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PATCH AND FILM BASE ORAL DRUG ADMINISTRATION: NEW METHODS

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ABSTRACT:

For systemic drug delivery, the buccal route is desirable because it bypasses the hepatic first pass metabolism and delivers a high bioavailability of the medication to the systemic circulation. A number of disorders can be better treated with buccal bioadhesive films, which release topical medications into the mouth over time at a controlled release rate. According to this article, recent advances in buccal adhesive delivery systems will be reviewed in order to give young scientists a solid foundation for avoiding the pitfalls of formulation design. Some drugs are metabolised in the liver before reaching the intestines, therefore buccal drug delivery may be an option to oral administration. The buccal mucosa has long been considered an appropriate location for giving drugs since it is painless and may be quickly and easily removed if the therapy has to be ended or interrupted. An optimal mucoadhesive system, the advantages and disadvantages of buccal delivery, the factors that affect buccal absorption and various types of patches, as well as their manufacturing process and composition, were all discussed in this overview of buccal drug delivery systems.

KEYWORDS: Buccal drug delivery system, Buccal patches, Mucoadhesive, Mechanism of buccal mucosa, Composition of the buccal patch, Evaluation of buccal patch.

INTRODUCTION:

Penicillin was first applied to the oral mucosa in 1947 when gum tragacanth and dental adhesive powder were combined together. Mucoadhesive drug delivery systems have gained considerable attention in recent years for their potential to deliver therapeutic medicines. A lack of efficacy in some medications can be attributed to factors including poor bioavailability, gastro-intestinal intolerance, irregular absorption patterns, or pre-systemic clearance. Mucosal medication delivery has seen an increase in interest due to recent advances in drug delivery technology. There are a variety of ways to access the mouth, such as via the buccal, ocular, nasal, and pulmonary pathways. Bioadhesion of certain polymers, which become sticky upon hydration, can be used to deliver drugs to a specific area of the body for an extended length of time using mucoadhesive drug delivery systems[3]. The capacity to keep a delivery system at a given area for an extended period of time has significant appeal for both local as well as systemic medication bioavailability[4]. Recently, mucoadhesion has been the focus of much research because it allows for the avoidance of either gastrointestinal destruction or the inactivation of drugs by first passing via the liver. This is a list of components used in mucoadhesive medication delivery:

1. Buccal drug delivery system
2. Sublingual drug delivery system
3. Rectal drug delivery system
4. Vaginal drug delivery system
5. Ocular drug delivery system
6. Nasal drug delivery system[5]

CHARACTERISTICS OF AN IDEAL MUCOADHESIVE SYSTEM

All of these features should be present in an ideal system for mucoadhesion :

1. In the first place, it must adhere quickly to the buccal mucosa, have suitable mechanical strength and spreadability, swelling and wetting capacities, biocompatibility, and the ability to penetrate oral mucosal tissue[6].
2. It is crucial to have a controlled medication release.
3. Third, it must increase the speed and completeness with which the medicine is absorbed.
4. It must be easy for patients to use.
5. Talking, eating, and drinking should not be hindered or impeded by it in any way.
6. Single-path medicine delivery is a must for this device.

7. Dental cavities and tooth rot should also be prevented, as they can lead to more serious health issues.
8. This is because saliva and water wash it away, thus it must be tough enough to withstand these pressures[7,8].

ADVANTAGES OF BUCCAL DRUG DELIVERY SYSTEM

There are several advantages of buccal drug delivery system-

1. When therapy must be stopped, paused, or discontinued due to an emergency, it is simple to inject medications directly into the membrane areas of the body.
2. Drugs that are unstable in acidic circumstances and do not come into touch with digestive fluid are needed to evade the first-pass metabolic process[9].
3. The dosage forms spend more time at the site of absorption than other forms of medication.
4. A significant blood supply and a high blood flow rate are necessary for rapid absorption to occur.

DISADVANTAGES OF BUCCAL DRUG DELIVERY SYSTEM

There are some disadvantages or limitations of buccal drug delivery system-

1. When administering medications that are not buccal pH stable, irritate the mucosal lining, have an off-putting flavour or a strong aroma, this method is out of the question.
2. Food and water intake may be restricted during administration[10].
3. Taking large doses of medication might be difficult to administer or distribute.
4. There is less space available for adsorption. Low drug concentrations at the membrane surface can be achieved by a continual flow of saliva in the mouth cavity, which dilutes drugs[11].

STRUCTURE OF BUCCAL MUCOSA

Oral mucosa refers to the tissue that covers both the inside and outside of your mouth. You'll find a mucosal lining on the buccal, sublingual, gingival, palatal, and labial parts of your mouth. The function of the oral epithelium is to protect the tissue against pathogens and loss of fluid. " The submucosa and lamina propria follow the epithelium. Between 1 and 2 metres thick, the foundation membrane The oral mucosa, which is located on the tongue, contains taste receptors that may be detected by the sense of smell. There are three types of oral mucosa in the mouth: mucous membrane, mucous membrane, and mucous membrane[12]. The lining mucosa covers approximately 60 percent of the mouth's surface area, particularly in the buccal mucosa and the sublingual region (below tongue). Mucosa on the tongue's dorsal surface (approximately 15% of the mouth's surface area) and masticatory mucosa (about 25% of the mouth's surface area) are found there (gums). The masticatory

mucosa contains keratinized epithelial cells that attach to the lamina propria. A thin elastic lamina connects the submucosa and lamina Propria to the lining mucosa, which comprises non-keratinized epithelium. In addition to keratinized and non-keratinized epithelium, the tongue's dorsal surface has specialised mucosa. Any of the following sites in the mouth can be used to give a medication:-

1. Buccal cavity
2. Sublingual cavity
3. Lingual cavity
4. The palate
5. Gingival region[13]

CLASSIFICATION OF ORAL MUCOSA BASED ON FUNCTION

- a) The lining mucosa is made up of non-keratinized stratified squamous epithelium, which can be found throughout the oral cavity.
- b) The mucosa that lies between the buccal and labial cavities, known as alveolar mucosa. It has a stronger crimson tone and a smoother, more glossy texture. There don't appear to be any rete pegs keeping it down[14].
- c) The buccal mucosa is the mucosa that covers the cheeks and the floor of the mouth, and is responsible for the lining.

Buccal mucosa layers are defined in figure 1.

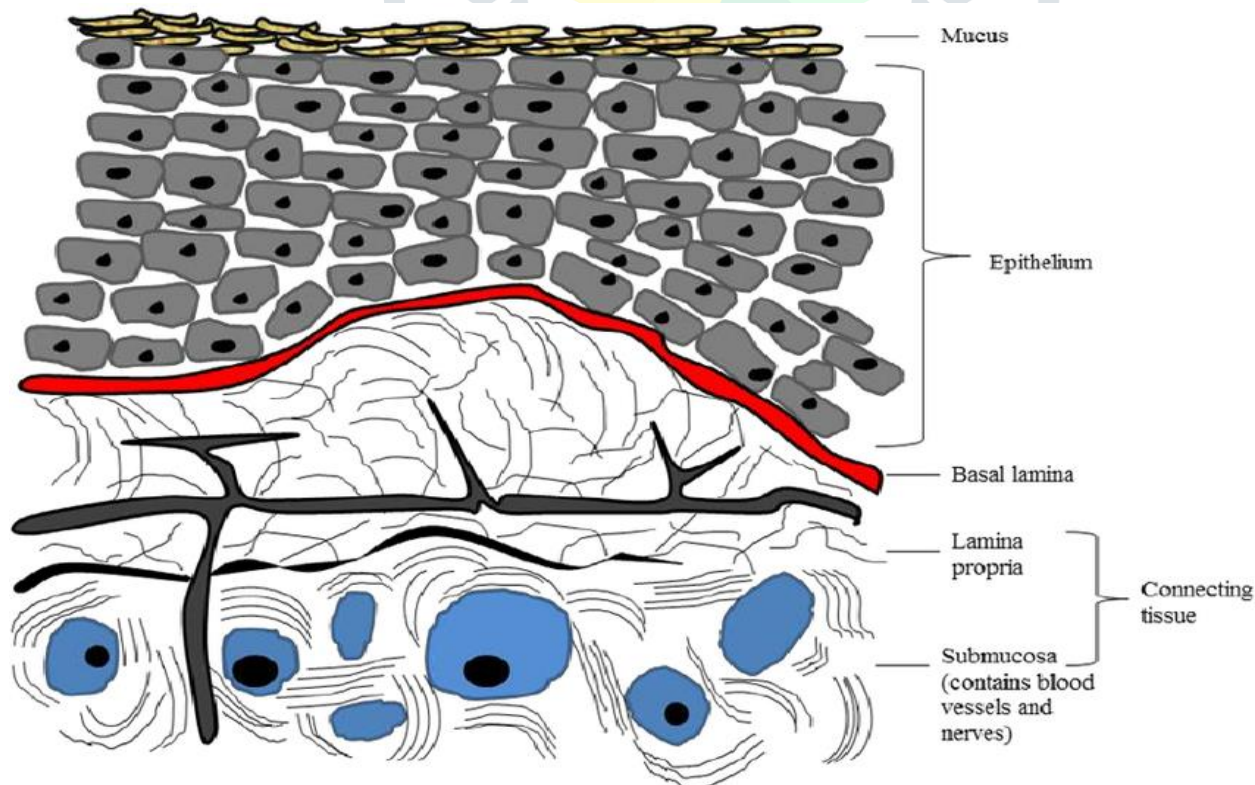


FIG.1 SCHEMATIC ILLUSTRATION OF THE LAYERS FOUND IN BUCCAL MUCOSA

MECHANISM OF BUCCAL ABSORPTION:

Medications can have both a systemic and local effect when absorbed through the buccal mucosa. Through the buccal mucosa, nonionized species can be absorbed through passive diffusion. a concentration gradient is used to stimulate passive diffusion in the epithelium's intercellular spaces or gaps For most non-ionic species in the buccal cavity, diffusion via lipid membranes is the primary mode of transport. The faster a medication molecule may be absorbed by the buccal mucosa, the more lipophilic it is[15]. This has been shown for many different mucosal membranes. Oral medicine absorption kinetics may be better explained by the first-order rate process. There are a variety of potential roadblocks to the absorption of buccal medicine. By altering or regulating the concentration of the drug in the mouth, salivary secretion modifies the buccal absorption kinetics of drug solution, according to Dearden and Tomlison (1971)[16].

Manufacturing Methods of Buccal Patches

Mucoadhesive buccal patches/films can be made using the following methods: solvent casting, hot melt extrusion, direct milling, semisolid casting, rolling method and direct milling[17].

- **Solvent casting:**

Polymer swells after being vortexed in a solvent casting procedure, which uses mucoadhesive polymers in the correct proportion to be treated with solvent. Plasticizer was added to the polymer mixture and vortexed for a second time. In order to add the required amount of medicine to the polymer solution, a tiny volume of solvent system was used to liquefy the drug. A petri plate has been cleaned and a fresh blend has been added to remove any trapped air. Desiccators hold the patches till the evaluation tests can be carried out[18].

- **Direct milling:**

Patches are made without the use of solvents in this method. Methods for motorised combining medication and excipients without liquefied solution include direct milling or kneading. Using a rolling machine, you may achieve the necessary thickness. The final step is to laminate the backing material. The absence of residual solvents and health risks caused by solvents makes the solvent-free approach the obvious choice[19].

- **Hot melt extrusion:**

The hot melt extrusion method involves forcing a molten combination of medicinal components through an aperture in order to produce various forms. It has been utilised to make controlled release matrix tablets, pellets, granules and oral disintegrating films. Drugs are extruded with immiscible components before solid dispersions are created. Finally, dies are used to mould the solid dispersions into films[20].

- **Semisolid casting:**

Initially, a solution of water soluble film forming polymer is structured in the semisolid casting process. A solution of acid insoluble polymer produced in ammonium or sodium hydroxide is added to the resultant solution[21]. The plasticizer aggregate is then added to form a gel mass. Finally, heat-controlled drums are used to cast the gel mass into films or ribbons for use in the final product stage.

- **Rolling method:**

Rolling a medication solution or suspension is used in this technique. Water and water/alcohol mixtures are the primary solvents. Following a thorough drying process using rollers, the film is ready to be cut into the necessary shapes and sizes[22].

TYPES OF BUCCAL PATCHES

(1) In matrix type- Using a hydrophilic or lipophilic polymer matrix and a consistent amount of medication, matrix-type buccal patches are created. To create the therapeutic disc, medicated polymer moulding is used.

(2) In reservoir type- The medicine and additives are separated from the adhesive in a cavity in the reservoir system. Attaching a water-resistant backing prevents drug loss.

THE BUCCAL PATCHES COMPOSITION

(1) Active Pharmaceutical Ingredient (API): A wide range of active medicinal ingredients are delivered using buccal patches. Large medications are difficult to include, however the active element in buccal patches has a size constraint[23].

(2) Polymers (adhesive layer): Polymer hydration and swelling may be the most important factor in the development of this disease. polyvinylpyrrolidone, polyvinyl alcohol, and carbopol are among the polymers that have been employed.

(3) Diluents: Lactose, microcrystalline starch, and starch are some of the diluents utilised in buccal patches.

(4) Sweetening agents: Sucralose, aspartame, and mannitol are used as sweeteners.

(5) Flavouring agents: Vanilla, cocoa beans, cocoa powder, and chocolate are some of the flavouring components that can be found in formulas[24].

(6) Backing layer: A polyvinyl alcohol-based backing layer is employed in patch applications.

(7) Penetration enhancer: Cyanoacrylate, EDTA, Citric acid, PEG-100, 400, propylene glycol, and other penetration enhancers are utilised.

MUCOADHESION THEORIES

Numerous theories have been put up to explain the mechanics of mucoadhesion. Among these theories are those of mechanical interlocking, electrostatic interpenetration, diffusion interconnection, adsorption, and fracture[25].

i. Wetting theory

Liquid systems that have an attraction for a surface and want to spread across it are covered by the wetting theory. The contact angle can be used to measure this affinity, as well as other ways. The rule of thumb is that the stronger the affinity, the smaller the contact angle. Spreadability is dependent on the contact angle, which should be equal or close to zero in order to be effective. The equation below shows how to derive the spreadability coefficient, S_{AB} , using the difference between the surface energies γ_B and γ_A and the interfacial energy γ_{AB} [26]. In order to attain a high level of mucoadhesion, this theory emphasises the relevance of the contact angle and the lowering of surface and interfacial energy.

$$S_{AB} = \gamma_B - \gamma_A - \gamma_{AB}$$

ii. Diffusion theory

Polymer and mucin chains penetrate each other to a sufficient depth to form a semi-permanent adhesive bond, according to diffusion theory. Adhesion strength may be related to the depth of polymer chain penetration, according to current thinking. The diffusion coefficient, flexibility and composition of the mucoadhesive chains, mobility, and contact time all influence the penetration rate. A bioadhesive bond requires an interpenetration depth of 0.2–0.5 μm , according to published research[27]. The following equation can be used to predict the interpenetration depth between polymer and mucin chains:

$$l = (tD_b)^{1/2}$$

Mucoadhesive substance diffusion coefficient in mucus is D_b , and t is contact time. A polymer's adhesion strength is achieved when the penetration depth is about equal to the chain length. This means that the bioadhesive and mucus must have chemical structures that are chemically comparable in order for diffusion to take place[28]. The stronger the mucoadhesive connection, the more structurally similar the two substances are.

iii. Fracture theory

Mucoadhesion mechanical measurement studies frequently employ this idea. After adhesion is achieved, it measures the force needed to separate the two surfaces. According to tests of the resistance to breakage, this

force s_m is computed by dividing the maximum detachment force (F_m) by the total surface area engaged in the adhesive interaction (A_0)[29].

$$S_m = F_m/A_0$$

iv. The electronic theory

In this idea, electron transfer between the mucus and the mucoadhesive system causes adhesion, resulting from variations in their electrical structures. Double layers of electrical charges are formed at the interface of the mucus and mucoadhesive after the electron transfer. Ultimately, a second layer of attractive forces is formed as a result of this process[30].

v. The adsorption theory

The adherence between the sticky polymer and the mucus substrate is the result of multiple surface interactions (primary and secondary bonding). Due to the permanence of ionic, covalent, and metallic bonding, primary bonds from chemisorptions result in adhesion. Van der Waals forces, hydrophobic interactions, and hydrogen bonding are the primary causes of secondary bonds. Even though these bonds can be broken more easily, they are the most common surface contacts in mucoadhesion processes due to their semi-permanent nature[31].

FACTORS AFFECTING ON MUCOADHESION

✓ Molecular weight

At molecular weights greater than 100,000, polymers have increased mucoadhesive strength. Polyoxyethylene polymers with molecular weights between 200,000 and 700,000 have a direct association with their mucoadhesive strength.

✓ Flexibility

First, there's a diffusion of polymer chains across the two surfaces. Since the polymer chains must be able to entangle with the mucus, it is imperative that they be flexible enough to do so. Polyethylene glycol's incorporation enhanced the polymer's structural flexibility, which resulted in an increase in chain interpenetration[32]. Flexibility of a polymer can be correlated to its viscosity and diffusion coefficient, because a polymer that is more flexible can penetrate into the mucus network more easily.

✓ Cross-linking density

Among the structural parameters of a polymer network are the average pore size, the number of cross-linked polymers, and the density of cross-linking. Because water transport into the polymer network happens at a reduced rate as cross-linking density increases, it stands to reason that the polymer will swell less and interpenetrate with mucin less[33].

✓ **Hydrogen bonding capacity**

A polymer's mucoadhesion can also be influenced by hydrogen bonding. Functional groups capable of forming hydrogen bonds must be present in the desired polymers, and the flexibility of the polymer is essential to enhance this capability. When it comes to polymers with high hydrogen bonding capacity, you can look to the likes of polyvinyl alcohol (PVA), hydroxymethyl methacrylate (HMMA), and poly methacrylic acid (PMMA)[34].

✓ **Hydration**

An adequate macromolecular mesh is created by expanding the mucoadhesive polymer and causing mobility in the polymer chains, both of which require hydration to improve the interpenetration process between polymer and mucin. When a polymer is swollen, it exposes the bioadhesive sites for hydrogen bonding and/or electrostatic contact with the mucus network[35]. However, there is a threshold level of hydration in the mucoadhesive polymer where optimum swelling and adhesion occur.

✓ **Charge**

Nonionic bioadhesive polymers appear to have a lower degree of adhesion than anionic bioadhesive polymers, according to prior studies. Mucoadhesion requires a polymer that has a strong anionic charge on it. The mucoadhesive capabilities of cationic polymers may be enhanced in neutral or slightly alkaline media[36]. Some cationic high-molecular-weight polymers, such as chitosan, have been found to exhibit good adhesion. The effect of membrane charge on mucoadhesion is not well documented, although the pH of the membrane has an effect on mucoadhesion since it can affect polymer ionised or unionised forms.

METHODS IN ASSESSING BUCCAL MUCOSA PERMEABILITY

In the preclinical setting, a variety of models are used to assess the permeability of the buccal mucosa, with in vivo testing providing the most accurate results. When it comes to preclinical compound screening, in vitro and in situ research are critical for understanding how the drug is transported, as well as assessing the potential of a penetration enhancer for buccal transport enhancement[37].

IN-VITRO TECHNIQUE

In an in vitro permeability study, which determines the barrier nature of a specific biological tissue, the drug diffusion is examined in an environment where parameters such as osmolarity, temperature, and pH may easily be adjusted. When using in vitro methods to estimate chemical absorption via the human buccal mucosa, it is crucial to select an appropriate animal model based on structural and permeability similarities to human buccal mucosa. In vitro studies of permeation frequently use diffusion cells and the buccal mucosa of an appropriate animal model[38]. These in vitro diffusion cells allow researchers to monitor the timing and kinetics of drug diffusion into the tissue. Preclinical investigations use a variety of diffusion cells can assess a compound's permeability.

IN VITRO STUDIES USING ANIMAL BUCCAL MUCOSAL MEMBRANES

In order to conduct permeation studies, animal mucosa that has just been dissected is used. Biochemistry, permeability, and form all point to animals' buccal mucosae closely resembling those of humans'. As a result of their keratinized buccal mucosa, rodents and hamsters' oral mucosa is an inadequate model for human buccal mucosa. It is common to utilise rabbits in permeation studies because to the non-keratinized mucosa on their lips and gums. This approach is rarely employed in permeation studies because rabbits' oral cavities contain so little non-keratinized mucosa[39]. This mucosa's epithelium is much thinner and more porous than that of human oral buccal mucosa, which is used as a model for the human oral buccal mucosa. There are many similarities between pigs and humans in terms of their physical, anatomical, nutritional, and metabolic habits. Because of this, pigs have become the most commonly used animal in human sickness research. Similar to human buccal mucosa, the mucosa of the canine mouth is non-keratinized and has many of the same traits. Porcine oral buccal mucosa matched human oral buccal mucosa in terms of tritiated water permeation, according to published studies. Recent studies reveal that mannitol and testosterone penetration into pig and human buccal mucosae are comparable[40].

➤ Franz-Type Diffusion Cells

Franz-type diffusion cells can be used to examine the in vitro skin and in vitro buccal mucosal permeation of pharmaceuticals. The buccal mucosa separates the donor chamber from the receptor chamber. There are separate supplies of medication and buffer solutions for each chamber of the device. With a magnetic stirrer, homogeneity may be maintained at 37°C by maintaining the temperature of the receptor phase. Replacement of the three millilitre aliquots with new medium is required at regular intervals[41]. A UV-Visible spectrophotometer will be used to measure the amount of medicine released over time in the samples.

➤ Flow-Through Diffusion Cells

Similar to Franz diffusion cells, buccal mucosa permeation studies make use of flow-through diffusion cells. Because of this, tissue drying and death can occur in this flow-through diffusion cell, unlike the Franz diffusion cell, which does not have a closed donor chamber and buccal mucosa exposed to the air. Since the receptor solution runs below the implanted buccal mucosa, there will be no drug buildup in the receptor chamber of this diffusion cell. After collecting the receptor solution on a regular basis, UV spectrophotometer is used to detect whether or not the drug has penetrated or diffused across the buccal membranes[42].

IN-VIVO TECHNIQUE

➤ Buccal Absorption Test

The buccal absorption test is probably the most widely used method of determining the mucosal permeability of the buccal cavity. A predetermined dosage of medication was given to the individual, who was then instructed to chew on it for a short period of time until it was expelled into a container. Water or buffer

solution is used to cleanse the patient before they are put back in with the drug solution. Drug concentration was measured in both the cleaned and combined solutions. In order to determine the amount of medicine that is absorbed by the oral mucosa, the difference between the original drug solution and the final drug concentration after spinning and washing is used. When Dearden and Tomlinson, 1971, used a correction factor to assess the amount of saliva produced during each test, they were able to obtain accurate results. According to certain studies, dilution in the saliva and unintended absorption of the solution can be predicted by adding a marker chemical like phenol red or polyethylene glycol to the swirling fluid. Tucker, 1988 revised the original test to evaluate the kinetic profile using oral cavity samples of whirling fluid rather than the whole solution. An individual's oral cavity absorption kinetics can be studied utilising this study design[43]. An easy test that does not include the collection of blood samples might be able to tell us how quickly and how much medicine we are losing. Thus, the amount of drug that exits the swirling solution cannot be connected to the amount of drug that enters the body. Absorption happens on all surfaces of the mouth cavity due to the solution being swirling around it.

➤ Perfusion Cells

The ability of perfusion cells in animals' and humans' mouths to attach to specific mucosa is limited in nonspecific oral absorption. A perfusion cell is used to administer the drug solution, and the amount of the drug that has been absorbed is measured by measuring how much of the perfusate remains. The main drawbacks of perfusion cells are drug solution leakage and variability across subjects. In addition, it would be helpful if the drug plasma concentration could be estimated. In order to determine a medication's levels in the blood, saliva samples might be taken and analysed[44,45].

EVALUATION PARAMETERS OF BUCCAL PATCH:

- **Surface pH:** The pH of the enlarged buccal patches was tested by placing pH paper on the surface of the agar media plates.
- **Thickness measurements:** For measurements, a screw gauge with a count of no less than 0.01 thickness is employed. The average thickness was calculated by taking measurements in five separate locations[46].
- **Swelling study:** The buccal patch is weighed, then incubated at $37^{\circ} \pm 1^{\circ}\text{C}$ in a 1.5% agar gel plate. The patch is taken from the petri dish after one hour time intervals up to three hours, and additional surface water is thoroughly desiccated using the filter paper. Finally, the swelling index of the affected area is calculated.
- **Folding endurance:** As a way of gauging folding endurance, the number of times patches could be doubled repeatedly before breaking was used[47,48].
- **Thermal analysis study:** The differential scanning calorimeter technique is used to perform thermal analysis.

- **Buccal patches morphological characterization:** When it comes to investigating patches, a scanning electron microscope is used.
- **Water absorption study:** The agar plates' surface is allowed to swell with the swelling of patches. Phosphoric acid was used to raise the pH to 6.7. At $37^{\circ}\text{C} \pm 0.5^{\circ}\text{C}$, the sample was stored in an incubator. Samples are weighed (wet weight) and dried for seven days at room temperature at a given interval of time. Following the drying process, the final constant weights are recorded[49].

APPLICATIONS OF BUCCAL PATCHES

The human buccal mucosa has been a popular venue for medication administration in recent years. There are several advantages to administering drugs through the buccal mucosa. Buccal patches can be used for the following purposes[50].

- i) vaccines
- ii) controlled and sustained release
- iii) nicotine replacement therapy
- iv) antifungal infections
- v) management of herpes
- vi) targeted therapy for oral cancer
- vii) cardiovascular diseases
- viii) hypoglycemic agents
- ix) antiemetic
- x) asthma

FUTURE CHALLENGES AND OPPORTUNITIES:

Using hydrophilic macromolecular medications as therapeutic agents is hindered by the fact that their oral absorption is inefficient and unpredictable. Peptides and proteins with improved pharmacological properties may now be produced in large quantities thanks to recombinant DNA research and modern synthetic and biotechnological technology[51]. On the other hand, the therapeutic potential of these chemicals is contingent upon our ability to design and implement effective delivery systems. Protein and peptide cloning, as well as polypeptide synthesis, will be a pressing issue for pharmaceutical experts in the future. Buccal permeation can be aided by a variety of penetration enhancers that can be applied to the skin and mucosal surfaces of the mouth.

Researchers are increasingly focusing on drug transport channels other than the conventional polymer networks. Nanoparticle-enabled buccal film or patch research is currently conducted to allow for buccal mucosal permeation and systemic targeting. Trans-buccal delivery systems will need to investigate new functional excipients like thiolated polymers, new paths for buccal permeation like the ion-pair method, and increasing drug loading in order to increase permeability[52]. Microneedle patches might deliver one milligramme of insulin and one milligramme of human growth hormone into pigs' buccal cavities in less than 30 seconds. Patients' compliance and painless drug administration may be enhanced by using microneedle patches on the buccal surfaces of human volunteers, according to researchers. The development of new materials for controlled release buccal adhesive drug delivery is heavily focused on copolymers with hydrophilic/hydrophobic interactions, block copolymers, complexation networks responding via hydrogen/ionic bonds, and new biodegradable polymers, particularly from naturally edible sources. Scientists are working to develop buccal adhesive systems that could improve the bioavailability of orally ineffective medications by changing formulation techniques such as pH modifiers, enzyme inhibitors, and permeability enhancers. Buccal mucosa is still under studied for its ability to influence medicine absorption[53]. Oral administration through the buccal mucosa has a long way to go before it can be regarded effective and safe. Before these innovative formulations can be developed, a massive amount of new knowledge regarding the chemical and physical properties of these novel materials must be processed. From 2003 to 2007, the annual growth rate for transmucosal medication delivery devices is expected to be 11%. (55 percent) The United States, Europe, and Japan make up 30 percent of the \$3 billion global market revenue (10 percent)[54].

CONCLUSION:

Traditional pharmaceutical delivery methods have been proved to be ineffective in some cases, and buccal patches have emerged as an alternative. Medications delivered using mucoadhesive buccal patches have risen to prominence in the pharmaceutical business in recent years. Numerous studies throughout the world continue to investigate mucoadhesive buccal patches produced from natural and manmade polymers. More research is needed into buccal drug delivery for the transfer of orally ineffective drugs to the body. Buccal patches can be manufactured utilising a range of innovative technologies, such as electrospinning, electrical spraying and 3D printing. Each of these processes has its own advantages and limitations. On the basis of recent research on mucoadhesive buccal patches and predictions for the future, these findings can be summarised.

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