A Review: Recent Approaches In Buccal Patches

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Abstract- *Buccal patches for the delivery of atenolol using sodium alginate with various hydrophilic polymers like carbopol 934 P, sodium carboxymethyl cellulose, and hydroxypropyl methylcellulose in various proportions and combinations were fabricated by solvent casting technique. Various physicomechanical parameters like weight variation, thickness, folding endurance, drug content, moisture content, moisture absorption, and various ex vivo mucoadhesion parameters like mucoadhesive strength, force of adhesion, and bond strength were evaluated. An in vitro drug release study was designed, and it is easy to administer for unconscious and less co-operative patients. Solvent casting method is used for the preparation of patches. The purpose of the present work is to provide a review of various aspects of buccal patches as a suitable drug delivery system.*

Keywords- Buccal patches, High bioavailability, Jugular vein,Non-dissolving, Solvent casting method.

I. INTRODUCTION

Extensive research efforts have recently been focused on placing a drug delivery system in a particular region of the body for maximizing biological drug availability and minimizing dose-dependent side effects. Buccal delivery of drugs provides an attractive alternate to other conventional methods of systemic drug administration.

Compounds absorbed through the stomach or small intestine usually take about 20 minutes to spread throughout the body. Because buccal mucosa absorb contents directly into the blood stream from the mouth, the effects of these compounds usually take effect in about 5-10 minutes after consumption. Buccal drug delivery system has different dosage forms like films, tablets, gels, ointments and patches can be used for delivery of drugs across the buccal mucosa.

For the desired mucoadhesive strength of the mucoadhesive dosage forms, there are various mucoadhesive polymers that can be used(3). The natural or synthetic polymer adhesion tissues are titled as bio-adhesion and are integrated among mucus membrane and polymer labelled as mucoadhesion(1).

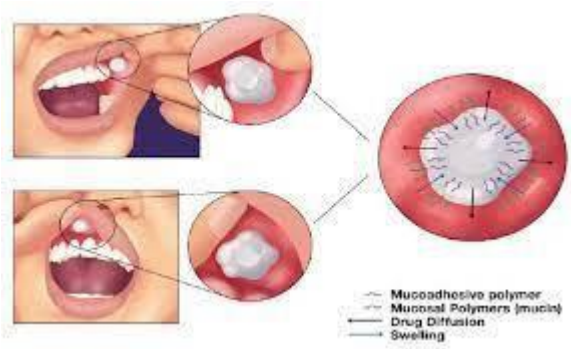
The polymer has achieved that significant interest in formulary the sustained release, extended release as well as prolonged release dosage form. From the last three decades, the use of mucoadhesive polymers has achieved a great interest in the field of pharmaceutical technology. Nowadays, the use of mucoadhesive polymers had been accepted as an important strategy to prolong the residence time and improve the localized effects of drug delivery system on various mucus membranes of a biological system.

Well defined bioadhesion is that the ability of a material (synthetic or biological) to stick to a biological tissue for an extended period of time. The biological surface may be epithelial tissue or it may be the mucus coat on the surface of a tissue. If adhesion is to a mucus coat, the phenomenon is mentioned as mucoadhesion. The use of mucoadhesive polymers in buccal drug delivery possess a greater application(3). However, buccal patch has greater flexibility and convenient than the other devices.

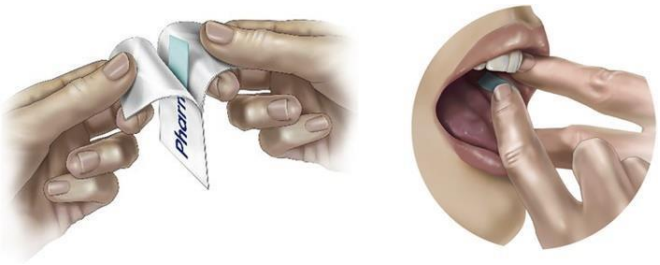
II. BUCCAL DOSAGE FORMS

Semisolids (ointments, gels, and powders) and buccal adhesive tablets, patches, films, are the novel type of buccal dosage forms.

A. **Buccal mucoadhesive tablets:** These dry medication dosage forms must be moistened before being applied to the buccal mucosa. Example: a double layered tablet with an inner core of cocoa butter containing insulin and a penetration enhancer, and an adhesive matrix layer made of hydroxyl propyl, cellulose, and polyacrylic acid (sodium glycocholate).



B. **Papers and Films:** Buccal patches are made of two laminates: an impermeable backing sheet is cast with an aqueous solution of the adhesive polymer, and the sheet is then cut into the necessary oval form. A brand-new mucosal adhesive film named "Zilactin" is made of three organic acids and an alcoholic solution of hydroxypropyl cellulose. Even when it is challenged by fluids, the film that is placed on the oral mucosa can be kept in place for at least 12 hours.



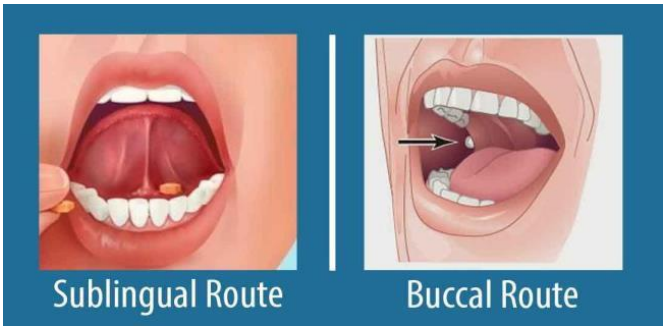
C. **Powders:** When beclomethasone and hydroxypropyl cellulose powder is sprayed into the oral mucosa of rats, a considerable increase in residence time compared to an oral solution is seen, and 2.5% of beclomethasone is kept on buccal mucosa for more than 4 hours(4).

III. ORAL MUCOSAL SITES

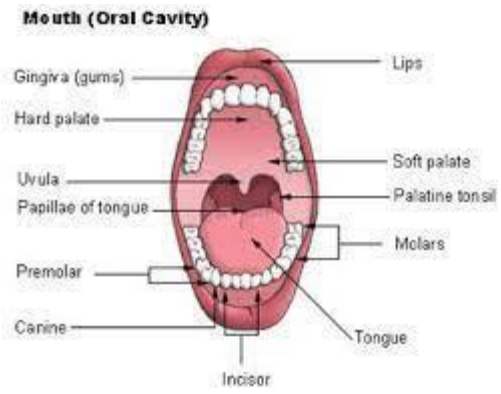
There are three categories in which medications are delivered within the oral mucosa:

- **Sublingual delivery:** refers to the administration of a drug to the systemic circulation through the sublingual mucosa, which is a membrane that covers the ventral surface of the tongue and the mouth's floor.
- **Buccal delivery:** refers to the administration of medication to the systemic circulation through the buccal mucosa, or cheek lining.
- **Local delivery:** to treat conditions of the oral cavity, particularly fungal infections, periodontal disease, and ulcers.

- These oral mucosal sites differ significantly from one another in terms of their anatomical makeup, permeability to to treat conditions of the oral cavity, particularly fungal infections, periodontal disease, and ulcers. drug application, and capacity to hold on to a delivery system for the necessary amount of time(5)(6).



IV. STRUCTURAL CHARACTERS OR COMPONENTS OF ORAL CAVITY



- The area of the mouth called the oral cavity is defined by the lips, cheeks, hard palate, soft palate, and floor of the mouth. There are two areas of the oral cavity.
- The outer oral vestibule, which is enclosed by the gingiva, teeth, lips, and cheeks (gums).
- The hard and soft palate make up the roof of the oral cavity proper, which stretches from the teeth and gums back to the fauces (which lead to the pharynx). The tongue extends from the cavity's floor (4).

V. LIMITATIONS

1. It is impossible to create medications with a bitter taste.
2. It is impossible to design medications that irritate the oral mucosa, cause allergic reactions or stain the teeth.
3. Drugs that are sensitive to moisture can occasionally be destroyed by saliva (13).
4. The absorptive membrane has a significantly smaller surf ace area. This area gets much smaller if the delivery system's dimensions determine the effective area for absorption.
5. Drug concentrations at the surface of the absorbing membrane are low because saliva continually released into the oral cavity dilutes medications at the site of absorption. A significant portion of the drug that has been released and is dissolved or suspended and swallowed unintentionally is

absorbed. Additionally, there is a chance that the delivery method might be consumed.

6. The oral cavity may not be an appropriate place for drug administration due to allergic properties. The drug candidates for this method may be constrained by taste irritability, allergies and undesirable effects including tooth erosion or discolouration. Traditional Buccal drug administration methods prevented the patients from eating, drinking, or in certain cases, converting at the same time.

VI. ADVANTAGES

- The oral mucosa has a healthy blood supply.
- Drugs enter the systemic circulation through the deep lingual or face vein, internal jugular vein, and braciocephalic vein after being absorbed from the oral cavity through the oral mucosa.
- Through Buccal administration, the drug bypasses the first pass effect and enters the systemic circulation directly.
- Avoiding contact with the digestive fluids of the gastrointestinal tract protects several medications against degradation, including insulin and other proteins, peptides, and steroids.
- Additionally, neither food nor gastric emptying rate affect the rate of medication absorption.
- Additionally, there are two sections of buccal membranes per mouth, making it possible to alternately put buccal drug delivery systems on the left and right buccal membranes since the area of buccal membrane is wide enough to accommodate placement of a delivery system at various times.
- The side effects subsided,and patience compliance increased
- In case of an emergency, patients can adjust the delivery schedule or stop it altogether. The buccal cavity can be administered with ease by the buccal drug delivery systems.Patient compliance is higher with the novel buccal dose forms (14).
- Buccal delivery systems are able to survive environmental factors, making prolonged drug delivery conceivable.
- The use of buccal dosage forms is simpler than other methods.
- If harmful consequences develop, they can be stopped.
- The oral cavity's lining membranes are easily accessible through the buccal mucosa, which makes application painless and comfortable (15)(16)(17).

VII. DRAWBACKS

- The continuous excretion of saliva results in the dilution of the medication.
- Giving medications orally poses challenges when their dosage is high.
- By repeatedly swallowing saliva, which may result in medicine loss, the dosage form is accidentally removed.
- The mouth cavity has less space for medication absorption.
- Drugs that irritate the mucosa or have a bitter taste are inappropriate.
- A drug cannot be delivered if the pH in the mouth is unstable (18).

VIII. IDEAL PROPERTIES

- One of the most creative and intriguing types of buccal dosage forms is mucoadhesive forms.
- In order to provide the patient with good comfort and ensure adhesion to the oral mucosa.
- The ideal buccal film should be flexible, elastic, properly shaped and sized.
- Cost effective.
- Should have peel, tensile, shear strength.
- Non-toxic, non-irritant, pure.

IX. METHOD OF PREPARATION

1. **SOLVENT CASTING:** In this technique, the medication and all patch excipients are co-dispersed in an organic solvent before being coated onto a release liner sheet. A thin layer of the protective backing material is laminated onto the coated release liner sheet after the solvent has evaporated. This creates a laminate that is die-cut into patches with the desired size and geometry (19).
2. **DIRECT MILLING:** In this process, no solvents are used to create the patches. Direct milling or kneading are typically used to mechanically combine the drug and excipients without the use of any liquids.

The finished product is rolled on a release liner until the desired thickness is reached after the mixing process. Following that, the backing material is laminated as previously mentioned (20).

While there aren’t any significant differences in patch performance between patches made using the two processes, there is a preference for the solvent-free process because there’s no chance of residual solvents and no associated health risks (21).

X. EVALUATION

1. SURFACE pH

Buccal patches wereapplied to previously prepared agar media plates for one hour period, and the pH of the swollen patches was measured using pHpaper (22).

2. MEASUREMENTS OF THICKNESS

There are made using a screw gauge with a minimum count of 0.01thickness. Five positions were used to measure thickness, and an average value as calculated (23).

3. SWELLING STUDY

A buccal patches is weighed, placed in a 1.5% agar gel plate, and incubated at 37±1ºC as part of a swelling study.

The patch is carefully desiccated using filter paper after one hour time intervals up to three hours by removing it from the petri dish. The swelling index is then estimated after weighing the swollen patch (24).

4. FOLDING ENSURANCE

In order to measure folding endurance, the thermal analysis is carried out.

5. THERMAL ANALYSIS STUDY

Utilizing a different calorimeter, the thermal analysis is carried out.

6. MORPHOLOGICAL CHARACTERIZATION

Patches are studied using scanning electronic microscope.

7. WATER ABSORPTION STUDY

Patches are allowed to expand on the surface of agar plates in order to analyse water absorption. Phosphoric acid brought the pHto 6.7. Sample maintained in an incubator at 37±0.5ºC. Samples are weighed (wet weight) and desiccated seven days at room temperature after the designated time interval. After drying, final constant weights are noted. The following equation evaluates water uptake (%).

Water uptake (%) = (Ww-Wi)/Wf ×100 Where,
Ww is the wet weight and Wf is the final weight(26).

8. EX- VIVO BIOADHESION TEST

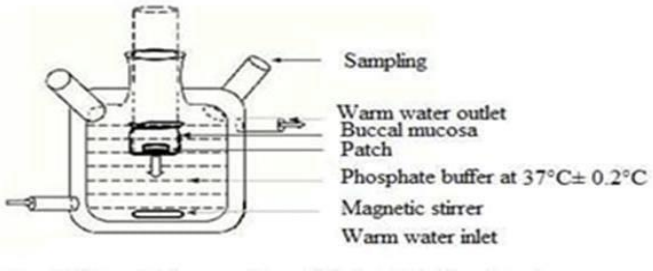
Fresh sheep mouth was isolated and cleaned with phosphate buffer (pH 6.8). A piece of gingival mucosa is tied in the open mouth of a glass vial that contains phosphate buffer (pH 6.8). This glass vial is snugly inserted into a glass beaker that contains phosphate buffer (pH 6.8, 37°C ± 1°C) so that it barely touches the mucosal surface. With cyanoacrylate adhesive, the patch is attached to the underside of a rubber stopper. A 5-g weight is used to balance the balance's two pans. The 5-g weight that had been loaded onto the left-side pan and attached to the patch over the mucosa is now removed. The balance is maintained in this position for the full five minutes of contact time.

Until the patch separated from the mucosal surface, w ater was progressively added to the right side pan at a rate of 100 drops per minute (27). The mucoadhesive strength was determined by weighing the patch in grams until it could be separated from the mucosal surface.

9. INVITRO DRUG RELEASE

The drug release from the bilayered and multi- layered patches is investigated using the rotating paddle method described in the United States Pharmacopeia (USP) XXIIIB. The phosphate buffer with a pHof 6.8 served as the dissolving media. The discharge is carried out at 37º C and 0.5º C and at 50 rpm. With the use of an instant adhesive, the glass disc is connected to the Buccal patch's supporting layer. The disintegration vessels's bottom receives the disc. At predetermined intervals, samples (5 ml) are removed and replaced with new media. Following the proper dilution, the samples were filtered using whatman filter paper and
examined for drug content. The invitro Buccal permeation via the Buccal mucosa (of sheep and rabbit) is carried out in a glass diffusion cell of the Keshary-Chein/Franz type at 37 ± 0.2ºC.

Between the donor and receptor compartments, there is mounted fresh buccal mucosa. The centre of the Buccal patch is positioned toward the mucosa, and the compartments are fastened together. The buffer is filled inside the donor compartment(28).



10. STABILITY STUDY IN HUMAN SALIVA

Human saliva is used to examine the stability of multi -layered and bilayered tailored patches. Humans are used to collect the sali va (age 18-50years). Buccal patches are inserted into individual petri dishes containing 5 ml of human saliva and heated for 6 hours at 37±0.2ºC. It is necessary to use dose formulations with improved bioavailability at set intervals of time (0, 1, 2, 3, and 6 hours). Improved transmucosal and transdermal medication delivery techniques would be extremely important since they completely eliminate the discomfort element associated with parenteral drug delivery.Buccal adhesive systems have a lot of benefits, including low enzymatic activity, economy, retentivity, administration and withdrawal, and high patient compliance. Adhesion of Buccal adhesive drugs to mucosal membranes improves bioavailability of systemically administered medications by increasing the gradient of drug concentration at the absorption site.

Additionally, Buccal adhesive dosage forms have been utilised to treat local conditions at the mucosal surface, such as mouth ulcers, in order to lessen the overall dose needed and decrease any potential side effects from systemic medications outside of conventional polymer networks. Currently, the most successful oral dosage forms on the market are solid dosage forms, liquids, and gels. Further developments in vaccine design and administration of tiny proteins peptides will influence buccal adhesive medication delivery. (29)

XI. LITERATURE REVIEW

P.K. Khobragade and etal..., A dosage form that avoids first pass metabolism and GI degradation must be created. In order to prevent first pass metabolism and GI degradation, oral cavity provides a route for the administration of therapeutic agent for local as well as systemic distribution. Solvent casting is a method that is often used for patch preparation. This review article discusses numerous studies on buccal patch composition and assessment.

Luana perioli and etal...,A novel formulation for topical drug administration in the oral cavity has been created using a number of mucoadhesive and film- forming polymers. The film's swelling, mucoadhesion, and organoleptic qualities have all been assessed. The most effective film was loaded with ibuprofen as a model compound and in vitro and in vivo release studies were carried out. This film contained carboxymethylcellulose sodium salt (NaCMC) as a mucoadhesive polymer and polyvinylpyrrolidone (pvp) as a film- forming polymer. The predominant drug release mechanism, as determined by statistical analysis of in vitro release, was the diffusion process, with the Higuchi's model offering the best fit. Ibuprofen was present in saliva for five hours, according to in vivo experiments, although noted. These mucoadhesive formulations have various benefits over conventional therapies and may be suggested as a new therapeutic tool for the treatment of dental and buccal diseases and disorders.

Marija jovanovic and etal...,In this study, buccal films containing propranolol hydrochloride and gelatin mucoadhesive are processed and characterized. Gelatin from swine skin, type A (GA), and gelatin from bovine skin are the two varieties that are employed (GB). It is determined how gelatin type affects the mechanical, mucoadesive, and biopharmaceutical properties of buccal films. In contrast to GB and PRH, which form a compound-complex, Fourier- Transfer infrared spectroscopy (FTIR) and differential scanning calorimetry (DSC) studies demonstrate that GA and propranolol hydrochloride (PRH) in the film (GAP) created a physical combination. GAP films display increased elastic modules, tensile strength, and hardness, according to the results of mechanical testing (tensile test, hardness). A mucoadhesion test reveals that GBP has stronger adhesion while GAP has higher adhesion work. Processed films can deliver efficient drug transport via the buccal mucosa, according to both in vitro release studies and insilico simulations. Comparing buccal films to immediate-release tablets in an artificial silico simulation reveals enhanced bioavailability, indicating that the therapeutic medication dose can be significantly decreased.

XII. CONCLUSION

The benefits of buccal mucosa for regulated drug distribution over a long period of time. First-pass metabolism in the liver and pre-systemic elimination in the gastrointestinal tract are avoided because the mucosa is well supplied with both vascular and lymphatic drainage. The region appears to offer various options that the patient will find acceptable and is well suited for a retentive device. The mucosa's permeability and the surrounding environment can be managed and controlled to allow for drug absorption with the proper dosage form design and formulation. Buccal drug administration is a promising topic for on-going study with the goal of systemic delivery of orally ineffective medications as well as a practical and alluring substitute for non-invasive delivery of powerful peptide and protein therapeutic molecules. However, a critical element for a potential future in the field of buccal medication delivery is the requirement for safe and efficient buccal permeation absorption enhancers.

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