva.[11] To ensure that the medicine is given unidirectionally, an impermeable backing layer can also be included in the dosage form. Patient acceptance (mouth feel, taste, and discomfort) and the inequitable dispersion of the drug within saliva for local therapy are potential drawbacks of buccal tablets.

It is important to draw attention to the potential issues that young children and the elderly may encounter when using adhesive tablets, such as discomfort that may be caused by the material applied to the mucosa and the potential for dosage separation from the mucosa, swallowing, and subsequent adhesion to the esophageal wall.

This type of bioadhesive formulation is typically composed of a bioadhesive polymer (like polyacrylic acids or a cellulose derivative), either alone or in combination, added to a matrix that also contains the active ingredient and excipients, as well as possibly a second impermeable layer to enable unidirectional drug delivery.[12][13]

Patches/flims

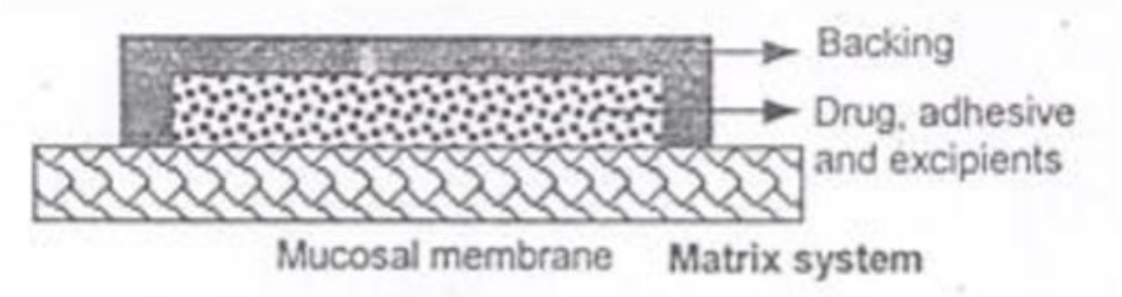
Patches are laminates made of an impermeable backing layer, a reservoir layer that holds the medicine and releases it gradually, and a surface that is bioadhesive for mucosal attachment. To administer medications directly to a mucosal membrane, flexible films or patches have been created using either the hot melt extrusion technique or the solvent casting method. They have advantages over lotions and ointments in that they can deliver a precise dosage of medication to the spot.[14]

Buccal patches are made of two laminates. An impermeable backing sheet is cast with an aqueous solution of the adhesive polymer before being cut into the desired oval shape. A brandnew mucosal adhesive film made of three different organic acids called "Zilactin."Even when it is challenged by fluids, the film that is placed to the oral mucosa can be kept in place for at least 12 hours.[15]

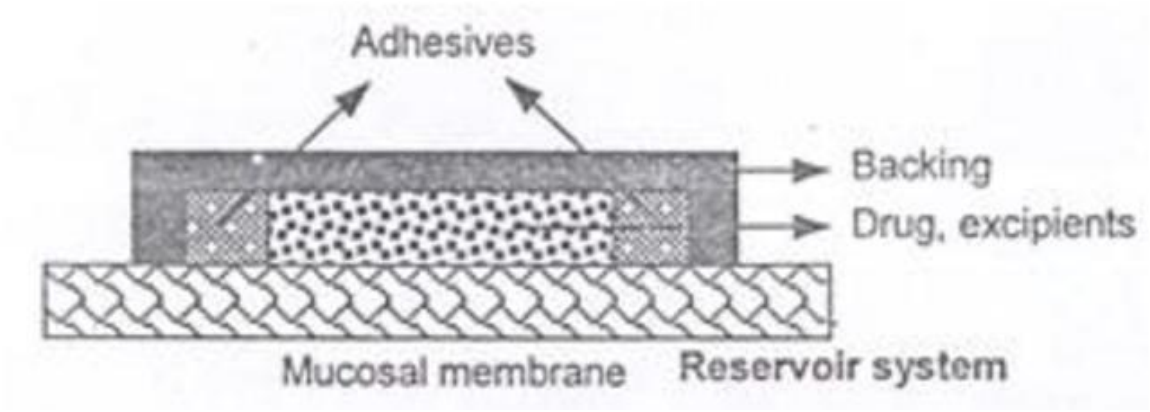
Backing layer of buccal patches: ethylcellulose, etc.[16]

1) Matrix type

The matrix-shaped buccal patches have a mixture of medication adhesive and additives in them.



2) Reservoir type

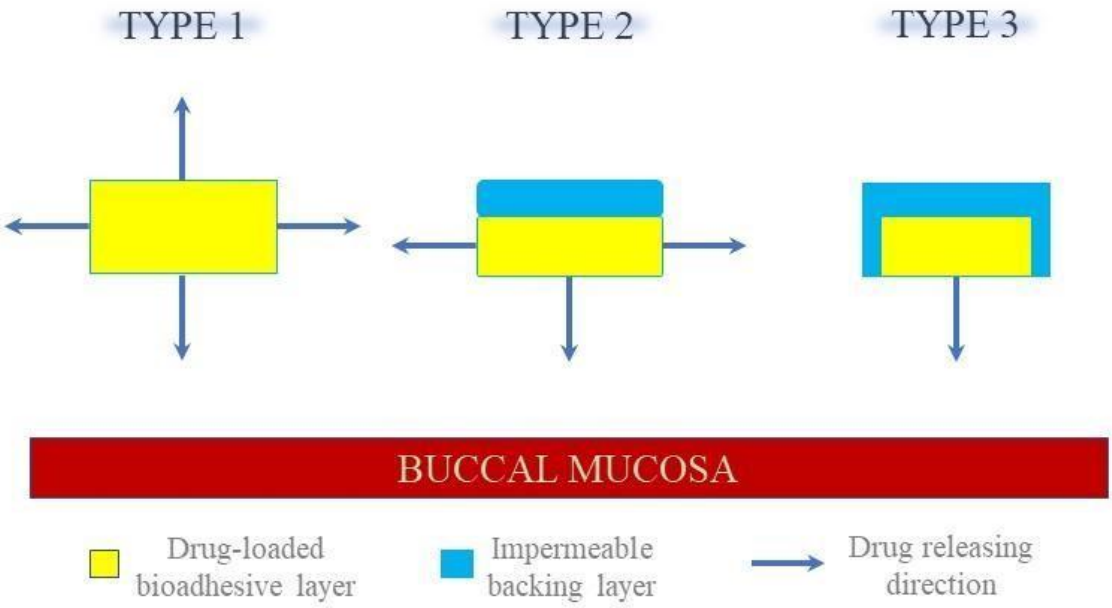


Buccal patches with a reservoir system have a cavity where the medication and additives are kept apart from the adhesive. To control the direction of medication delivery, lessen patch deformation and disintegration while in the mouth, and avoid drug loss, an impermeable backing is used.[17]

DRUG RELEASE FROM BACKING MEMBRANE

The Nair AB has been a drug release investigation over the backing membrane was conducted utilising a Franz diffusion cell in order to assess the barrier property of the backing membrane. A biopsy punch was used to puncture the film, and it was then clamped between the donor and receptor compartments of the diffusion cell, which was kept at 37 ± 1°C. Phosphate buffer solution was used to fill the donor compartment (1 ml) and the receptor cell (5 ml). Samples were taken from the donor compartment at predetermined intervals and examined using high-performance liquid chromatography (HPLC).[18]

TYPES OF BUCCAL MUCOADHESIVE DOSAGE FORMS

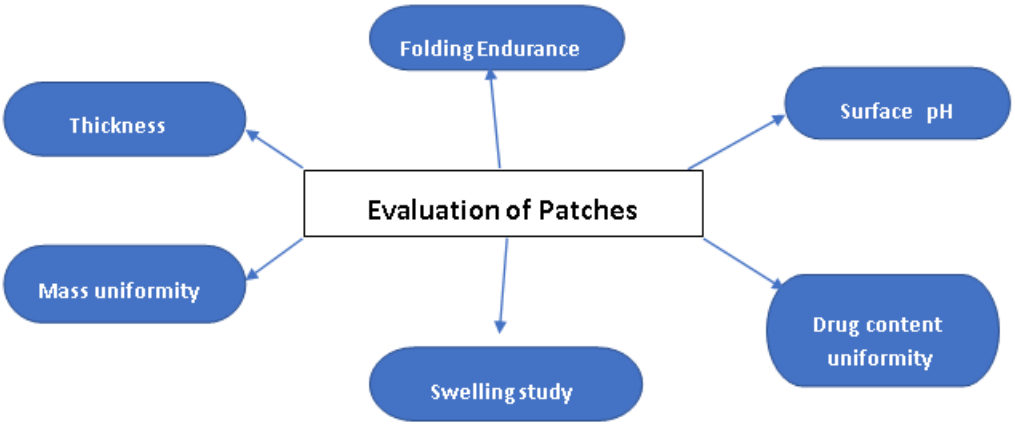


Type I: One layer of this contains a dose form that allows for multidirectional medication release. The main drawback of this kind is that swallowing causes a significant amount of medication loss.

TypeII: The drug-loaded bioadhesive layer is present, and the backing membrane is impermeable. The backing membrane only covers the side that is opposite from the site of connection, avoiding drug loss from the device's top surface.

Type III: With the exception of the side that adheres to the target area, all sides of the drug-loaded mucoadhesive layer are impermeable in this type. It is a one-way drug flow that stops all types of unintended medication loss.[19]

WITHOUT BACKING MEMBRANE EVALUATION OF BUCCAL PATCHES.



Mass uniformity, thickness, folding endurance

Using a digital balance and a digital vernier calliper, uniformity and thickness of created buccal patches (without backing layer) were tested, respectively. By repeatedly folding a patch at the same location until it broke or developed obvious cracks, or by folding more than 250 times without breaking, the folding endurance of the patches (without supporting layer) was determined.[20]

Surface pH

Acidic or alkaline pH may irritate the buccal mucosa and have an impact on how well hydrated polymers are. The patches' surfaces had pH values between 5.97 ± 0.15 and 7.02 ± 0.11 respectively. All of the formulations' results were found to be almost neutral, which suggests there is less chance that they will irritate the buccal mucosa.

Drug content uniformity

The Chopra.S, et al., said to the ranges for the drug content (%) in all formulations were 89.70± 0.36% to 99.19 ± 0.21%. This shows that the medication distributed evenly across the polymeric patches.[21]

CONCLUSION

The present review concluded that buccal film is most acceptable, palatable dosage form. It is bypasses first pass metabolism and also enhance bioavailability of active molecule due to its specific characteristic features than other novel buccal drug delivery system. The importance of backing membrane and use in the buccal patches of buccal drug delivery system are summarize in the review. The use of natural polymers is increasing in buccal patches formulation. A lot of work is still going on all around the world on mucoadhesive buccal patches using various natural polymers. This review is an effort to summarize the work done till date and to show the future pathway of mucoadhesive buccal patches preparation using natural polymers. Buccal film is buccoadhesive drug delivery system which enhances safety, Efficacy and stability of active pharmaceutical ingredient. buccal film is novel technology due to its better option to optimize therapeutic efficacy.

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