

BUCCAL DRUG DELIVERY SYSTEM

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Introduction

- Novel drug delivery systems(NDDS) are the system where the man searches for now method of entry of drug in to the body in order to show its activity in the body.
- The new drug delivery system that have been developed and developing are the mucoadhesive drug delivery systems, drug patches, transdermal patches etc.

Buccal drug delivery system

- The *buccal mucosa* lines the *inner cheek* and buccal formulation are placed in mouth between the upper gums and cheek to treat local and systemic conditions
- It is richly vascularized and more *accessible* for the *administration* and removal of dosage from.
- Additionally ,buccal drug delivery has highly *patient acceptability* compared to other non-oral routes of drug administration.
- *Extensive first pass metabolism* and drug degradation in the harsh gastrointestinal environment can be administering the drug via buccal route.

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- Drug absorption through buccal mucosa is mainly by *passive diffusion* into lipoidal membrane.
- After absorption, the drug is *transported* through *facial vein* which then *drains* into the general circulation via *jugular vein*, by passing the liver and there by sparing the drug from first pass metabolism.
- Buccal route provides one of the *potential routes* for typically large, hydrophilic and unstable proteins, oligonucleotides and polysaccharides as well as conventional small drug molecules.

Advantages Of Mucoadhesive Buccal Drug Delivery Systems

1. *Ease* of administration.
2. Termination of *therapy is easy*.
3. Permits localization of drug to the oral cavity for a *prolonged period of time*.
4. Can be administered to *unconscious patients*.
5. Offers an excellent route, for the systemic delivery of drugs with *high first pass metabolism*, thereby offering a greater bioavailability.
6. A significant *reduction in dose* can be achieved thereby *reducing dose related side effects*.

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- Drugs which are *unstable* in the *acidic environment* are destroyed by enzymatic or alkaline environment of intestine can be administered by this route.
- Drugs which show *poor bioavailability* via the *oral route* can be administered conveniently.
- The presence of saliva ensures relatively *large amount of water* for drug *dissolution* unlike in case of rectal and transdermal routes.
- Systemic absorption is rapid.
- This route provides an *alternative* for the *administration* of various hormones, narcotic analgesic, steroids, enzymes, cardiovascular agents etc.
- The buccal mucosa is *highly perfused* with blood vessels and offers a greater permeability than the skin.

Disadvantages

- 1. Drugs, which *irritate the oral mucosa*, have a bitter or unpleasant taste, odour; can not be administered by this route.
- 2. Drugs, which are *unstable at buccal pH* can *not* be *administered* by this route.
- 3. Only drugs with *small dose* requirements can be administered.
- 4. Drugs may *swallow with saliva* and loses the advantages of buccal route.
- 5. Only those drugs, which are absorbed by passive diffusion can be administered by this route.
- 6. Eating and *drinking* may become *restricted*.

Limitations:

- The mucus is constantly removed from the epithelial surfaces. It will eventually wash out the dosage form from the site of application.
- The mucous turn over rate is different from person to person so fabrication of the dosage form is difficult.
- The adhesion rate of dosage form in the body may not be as per proposed specification due to disease state, different physiological factors, etc.

Limitations:

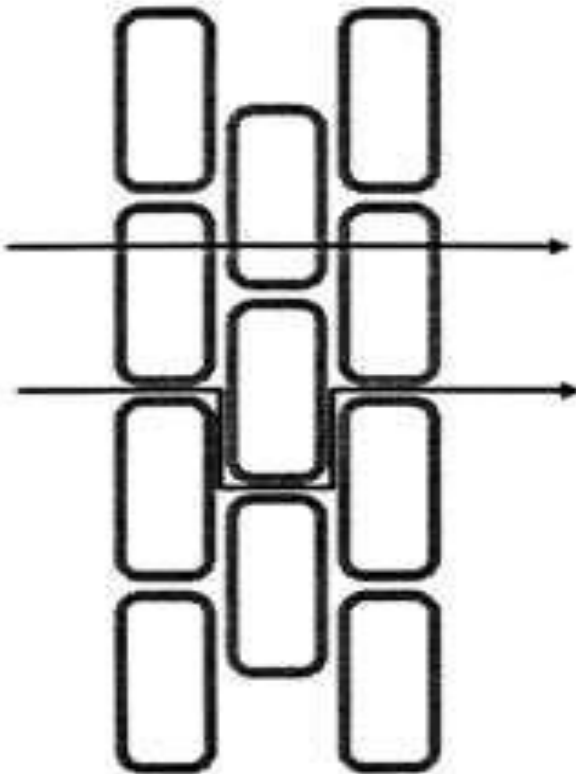
- The good mucoadhesive polymers that will fulfill all the requirements are less.
- Mucoadhesive polymers are poly electrolytes. Slight variation in pH, charge of the mucus changes mucoadhesion property of polymer significantly.
- This type of drug delivery system is not suitable for drugs that causes tissue irritation

Uses of Buccal Delivery

- ✓ The oral cavity can be used for local and systemic therapy.
- ✓ Examples of local therapy would be the treatment of oral infections , dental caries, mouth ulcers, stomatitis , gingivitis etc.
- ✓ The buccal route is of particular interest with regard to the systemic delivery of small molecules that are subjected to first-pass metabolism

Drug Delivery Pathways

Two possible routes of drug absorption through oral mucosa .



Transcellular route

(Preferred by lipophilic drugs)

Paracellular route

(preferred by hydrophilic drugs)

Oral Mucosa

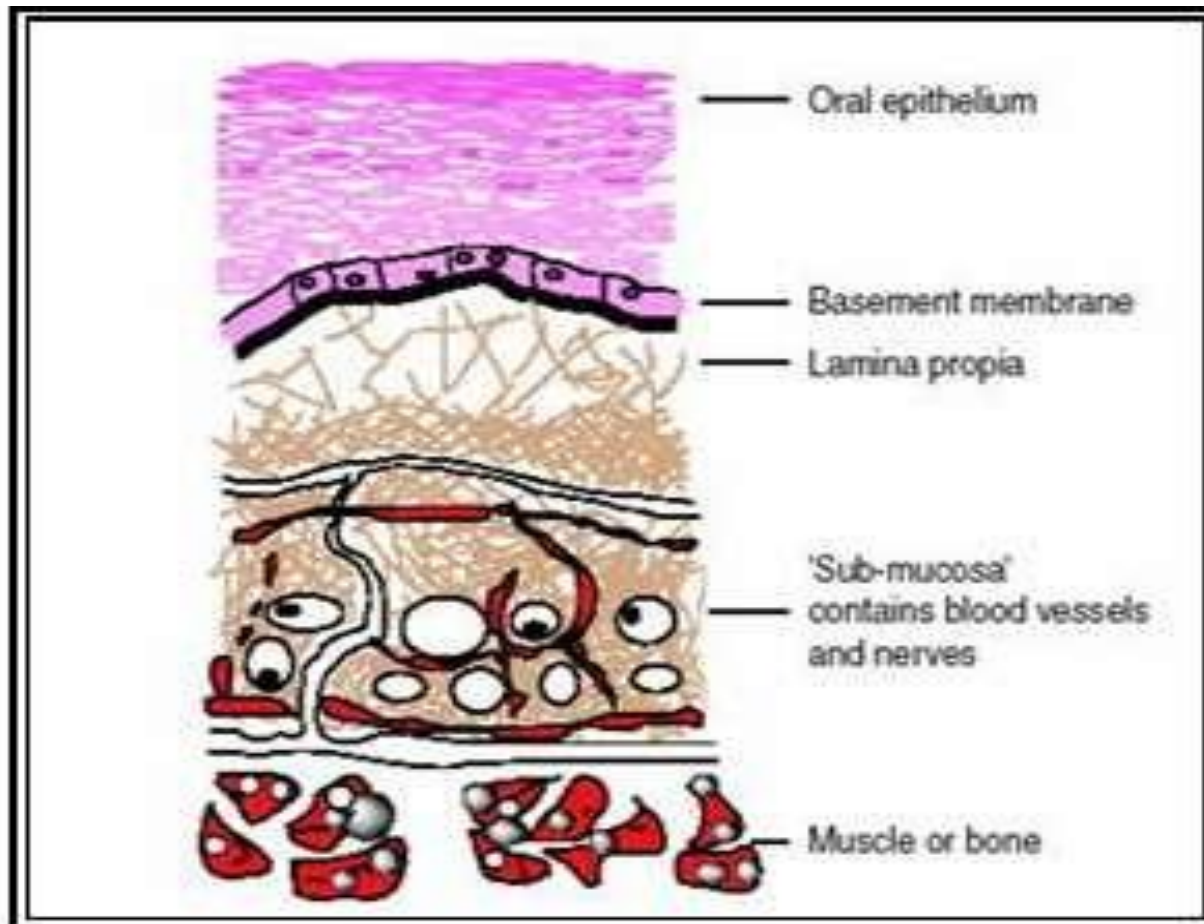


Fig. 1. Cross section view of buccal mucosa

Environment Of Buccal Mucosa

- The cells of the oral epithelia are surrounded by an intercellular ground substance, mucus.
- The oral cavity is marked by the presence of saliva produced by the salivary glands.
- Mucus which is secreted by the major and minor salivary glands as part of saliva .

Environment Of Buccal Mucosa

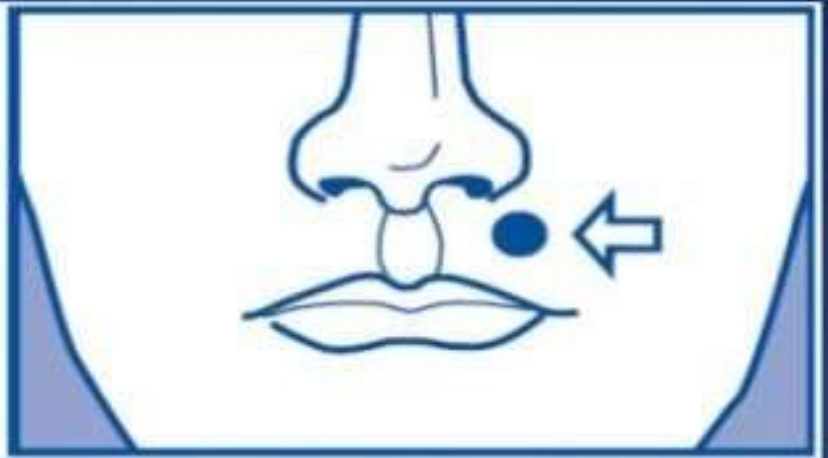
- **Role of Saliva**
- Continuous mineralization / demineralization of the tooth enamel
- Protective fluid for all tissues of the oral cavity
- To hydrate oral mucosal dosage forms
- **Role of Mucus**
- Bioadhesion of mucoadhesive drug delivery systems
- Made up of proteins and carbohydrates
- Cell-cell adhesion
- Lubrication

Buccal Drug Delivery And Mucoadhesivity

Mucoadhesion of the device is a key element
The term '*mucoadhesive*' is commonly used for materials that *bind to the mucin layer* of a biological membrane.

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Achieve systemic delivery of drugs include tablets, patches, tapes, films, Semisolids and powders.



A. Just applied



B. After 1 hour



C. After 5 hours



D. After 10 hours

Design Of Buccal Dosage Form

- **Matrix type :**

The Buccal patch designed in a matrix configuration contains drug, adhesive, and additives mixed together.

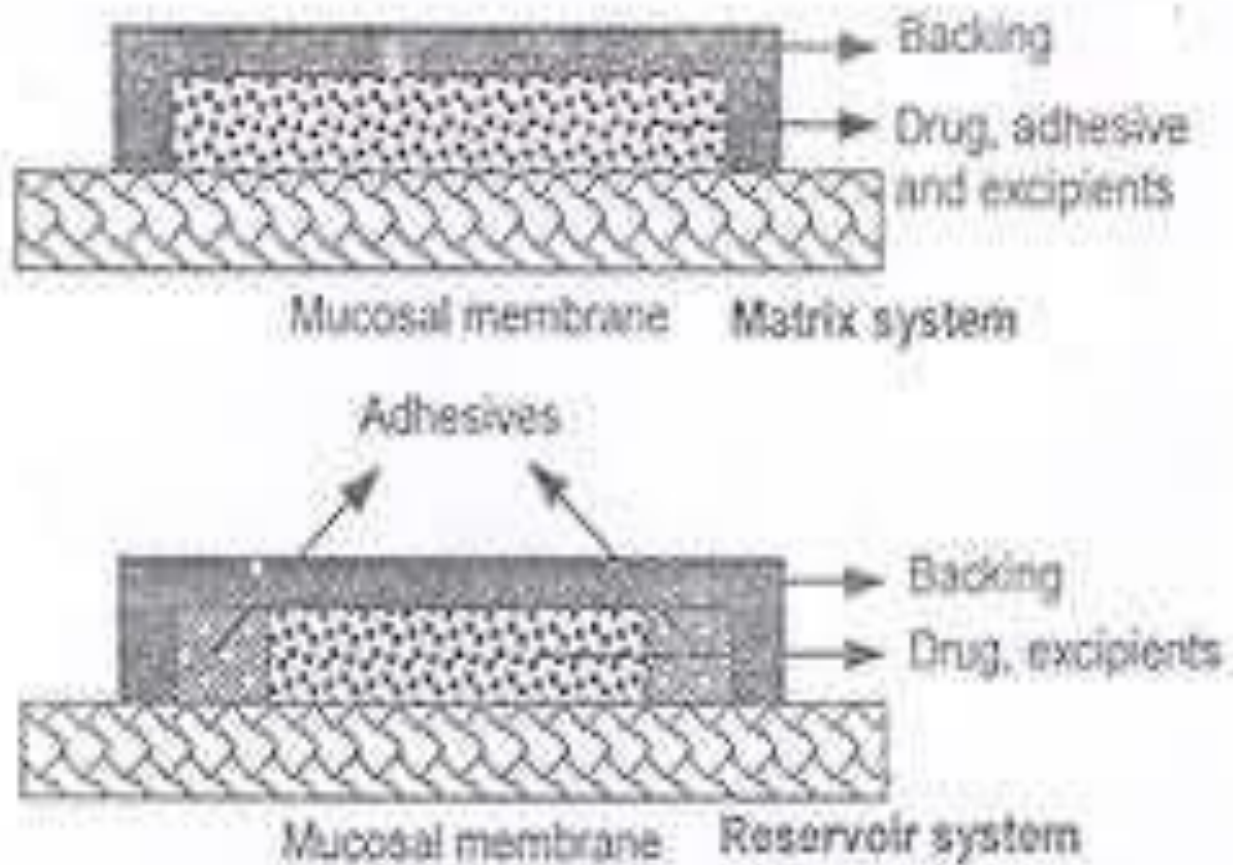
Bi-directional patches release drug in both the mucosa and the mouth

Drug + Mucoadhesive Matrix

Design Of Buccal Dosage Form

- **Reservoir type:** The buccal patch designed in a reservoir system contains a cavity for the drug and additives separate from the adhesive.
- Impermeable backing is applied to control the direction of drug delivery; to reduce patch deformation and disintegration while in the mouth; and to prevent drug loss.

Design Of Buccal Dosage For



BUCCAL MUCOADHESIVE DOSAGE FORMS

- Three types based on their geometry

Type-I

1. Single layer device with multidirectional release.
2. Significant drug loss due to swallowing.

Type-II

1. Impermeable backing layer is superimposed.
2. Preventing drug loss into the oral cavity.

Type-III

1. Unidirectional release device, drug loss is minimal.
2. Achieved by coating every face except contact face.

BUCCAL FORMULATION

- **Buccal tablets :**
- Buccal tablets are small, flat, and oval shaped dosage form.
- Unlike conventional tablets, buccal mucoadhesive tablets allow for drinking and speaking without major discomfort .
- They soften, adhere to the mucosa , and are retained in position until dissolution and/or release is complete .
These tablets can be applied to different sites in the oral cavity, including the palate, the mucosa lining the cheek, as well as between the lip and the gum .

Buccal tablets

- These tablets are usually prepared *by direct compression* , but wet granulation techniques can also be used.
- *Multilayered* tablet may be prepared by *sequentially adding and compressing the ingredients layer by layer*.
- Some newer approaches use tablets that melt at body temperature.
- The two buccal bioadhesive tablets Commercially available buccoadhesive tablets in UK are " Bucastem " (Nitroglycerine) and " Suscard buccaP '(Prochloroperazine).
- *Examples:*
- a) Nitroglycerin bioadhesive tablets for the treatment of angina pectoris.
- b)Sumatriptan succinate buccal adhesive tablet which is effective in the acute treatment of migraine and cluster headache.

Buccal Patch/Film

- Buccal Patch/Film are laminates consisting of an impermeable backing layer, a drug-containing reservoir layer from which the drug is released in a controlled manner, and a bioadhesive surface for mucosal attachment .
- Two methods used to prepare adhesive patches include *solvent casting* and *direct milling* .
- In the solvent casting method , the intermediate sheet from which patches are punched is prepared by casting the solution of the drug and polymer(s) onto a backing layer sheet and subsequently allowing the solvent(s) to evaporate.

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- In the **direct milling method** , formulation constituents are homogenously mixed and compressed to the desired thickness, and patches of predetermined size and shape are then cut or punched out.
- An impermeable backing layer may also be applied to control the direction of drug release , prevent drug loss, and minimize deformation and disintegration of the device during the application period.
- **Example:** a) Isosorbid dinitrate in the form of unidirectional erodible buccal film are developed and characterized for improving bioavailability. b) Buccal film of salbutamol sulphate and terbutalin sulphate for the treatment of asthma. c) Buccoadhesive film of clindamycin used for pyorrhoea treatment

Buccal Gel/Ointment

- Buccal Gel/Ointment Such semisolid dosage forms have the advantage of *easy dispersion* throughout the oral mucosa .
- Has been overcome by using bioadhesive formulations .
- Certain bioadhesive polymers undergo a phase change from a liquid to a semisolid; this change enhances the viscosity , which results in sustained and controlled release of drugs

Evaluation Of Buccal Tablets

- ***Parameters of Evaluation :***
- Determination of residence time.
- Permeation studies.
- Swelling studies.
- Release rate studies.
- Toxicity and irritation study.
- Bioadhesion measurement.
- Folding Enduance Content uniformity.
- Surface pH: 1% agar solution for 2 hrs and equill. for 1 min.

PRODUCT

1. Oral bioadhesive formulation :

Corlan – hydrocortisone succinate

Bonjela – hypromellose

Daktarin – miconazole

Corsodyl – chlorohexidine

2. Buccal mucosa formulation :

Buccastem – nausea , vomiting, vertigo

Suscard- angina

CONCLUSION

- Buccal drug delivery is a promising area for systemic delivery of orally inefficient drugs as well as an attractive alternative for noninvasive delivery of potent peptide and perhaps protein drug molecules

REFERENCES

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