A REVIEW ON MUCOADHESIVE BUCCAL PATCH AS A NOVEL DRUG DELIVERY SYSTEM

Gaurav Kumar Sharma*, Pramod Kumar Sharma, Mayank Bansal

Department of Pharmaceutical Technology, Meerut Institute of Engineering & Technology, NH-58, Baghpat Road-Bypass Crossing, Meerut-250005 (U.P), India

ABSTRACT

Drug release from mucoadhesive patches at predetermined rate in oral cavity having distinct advantages over traditional dosage forms as tablets, gels and solutions. This review provides brief information about method of preparation and evaluation of mucoadhesive buccal patches for the controlled systemic delivery of drug by which first pass hepatic metabolism can be avoided. Mucoadhesive buccal patches can be prepared by several methods as solvent casting method, semisolid casting, hot melt extrusion, solid extrusion dispersion and rolling method. After preparation of mucoadhesive patches next phase is evaluation of mucoadhesive patches those are weight variation, patch thickness, % volume entrapment efficiency, measurement of the % elongation at break, surface pH, folding endurance and stability study. A wide number of drugs have already been used in mucoadhesive buccal drug delivery system such as Prochlorperazine maleate, Glipizide, Felodipine, Ibuprofen, Diltiazem hydrochloride, Metoprolol tartrate, Atenolol, Chlorpheniramine maleate.

Keywords: Mucoadhesive buccal patches, Systemic delivery, Hepatic metabolism, controlled systemic delivery.

INTRODUCTION

In conventional routes of drug administration the rate and extent of absorption differs due to the various factors which may be drug itself, its formulation, presence of food, drug interactions, first-pass metabolism, and gastrointestinal pH. Apart from this, conventional routes of drug administration have many demerits. Better dosage forms or drug delivery mechanisms could minimize these problems. Buccal delivery of drugs provides an attractive alternate to the oral route of drug administration [1]. Drugs delivery via the buccal drugs utilization is patient compliance, because drug absorption can be terminate in condition of drug toxicity by removing buccal dosage form from buccal cavity [2]. The oral transmucosal drug delivery by passes liver and avoids pre-systemic elimination in the GI tract and liver especially peptides and proteins. These factors make the oral mucosa a very attractive site for systemic drug delivery [3]. The mucosa is

www.pharmasm.com  IC Value – 4.01 30
relatively permeable, has a rich blood supply, and shows short recovery times after stress or damage. The systemic delivery of drugs through novel methods of administration is one area in which significant changes and improvements have been made. Consequently, precise control of drug input into the body by a variety of routes is now possible. Controlled and sustained release formulations have been developed and are gaining popularity and medical acceptance \([4]\). Buccal delivery involves the administration of the desired drug through the buccal mucosal membrane lining of the oral cavity. Unlike oral drug delivery, mucoadhesive buccal delivery system presents a hostile environment for drugs, especially proteins and polypeptides, due to acid hydrolysis and the hepatic “first-pass” effect, the mucosal lining of buccal tissues provides a much milder environment for drug absorption. Chitosan has been used in a wide variety of biomedical applications like sustained release of drugs \([5, 6, 7]\).

**Disadvantages of Conventional Dosage form:**

Oral drug administration is limited by many disadvantages, some of them are mentioned below:

1. Some of oral preparations undergo a first-pass effect in the liver, requiring larger doses \([8]\).
2. The rate and extent of absorption can vary greatly depending on the drug, its formulation, presence or absence of food in the stomach, drug interactions, and pH of gastrointestinal fluids.
3. Drug metabolites formed following first-pass through the liver may not be as active or as potent as the parent drug (e.g. butorphanol), thus necessitating the oral dose to be much greater than the parenteral dose required to cause the same clinical effect.

**Advantage of Mucosal Drug Delivery System over Conventional Dosage Form:**

Mucoadhesive drug delivery system having many advantages over conventional dosage form some of them are mentioned below:-

1. Buccal film is enough strong enough to withstand breakage due to stress from activities in the mouth \([9]\).
2. Buccal patches offer greater flexibility and comfort than adhesive tablets.
3. It is patient compliance due to elimination of pain due to injections.
4. Administration of drugs in unconscious patients.
5. It provides convenience over the oral and injections in drug delivery.
6. It increases the ease of drug administration and termination of drug delivery by detaching the patch \[^{10}\].

**Method of Preparation of Mucoadhesive Patches**

Mucoadhesive buccal patches can be prepared by methods mentioned below:-

1. **Solvent Casting Method**: Mucoadhesive patches are prepared by solvent casting method. All ingredients were accurately weighed and mixed in pestle and mortar. Then the mixture added gradually to magnetically stir solvent system, which contain the plasticizer. Continue the stirring until a clear solution is obtained. The solution is then transferred quantitatively to petri-dish. The petri-dish covered with inverted funnels to allow evaporation of the solvents. These are kept at 20-25°C temperature for 24 to 48 hours depending upon the solvent system used. Size of patches are 15 to 20 mm diameter, 0.2 to 0.3 mm thick are carefully pull out from the petri-dishes \[^{11, 12, 13}\].

2. **Semisolid casting**: In semisolid casting method, initially prepare a solution of water soluble film forming polymer. The resulting solution is added to a solution of acid insoluble polymer (e.g. cellulose acetate phthalate, cellulose acetate butyrate), which is prepared in ammonium or sodium hydroxide. Then appropriate amount of plasticizer is added so that a gel mass is obtain. Finally the gel mass is cast into the films using heat control drums.

3. **Hot melt extrusion**: In hot melt extrusion method, firstly the drug is mixed with carriers in solid form. Then the extruder containing heaters are used to melt the mixture. In the end, the melt are given the shape of films with the help of dies. Hot melt extrusion have merit as patches prepared through this method have better content uniformity \[^{14}\].

4. **Solid dispersion extrusion**: In this method immiscible components are extruded with drug and then solid dispersions are prepared. Finally the solid dispersions are shaped into films by mean of dies.

5. **Rolling Method**: In rolling method a solution or suspension containing drug is rolled on a carrier. Solvent is mainly water and mixture of water and alcohol. Film is dried on the rollers and cut into desired shapes and sizes \[^{15}\].

**Evaluation of Mucoadhesive Patches** \[^{16, 17}\]
Evaluation of mucoadhesive buccal patches can perform as mention below:

1. **Weight variation:** Weight variation used to done by comparing the averages weighed of 10 different patches from each batch and individual patch.

2. **Patch thickness:** Patch thickness is measured at 5 different randomly selected spots with the help of a screw gauge.

3. **Volume entrapment efficiency %:** Volume entrapment efficiency % is volume uptake capacity of buccal patches after adhesion into the buccal cavity.

4. **Measurement of the % elongation at break:** % elongation of patch is measured by using the following formula.

\[
\% \text{ E elongation at break} = \frac{\text{Increase in length} \times 100}{\text{Initial length}}
\]

5. **Surface pH:** The patches are allowed to swell in contact with 0.5 ml of distilled water (pH 6.5±0.5) for 60 min at room temperature and pH was noted down.

6. **Folding endurance:** Folding endurance of patches are determined by repeatedly folding one patch at 180 angle of plane at same plane till it broke or folded to 200 time without breaking.

7. **Stability study:** The stability study of optimized mucoadhesive patch formulation is performed at 40°C 37 ±5°C & 75±5% RH for three months.

**Reported mucoadhesive buccal patches formulations**

Much work on buccal patches formulations have not been done yet. The reported mucoadhesive buccal patches drug delivery system are summarized here.

Kolli CS et al [18] has done work on development of mucoadhesive patches for buccal administration of prochlorperazine: evaluation of in vitro release and mechanical properties. Results have shown that prochlorperazine maleate could permeate through human buccal membrane. Hence there is a scope for development of buccal dosage form for prochlorperazine maleate at industrial scale.

Semalty M et al [19] has done work on development of mucoadhesive buccal films of glipizide. The films containing 5mg glipizide in 4.9% w/v HPMC with 1.5% w/v SCMC (F2), show good swelling, a convenient residence time and promising controlled drug release, thus seems to be a good candidate for the development of buccal film for effective therapeutic use.
Palem CR et al. [20] has done work on development of bilayered mucoadhesive patches for buccal delivery of felodipine: in vitro and ex vivo characterization. Bilayered buccoadhesive patches for buccal delivery of felodipine could be prepared. It showed significant bioadhesive properties with an optimum release profile and could be useful for buccal delivery.

Perioli L et al. [21] has done work on development of mucoadhesive patches for buccal administration of ibuprofen. Result indicates that this buccal film is very tolerable and comfortable because it is non-irritant and may be preferred over adhesive tablet in terms of elasticity, flexibility and capability to protect the wounded or inflamed surfaces.

Saisivam S et al. [22] has done work on design and evaluation of diltiazem hydrochloride buccal patches. Results indicate that formulation containing drug reservoir with 3% HPMC and 3% EC as rate controlling membrane has achieved the objective of prolong drug release, drug frequency of administration and thus improved patient compliance.

Ramana MV et al. [23] has done work on design and evaluation of mucoadhesive buccal drug delivery systems containing metoprolol tartrate. Study concludes that drug release could be obtained up to 8 hours with a polymer combination of CP934 and HEC in ratio of 1:2.

Satishbabu BK et al. [24] has done work on preparation and evaluation of buccoadhesive films of atenolol. Study concludes that, the addition of carbopol 934P increases the viscosity and swelling of the films there by controls the release of drug and improves mucoadhesive properties.

Sekhar KC et al. [25] has done work on transbuccal delivery of chlorpheniramine maleate from mucoadhesive buccal patches. Result shows that in vitro drug release and moisture absorbed were governed by HEC content and formulations exhibited good tensile and mucoadhesive properties. Bioavailability from optimized buccal patch was 1.46 times higher than the oral dosage form and the results showed statistically significant difference.

Methods to increase buccal absorption

Drug permeation throughout epithelial barriers could be increased by penetration enhancers having capability of lowering the barrier properties of the mucosa by different
mechanisms. Enhancement of drugs permeation through buccal absorption can be achieved through different techniques such as chemical or physical methods \[26\].

1. Chemical methods: The efficacy of chemical enhancers depends on the physicochemical properties of both the drug and the vehicle.

   Chemical enhancement done by:
   - Enhancing cell membrane fluidity.
   - Through extraction of structural lipids.
   - Either by altering the rheological property of the mucus layer or by altering the lipid bilayer membrane.

2. Physical method: Enhancement of drug permeation can achieve through one more method that is physical method either by mechanical means or by electrical means.

   Mechanically done by:
   - Decreasing the barrier thickness by removal of the outermost layers of the epithelium.
   - Producing micromechanical, thermal and cavitation effects through phonophoretic drug delivery \[27\].

   Electrically done by three methods:
   - Ionophoresis: In ionophoresis the drug permeation can be promoted by application of low level current, through which ionic or ionizable drugs can be delivered \[28, 29\].
   - Electro-osmosis: In this method migration of charged particles towards less charged area.
   - Electro-poration: As the name defines, this process allows the molecule permeation throughout the tissue through a large electric pulse temporarily \[30\].

### CONCLUSION

From above, it can be concluded that mucoadhesive buccal patches is a novel drug delivery system because it has several advantages over the conventional drug delivery system. The drugs delivery via the buccal route is safe, because drug absorption can be promptly terminated in case of toxicity by removing buccal dosage form from buccal cavity and number of drugs can be administered through mucoadhesive buccal patches.
ACKNOWLEDGEMENTS

The authors are thankful to Chairman of MIET Meerut for providing the necessary library and internet facilities.

REFERENCES


For Correspondence:
Gaurav Kumar Sharma,
Research Scholar,
Department of Pharmaceutical Technology,
Meerut Institute of Engineering and Technology, NH-58, Baghpat Crossing, Delhi Roorkee Highway, Meerut-250005 (U.P), India.
Email: gaurav.pharma1982@gmail.com