UNIT VI

BUCCAL DRUG DELIVERY SYSTEM

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INTRODUCTION

The Buccal mucosa lines the inner cheek

Placed between the upper gingivae and cheek

Treat local and systemic conditions

Typically large, hydrophilic and unstable proteins, oligonucleotides and polysaccharides
An ideal dosage regimen in the drug therapy of any disease is the one, which immediately attains the desired therapeutic concentration of drug in plasma (or at the site of action) and maintains it constant for the entire duration of treatment.
ADVANTAGES

- Avoids first pass effect
- Abundance of blood vessel
- Less hostile environment than GIT
- Ease of administration and termination
- Fast cellular recovery
- Directly & easily modify microenvironment
- Lower intersubject variability as compared to transdermal patches
Contd…

- Permeability enhancers
- Rapid absorption possible & hence relatively rapid onset of action
- In comparison to TDDS, mucosal surfaces do not have a stratum corneum thus, the major barrier layer is absent
DISADVANTAGES

- Relatively small absorptive surface area (0.01 sq m vs 100 sq m for GIT)
- Movement affects mucoadhesive systems
- Less permeable than the small intestine
- Salivation and swallowing
- Taste of the drug
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.
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
Two possible routes of drug absorption through oral mucosa
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

Achieve systemic delivery of drugs include tablets, patches, tapes, films, semisolids and powders
BIOADHESIVE DDS FOR MUCOSAL DRUG DELIVERY

1. A liquid polymer solution containing drug is contacted with a mucosal surface.

2. Polymer adheres and forms a gel at mucosal surface temperature.

3. Drug, d, is slowly released as polymer erodes away.

4. Final condition: drug has been delivered and polymer has eroded away.
MUCOADHESIVE POLYMERS

GENERAL PHYSIOCHEMICAL FEATURES

Predominantly anionic hydrophilicity with numerous hydrogen bond-forming groups

Suitable surface property for wetting mucus/mucosal tissue surfaces and

Sufficient flexibility to penetrate the mucus network or tissue crevices
<table>
<thead>
<tr>
<th>Carboxymethyl cellulose</th>
<th>Carbopol</th>
<th>Polycarbophil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium Alginate</td>
<td>Hydroxyethyl cellulose</td>
<td>Hydroxypropyl methylcellulose</td>
</tr>
<tr>
<td>Chitosan</td>
<td>Gelatin</td>
<td>Pectin</td>
</tr>
</tbody>
</table>
CONSIDERATION

The drug must resist, or be protected by salivary and tissue enzymes

The drug and adhesive materials must not damage the teeth, oral cavity

No keratinolysis, discoloration, and irritation
Hydrophilic macromolecules such as peptides, absorption enhancers have been used.
Smaller molecules greater transport.
No ionized forms have greater transport.
More lipid soluble higher its permeability.
More partition coefficient more permeability.
Lipid-soluble drug stores in Obese individuals.
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.
• **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.
BUCCAL MUCOADHESIVE DOSAGE FORMS

Three types based on their geometry

Type-I
- single layer device with multidirectional release
- significant drug loss due to swallowing

Type-II
- impermeable backing layer is superimposed
- preventing drug loss into the oral cavity

Type-III
- unidirectional release device, drug loss is minimal
- achieved by coating every face except contact face
**Peptides and Proteins: Buccal Absorption**

Fig. 4  Schematic diagram showing the geometric designs of buccal delivery devices. (From Ref. 9.)
BUCCAL FORMULATION

Buccal tablets
- Most commonly investigated dosage form for Buccal drug
- Tablets are small, flat, and oval, with a diameter of approximately 5–8 mm
- Tablets can be applied to different sites in the oral cavity
- Drawback: lack of physical flexibility, poor patient compliance

Buccal patches
- laminates consisting of an impermeable backing layer, a drug-containing reservoir layer, a bioadhesive surface for mucosal attachment
- similar to those used in transdermal drug delivery
- Backing layer control the direction of drug release, prevent drug loss, minimize deformation and disintegration
Contd...

**Buccal films**
- Most recently developed dosage form for Buccal administration
- Preferred over adhesive tablets in terms of flexibility and comfort
- Flexible, elastic, and soft, yet adequately strong
- Effective in oral disease

**Buccal gels**
- Semisolid dosage forms, have the advantage of easy dispersion throughout the oral mucosa
- may not be as accurate as from tablets, patches, or films
- Poor retention of the gels at the site of application has been overcome by using bioadhesive formulations
EXPERIMENTAL METHODOLOGY FOR BUCCAL PERMEATION STUDIES

EVALUATION

In vitro Methods

In vivo Methods
IN VITRO EVALUATION

- Percentage increase in weight
- Swelling properties of films
- Shear stress method
- Folding endurance
- Diffusion study
- Thickness study
IN VIVO EVALUATION

1  2  3  4  5

Intelli Drug Device
## ACTIVE INGREDIENTS DELIVERED VIA A BUCCAL ROUTE

<table>
<thead>
<tr>
<th>Insulin</th>
<th>nicotin</th>
<th>nifedipine</th>
<th>Flurbiprofen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acyclovir</td>
<td>pindolol</td>
<td>oxytocin</td>
<td>Diclofenac sodium</td>
</tr>
<tr>
<td>Arecoline</td>
<td>Propolis</td>
<td>Omeprazole</td>
<td>Melatonin</td>
</tr>
<tr>
<td>Carbamazepine</td>
<td>Fluride</td>
<td>Danazol</td>
<td>Testosterone</td>
</tr>
<tr>
<td>Chlorhexidine diacetate</td>
<td>Metoprolol tartrate</td>
<td>Chlorhexidine diacetate</td>
<td>Morphine sulphate</td>
</tr>
</tbody>
</table>
RECENT & FUTURE OF BDDS

- Buccal nitroglycerin, can use for acute therapy for an anginal attack as well as for chronic prophylaxis

- Novel liquid aerosol formulation of insulin

- Development of suitable delivery devices, permeation enhancement, and Buccal delivery of drugs that undergo a first-pass effect, such as cardiovascular drugs, analgesics, and peptides

- Research yield some successes
- Promote further research; more companies
- Rest depend on delivery technology
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.
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THANK YOU
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