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Review Article

RECENT ADVANCES IN MUCOADHESIVE BUCCAL DRUG DELIVERY SYSTEMS AND ITS MARKETED SCOPE AND OPPORTUNITIES

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ABSTRACT

Extensive efforts have been focused on targeting a drug or drug delivery system in a particular region of the body for extended period of time, not only for local targeting of drug but also for better compliance of systemic drug delivery. Mucoadhesive characteristics are a factor of both the bioadhesive polymer and the medium in which the polymer will reside. Buccal dosage forms can be of Matrix or Reservoir types. However, this route could become a significant means for the delivery of a range of active agents in the coming years, if the barriers to buccal drug delivery are overcome. Mucoadhesive drug delivery system prolong the residence time of the dosage form at the site of application or absorption and facilitate an intimate contact of the dosage form with the underline absorption surface and thus contribute to improved and better therapeutic performance of the drug. To overcome the relatively short gastrointestinal (GI) time and improve localization for oral controlled or sustained release drug delivery systems, bioadhesive polymers that adhere to the mucin/epithelial surface are effective and lead to significant improvement in oral drug delivery. Improvements are also expected for other mucus-covered sites of drug administration. Bioadhesive polymers find application in the eye, nose, and vaginal cavity as well as in the GI tract, including the buccal cavity and rectum.

KEYWORDS : Mucosa, mucoadhesion, mucoadhesive polymers, mucoadhesive drug delivery system

INTRODUCTION

Conventional dosage forms for delivery of drugs via the oral mucosa include solutions, erodible or chewable, buccal or sublingual tablets and capsules. Unfortunately, a major portion of the drug in these systems may be unavailable due to involuntary swallowing and a very short residence time, because of mastication, speech etc

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and hence sustained release is usually not within the scope of such formulations[1]. In recent years, significant interest has been shown in the development of novel bioadhesive dosage forms for mucosal delivery of drugs that attempt to overcome these limitations[1] Drug absorption into the oral mucosa is mainly via passive diffusion into the lipoidal membrane. Compounds with partition coefficient in the range 40-2000 and pK_a 2-10 are considered optimal to be absorbed through buccal mucosa. Compounds administered by buccal route include steroids, barbiturates, papain, and trypsin etc[1]. Drugs can be absorbed from the oral cavity through the oral mucosa either by sublingual or buccal route[1]. Absorption of therapeutic agents from these routes overcomes premature drug degradation within the gastrointestinal tract as well as active drug loss due to first-pass hepatic metabolism that may be associated with oral route of administration[3]. In general, rapid absorption from these routes is observed because of the thin mucus membrane and rich blood supply. After absorption, drug is transported through the deep lingual vein or facial vein which then drains into the general circulation via the jugular vein, bypassing the liver and thereby sparing the drug from first-pass metabolism[1, 2]. Since sublingual administration of drugs interferes with eating, drinking and talking, this route is generally considered unsuitable for prolonged administration. On the other hand, the duration of buccal drug administration can be prolonged with saliva activated adhesive polymers without the problems of sublingual administration[1, 2]. In recent years, significant interest has been shown in the development of novel bioadhesive dosage forms for mucosal delivery of drugs that attempt to overcome these limitations [1]. A bioadhesive dosage form necessitates the use of mucoadhesive polymers to adhere to mucosa and withstand salivation, tongue movement and swallowing for significant period of time [2]. High molecular weight polymers are generally used for bioadhesion. Hydrogen bonding due to hydrophilic groups such as -COOH or -OH plays an important role in bioadhesion [3] The focus of pharmaceutical research is being steadily shifted from the development of new chemical entities to the development of novel drug delivery system (NDDS) of existing drug molecule to maximize their effect in terms of therapeutic action and patient protection. Mucoadhesive systems are known to provide intimate contact between dosage form and the absorptive mucosa, resulting thereby in a high drug flux through the absorbing tissue. In addition, mucoadhesive dosage forms have been used to target local disorders at the mucosal surface to reduce the overall dosage required and to minimize the side effects that may be caused by the systemic administration of the drugs.

ADVANTAGES OF MUCOADHESIVE BUCCAL DRUG DELIVERY SYSTEMS[1, 4, 5, 6, 13]:

Drugs administration via oral mucosa offers several advantages

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.

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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.
7. Drugs which are unstable in the acidic environment are destroyed by enzymatic or alkaline environment of intestine can be administered by this route.
8. Drugs which show poor bioavailability via the oral route can be administered conveniently.
9. It offers a passive system of drug absorption and does not require any activation.
10. The presence of saliva ensures relatively large amount of water for drug dissolution unlike in case of rectal and transdermal routes.
11. Systemic absorption is rapid.
12. This route provides an alternative for the administration of various hormones, narcotic analgesic, steroids, enzymes, cardiovascular agents etc.
13. The buccal mucosa is highly perfused with blood vessels and offers a greater permeability than the skin.

LIMITATION OF BUCCAL DRUG ADMINISTRATION[1, 4, 5, 6, 13]:

Drug administration via buccal mucosa has certain limitations.

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.
7. Swallowing of the formulation by the patient may be possible.
8. Over hydration may lead to the formation of slippery surface and structural integrity of the formulation may get disrupted by the swelling and hydration of the bioadhesive polymers.

MARKETED SCOPE AND OPPORTUNITIES

Novel drug delivery systems are becoming one of the most important fields in the modern pharmaceutical formulation technology. Several techniques areemployed to design the sustained or controlled drug delivery systems. Studieson mucoadhesive systems have focused on a broad array of aspects. It is a growth areawhose goal is the development of new devices and more “intelligent” polymers,as well as the creation of new methodologies that can better elucidate themucoadhesion phenomenon. With the great influx of new molecules stemmingfrom drug

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research, mucoadhesive systems may play an increasing role in thedevelopment of new pharmaceuticals. The advantages are tremendous which make further study in this field extremely important. The formulation of these drug delivery systems depends on the developments of suitable polymers with excellent mucosal adhesive properties, stability and biocompatibility. The buccal cavity provides a highly vascular mucous membrane site for the dministration of drugs. The epithelial lining of the oral cavity differs both in type (keratinized and non-keratinized) and thickness in different areas, and the differences give rise to regional variations in permeability to drugs. So far, the oral mucosa has been utilized for the delivery of small drug molecules, since their adsorption occurs more reproducibly and rapidly. The main advantages of the buccal route of administration over the traditional per oral route are that drug degradation in the stomach is avoided, first-pass metabolism is avoided, and therapeutic drug levels of drug can be achieved rapidly. Clearly these advantages are presently clinically relevant for only a limited number of drugs. However, with the recent developments of new formulation types, such as mucoadhesive preparations and the use of peptides as drugs, this number may increase in the future. . Mucoadhesive drug delivery systems available in the market include aftach tablet (Triamcinolone acetonide), suradrin tablet (Nitroglycerin), Buccostem tablet (prochlormperazine maleate). Salcoat powder sprays (Beclomethazone dipropionate. Rhinocort powder spray (Beclomethazone Dipropionate) and sucralfate (Aluminum hydroxide). Though there are only a few mucoadhesive formulations available currently, it can be concluded that drug delivery using mucoadhesive formulations offers a great potential both for systemic and local use in the near future. Mucoadhesive drug delivery systems, are gaining popularity day by day in the global pharma industry and a burning area of further research and development. Extensive research efforts throughout the world have resulted in significant advancesin understanding the various aspects of mucoadhesion. The research on mucoadhesives, however, is still in its early stage, and further advances need to be made for the successful translation of the concept into practical application in controlled drug deliverysystem (CDDS). There is no doubt that mucoadhesion has moved into a new area with these new specific targeting compounds (lectins, thiomers, etc.) with researchers and drug companies looking further into potential involvement of more smallercomplex molecules, proteins and peptides, and DNA for future technological advancement in the ever-evolving drug delivery arena.

FACTORS INFLUENCING DRUG ABSORPTION FROM THE ORAL CAVITY[4,6]:

As the oral mucosa is a highly vascular tissue, the main factors that influence drug absorption from the mouth are:

a) The permeability of the oral mucosa to the drug.

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b) Physicochemical characteristics of the drug and
c) Miscellaneous factors

a) Permeability of the oral mucosa to drugs [1, 4, 6]

Permeability of the buccal mucosa is 4-4000 times greater than that of the skin. As indicated by a wide range in this reported values, there are considerable differences in permeability between different regions of the oral cavity. In general, permeability of the oral mucosa decreases in the order of sublingual greater than buccal and buccal greater than palatal. This is based on the relative thickness and degree of keratinization of these tissues.

The keratin layer is an effective barrier to penetration of human skin by water soluble substances. The permeability barriers of the oral mucosa are supposed to reside within the superficial layers of the epithelium. It has been shown that for some compounds the barrier to penetration is not the upper one third of the epithelium. Alfano and his coworkers studied the penetration of endotoxins through non-keratinized oral mucosa. The results indicated that the basement membrane is a rate limiting barrier to permeation[1].

Some workers have suggested that the permeability barrier in the oral mucosa is a result of intercellular material derived from the so-called "Membrane Coating Granules" (MCGs). The barriers exist in the intermediate cell layers of many stratified epithelia and are of 100-300 nm in diameter.

Other factors which may affect the permeability of molecules include exogenous substances placed in the mouth for their local effects, such as mouthwashes and toothpastes, which contain surfactants and nutritional deficiencies.

b) Physicochemical characteristics of the drug[6]:

The various physicochemical characters that play an important role in absorption of drug from the oral cavity are considered below:

i) Molecular weight:

Molecules penetrate the oral mucosa more rapidly than ions and smaller molecules more rapidly than larger molecules. In case of hydrophilic substances, the rate of absorption appears to be rapid for small molecules (molecular weight less than 75-100 Da), but permeability falls off rapidly as the molecular size increases.

ii) **Degree of ionization:**

The average pH of saliva is 6.4. Because the un-ionized form of a drug is the lipid-soluble-diffusible form, the pK_a of the drug plays an important role in its absorption. Adequate absorption through the oral mucosa occurs if the pK_a is greater than 2 for an acid or less than 10 for a base.

iii) Lipid solubility:

A common way of assessing the lipid solubility of a drug is to measure its oil-water partition coefficient. Partition coefficient between 40-2000 is necessary for optimal drug absorption. If the partition co-efficient exceeds 2000, solubility in the saliva is insufficient to provide the concentration gradient necessary for drug absorption. That is in addition to high lipid solubility, the drug should be soluble in aqueous buccal fluids for absorption.

iv) pH of the saliva :

The saliva pH ranges from 5.5 to 7 depending on the flow rate. At high

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flow rates, the sodium and bicarbonate concentration increases leading to and increase in the pH[6]. Absorption is maximum at the un-ionized form of drug in pH of saliva.

c) Miscellaneous:

i) Binding to oral mucosa:

Systemic availability of drugs that bind to oral mucosa is poor.

ii) Storage Compartment:

A storage compartment in the buccal mucosa appears to exist which is responsible for the slow absorption of drugs. iii) Thickness of oral epithelium:

Sublingual absorption is faster than buccal since the epithelium of former region is thinner and immersed in a larger volume of saliva.

MECHANISM OF BUCCAL ABSORPTION[6, 7]:

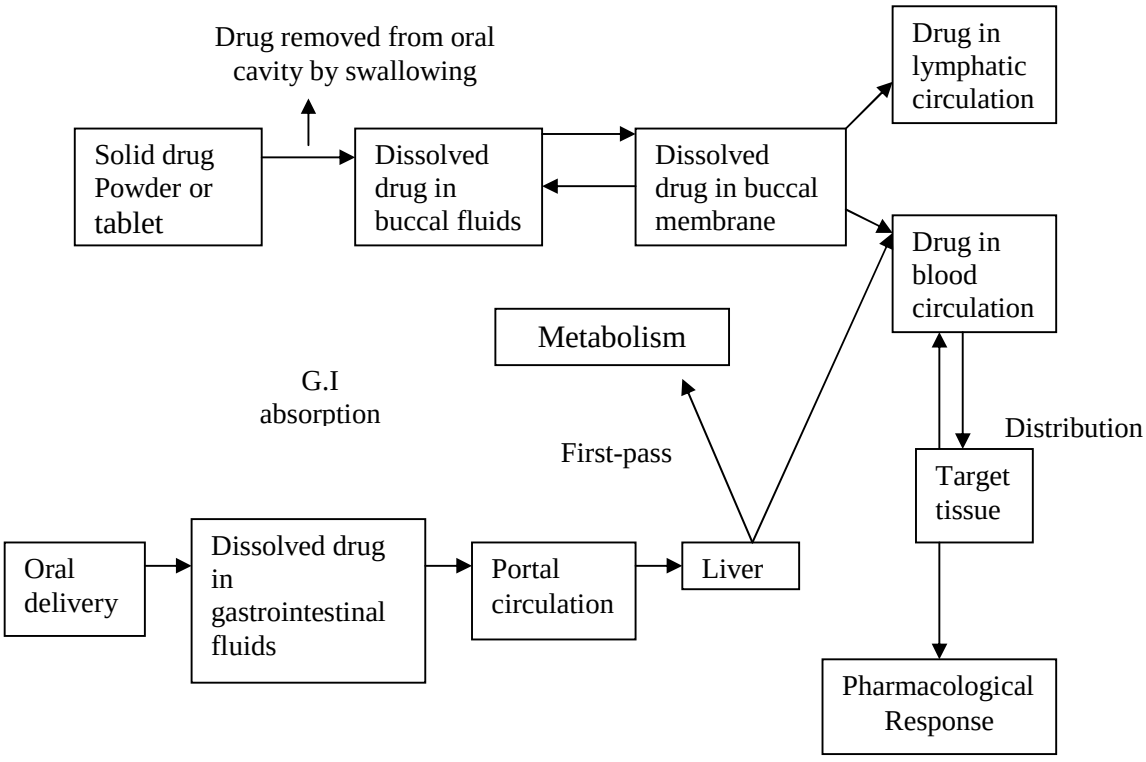

Fig. 1: Comparative Drug Absorption between Oral & Buccal Route

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As shown in fig.1 buccal route provides the potential pathway to bypass first-pass effect following oral administration. The mechanisms by which drugs cross biologic lipid membranes are passive diffusion, facilitated diffusion, active transport and pinocytosis. Among these, majority of drugs move across oral mucosa by passive mechanism which is governed by the laws of diffusion.

In case of simple diffusion, two potential routes of drug transport are the paracellular or aqueous pore pathway and transcellular or lipoidal pathway, as shown in fig.3.

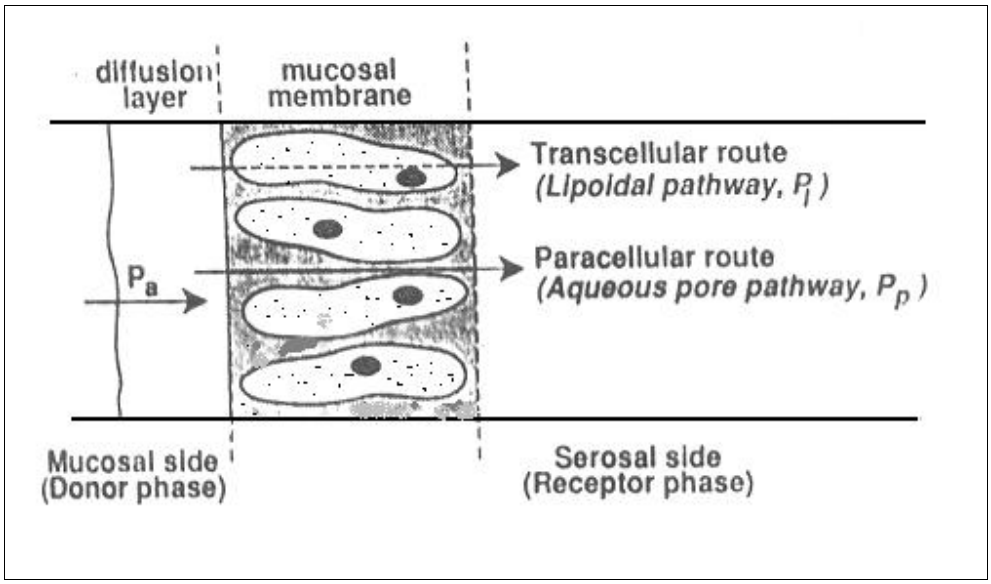

Fig. 2 Trans-membrane permeation across a mucosal membrane.

The para-cellular route involves the passage of molecules through intercellular space, while tran-scellular route involves transport into and across cells. Substances with high lipid solubility are expected to cross the oral mucosa by lipoidal pathway, while water-soluble substances and ions are expected to cross the oral mucosa by aqueous pore pathway. Although passive diffusion is the major transport mechanism for drugs, the absorption of nutrients from the mouth has been shown to involve carrier systems.

BIOADHESION AND MUCOADHESION [1,3,4,7]:

The term bioadhesion refers to any bond formed between two biological surfaces or a bond between a biological and a synthetic surface. In the case of bioadhesive drug delivery systems, it is a bond formed between polymers and soft tissues. If the bond is formed between

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mucus and polymer, it is described as mucoadhesion.

Although the target of many bioadhesive delivery systems may be a soft tissue cell layer (i.e. epithelial cells), the actual adhesive bond may form with either the cell layer, a mucous layer or a combination of the two. In instances in which bonds form between mucus and polymer, the term mucoadhesion is used synonymously with bioadhesion. In general, bioadhesion is an all-inclusive term used to describe adhesive interactions with any biological or biologically derived substance, and mucoadhesion is used only when describing a bond involving mucus or a mucosal surface.

a) **Mechanism of Bioadhesion[3, 4]:**

The *mechanisms* responsible for the formation of bioadhesive bonds are not completely clear. Most research has been focused on analyzing bioadhesive interactions between polymer hydrogels and soft tissues.

Mechanism of bioadhesion can be described in three successive steps:

1. Wetting and swelling of polymer to permit intimate contact with biological tissue.
2. Interpenetration of bioadhesive polymer chains and entanglement of polymer and mucin chains and
3. Formation of weak chemical bonds between entangled chains.

The figure no.4 shows the schematic presentation of steps involved in bioadhesion

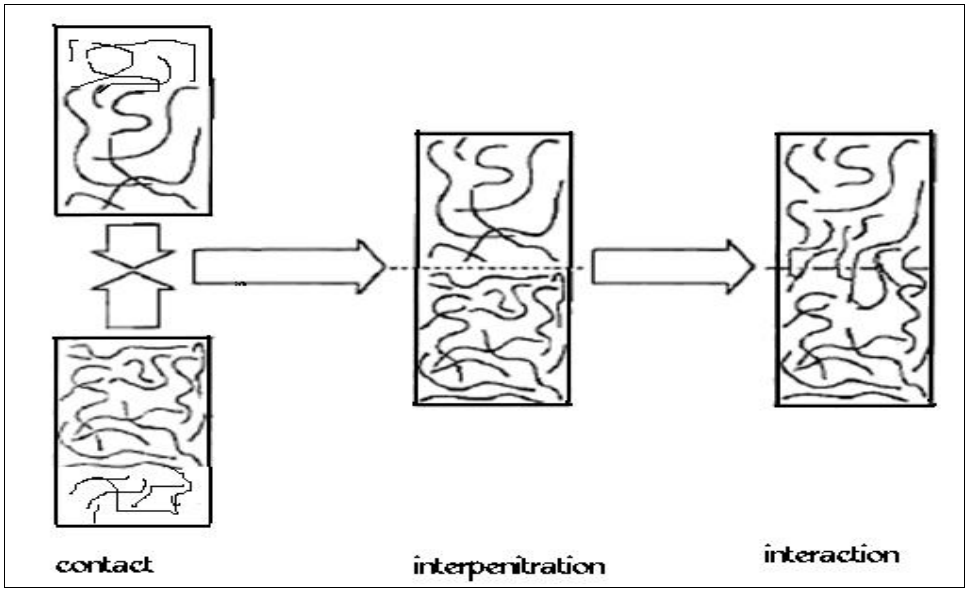

Fig. 3: Schematic presentation of steps involved in bioadhesion[9].

Following are the some of polymer characteristics that are required to obtain adhesion[7]:

- Sufficient quantities of hydrogen- bonding chemical groups (-OH and COOH).
- Anionic surface charges
- High molecular weight

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of mucin strands with flexible polymer chains and/or interpenetration of mucin strands into a porous polymer substrate.

b) Theories of Bioadhesion[1,4, 8]:

High chain flexibility and

Surface tension that will induce spreading into the mucus layer.

Each of these characteristics favors the formation of bonds that are either chemical or mechanical in origin[1, 4, 8].

Chemical bonds include strong primary bonds (i.e. covalent bonds), as well as weaker secondary forces such as ionic bonds, vander-Waals interactions and hydrogen bonds. Both types of interactions have been exploited in developing bioadhesive drug delivery systems

Mechanical bonds can be thought of as physical connections between surfaces, similar to interlocking puzzle pieces. Macroscopically, they involve the inclusion of one substance in the cracks or crevices of another. On a microscopic scale, they can involve physical entanglement

Following are the theories that have been adopted to study bioadhesion.

i) The Electronic Theory:

According to this theory, electron transfer occurs upon contact of an adhesive polymer with a mucus glycoprotein network because of differences in their electronic structures. This results in the formation of an electrical double layer at the interface. Adhesion occurs due to attractive forces across the double layer.

ii) The Adsorption Theory:

According to this theory, after an initial contact between two surfaces, the material adheres because of surface forces acting between the atoms in the two surfaces. Two types of chemical bonds resulting from these forces are:

- Primary chemical bonds of covalent nature.
- Secondary chemical bonds having many different forces of attraction including electrostatic forces, Vander Waals forces, and hydrogen and hydrophobic bonds.

iii) The Wetting Theory:

This theory describes the ability of mucus to spread and develop intimate contact with its corresponding substrate which is one important factor in bond formation. The wetting theory uses interfacial tensions to predict spreading and in turn adhesion.

Diffusion Theory:

According to this theory the polymer chains and the mucus mix to a sufficient depth to create a semi permanent adhesive bond. The exact depth to which the polymer chains penetrate the mucus **iv) The** depends on the diffusion coefficient and the time of contact. This diffusion coefficient, in turn, depends on the value of molecular weight between cross-links and decreases significantly as the linking density increases.

v) The Fracture Theory:

This theory analyzes the forces required to separate two surfaces after adhesion. The maximum tensile stress produced during detachment can be determined by dividing the maximum force of detachment by the total surface area involved in the adhesive interaction.

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It does not require measuring entanglement, diffusion or interpenetration of polymer chains.

FACTORS AFFECTING MUCOADHESION[1, 4, 8]:

The mucoadhesive power of a polymer is affected by the nature of polymer and also by the nature of surrounding medium.

a) Polymer Related Factors:

i) Molecular weight:

For the successful mucoadhesion, the molecular weight of polymer should be at least 100000. For example, polyethylene glycol (PEG), with a molecular weight of 20000 has a little adhesive character, where as PEG-200000 has improved and a PEG-400000 has superior adhesive properties. Thus mucoadhesiveness improves with increasing molecular weight for linear polymers.

ii) Concentration:

There is an optimum concentration of a mucoadhesive polymer to produce maximum mucoadhesion. In highly concentrated systems, the adhesive strength drops significantly, because the coiled molecules become separated from the medium so that the chains available for interpenetration become limited.

iii) Chain flexibility:

This factor is important in case of interpenetration and entanglement. As water soluble polymers become cross linked, mobility of individual polymer chains
decrease and thus the effective length of the chain that can penetrate into the mucus layer decreases, which reduces mucoadhesive strength.

b) Environment – Related Factors:

i) pH:

pH can influence the charge on the surface of mucus as well as of certain ionisable mucoadhesive polymers. Some studies have shown that the pH of the medium is important for the degree of hydration of crosslinked polyacrylic acid, showing consistently increased hydration from pH 4 through pH 7 and then a decrease as alkalinity and ionic strength increases.

ii) Contact Time:

Contact time between the mucoadhesive and mucus layer determines the extent of swelling and interpenetration of the mucoadhesive polymer chains. Moreover, mucoadhesive strength increases as the initial contact time increases.

iii) Swelling:

Swelling depends on the polymer concentration, ionic strength, as well as presence of water. During the dynamic process of mucoadhesion, maximum mucoadhesion occurs with optimum water content. Over-hydration results in the formation of a wet slippery mucilage without adhesion.

iv) Physiological variables like, mucin properties, turnover and disease states:

The extent of interaction between the polymer and the mucus depends on mucus viscosity, degree of entanglement and water content. How long the mucoadhesive remains at the site depends on whether polymer is soluble or insoluble in water and the associated turnover rate of mucin. Estimates of mucin turnover vary widely, depending on location and method of measurement.

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MUCOADHESIVE POLYMERS [1, 5,6,7,8]:

Mucoadhesive polymers are water soluble and water insoluble polymers which are swellable networks jointed by cross linking agents. The polymers should possess optional polarity to make sure it is sufficiently wetted by the mucus and optimal fluidity that permits the mutual adsorption and interpenetration of polymer and mucus to take place. An ideal polymer for a mucoadhesive drug delivery system should have the following characteristics.

1. The polymer and its degradation products should be nontoxic and nonabsorbable in the gastrointestinal tract.
2. It should be nonirritant to the mucus membrane.
3. It should preferably form a strong noncovalent bond with the mucin epithelial cell surfaces.
4. It should adhere quickly to moist tissue and should possess some site specificity.
5. It should allow easy incorporation of the drug and offer non hindrance to its release.
6. The polymer must not decompose on storage or during shelf-life of the dosage form.
7. The cost of polymer should not be high.

Some of the mucoadhesive polymers along with their mucoadhesive property are summarized below:

Table: 1 Mucoadhesive polymers with their mucoadhesive property[5]

Sr.No	Polymer	Mucoadhesive property
1	Carbopol 934	+++
2	Carboxymethylcellulose	+++
3	Polycarbophil	+++
4	Tragacanth	+++
5	Sodium alginate	+++
6	Hydroxyethyl cellulose	+++
7	Hydroxypropyl methylcellulose	+++
8	Gum karaya	++
9	Guar gum	++
10	Polyvinylpyrrolidone	+
11	Polyethylene glycol	+
12	Hydroxypropyl cellulose	+

Note: +++ excellent, ++ fair, +poor

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BIOADHESIVE DOSAGE FORMS[1, 4, 7, 8]:

Bioadhesive dosage forms can be developed as sublingual, buccal or gingival systems for systemic drug delivery or local drug delivery at any particular site. Within the oral cavity, the buccal region has been extensively explored and appears promising for certain drugs.

I) Buccal Dosage Forms:

a) Adhesive tablets [1, 10, 12]:

Adhesive tablets are held between the gum and cheek. These are generally flat, elliptical or capsule-shaped. The parotid duct empties into the mouth at a point opposite the crown of the second upper molar, near the spot where buccal tablets are usually placed. This location provides the medium to dissolve the tablets and to provide for release of the medication. Buccal tablets are prepared either by the procedures used for granulation or by direct compression. Formulation contains no disintegrants, so the tablet will dissolve slowly. Flavouring agents and sweeteners are sometimes added to make the tablets more palatable, but this may result in increased flow rate of saliva, which is not desirable. It is also important to minimize the swallowing of saliva during the time that the buccal tablet is held in place. Since buccal tablets are to be held in the mouth for relatively long periods of time, particular care should be taken to see that all the ingredients are finely divided so that the tablets are not gritty or irritating.

Buccoadhesive tablet may be monolithic or bilaminated system. The main disadvantages of the monolayer tablet is the multidirectional release of the drug, hence some of the fraction of drug may swallowed. In order to avoid multidirectional release of the drug a bilaminated system was used. The Bilayered tablet made up of two layers, drug containing core layer and backing layer. The backing layer may be of water insoluble material like Ethyl cellulose or hydrogenated caster oil or may be polymeric coating layer which functioning as a adhesive and backing layer. A mucoadhesive delivery system with a backing layer on one side can be used for local as well as systemic transmucosal drug delivery. Such a backing layer avoids sticking of the tablet to the finger during application in the oral cavity.

The figure no. 5 shows the monolayer, Bilayered and compressed coated tablet and schematic release of the drug.

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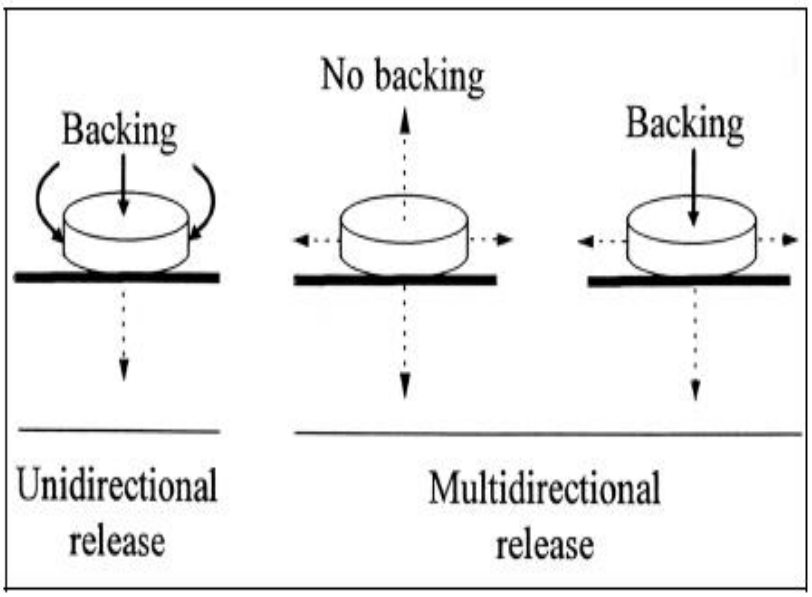

Fig. 4: Schematic representation of Unidirectional and Bidirectional release from buccal tablet

b) Adhesive gels[1, 4]:

Gels are usually clear, transparent, semisolids containing solubilized active substances. Gel forming hydrophilic polymers is typically used to prepare lipid-free semisolid dosage forms. e.g. Methylcellulose, carbopols, hydroxy ethylcellulose etc. Gel vehicles containing therapeutic agents are especially useful for application to mucus membranes and ulcerated or burned tissues, because their high water content reduces irritancy. Due to their plastic rheological behaviour they can remain to the surface of application for a reasonable duration before they are washed off. In comparison to solutions, gels can significantly prolong residence time and hence improve bioavailability.

c) Adhesive patches[1, 4]:

Patches may range from simple erodible or nonerodible adhesive disks to laminated systems. The size of buccal patch can vary from 1 to 15cm^2. Patches can be formulated with a backing layer providing unidirectional release of the drug into the mucus layer, thus minimizing loss of drug to the saliva and maximizing concentration gradient of the drug to the mucosa. On the other hand with no backing layer it can provide a bi-directional release of drug,

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resulting in significant loss during swallowing of saliva.

d) Adhesive ointments[1, 4]:

Three bases white petrolatum, hydrophilic petrolatum and lauromacrogol along with carbopol are used in preparing adhesive ointments. Bioadhesive ointments have been investigated as extensively as tablets and patches.

II) Sublingual[1, 4]:

Sublingual tablets are held beneath the tongue. These tablets can be either molded or compressed and are prepared from soluble ingredients, so that the tablets are completely and rapidly soluble. The requirements for sublingual tablets are rapid drug release and a correspondingly rapid physiologic response, which are normally best achieved with a rapid soluble molded tablet. However, compressed sublingual tablets normally have lesser weight variation and better content uniformity. Compressed tablets disintegrate quickly and allow the active ingredient to dissolve rapidly in the saliva.

III) Dental or gingival[1, 4]:

Denture adhesives are devices that are prescribed as an aid to retain dentures or reduce discomfort after the insertion of dentures. Both natural and synthetic hydrocolloids have been used for denture adhesives. The excipients of denture adhesives include swellable polymers, gels, antibacterial agents, and preservatives, fillers, wetting and flavoring agents. The disadvantages of using denture adhesives are the short and variable duration of action, nausea, damage to the prosthesis and the danger of prolonging the service life of an ill-fitting denture.

CONCLUSION

Mucoadhesive drug delivery system utilize the property of bioadhesion of certain water soluble polymer which become adhesive on hydration and hence can be used for targeting a drug to a particular region of the body for an extended period of time. Development of novel mucoadhesive delivery systems are being undertaken so as to understand the various mechanism of mucoadhesion and improved permeation of active agents. Many potential mucoadhesive systems are being investigated which may find their way into the market in near future. The idea of bioadhesive began with the clear need to localize a drug at a certain site in the GI tract. Therefore a primary objective of using bioadhesive systems orally would be achieved by obtaining a substantial increase in residence time of the drug for local drug effect and to permit once daily dosing.

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