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# REVIEW ON "MUCOADHESIVE BUCCAL TABLETS OF SUMATRIPTAN SUCCINATE USING NATURAL BIOADHESIVE GUMS"

**AUTHOR'S:Ritu Singh, Madhuri Dubey**

DEPARTMENT OF PHARMACEUTICS

SARASWATI HIGHER EDUCATION AND TECHNICAL COLLEGE OF PHARMACY, GAHANI, VARANASI

**ABSTRACT**

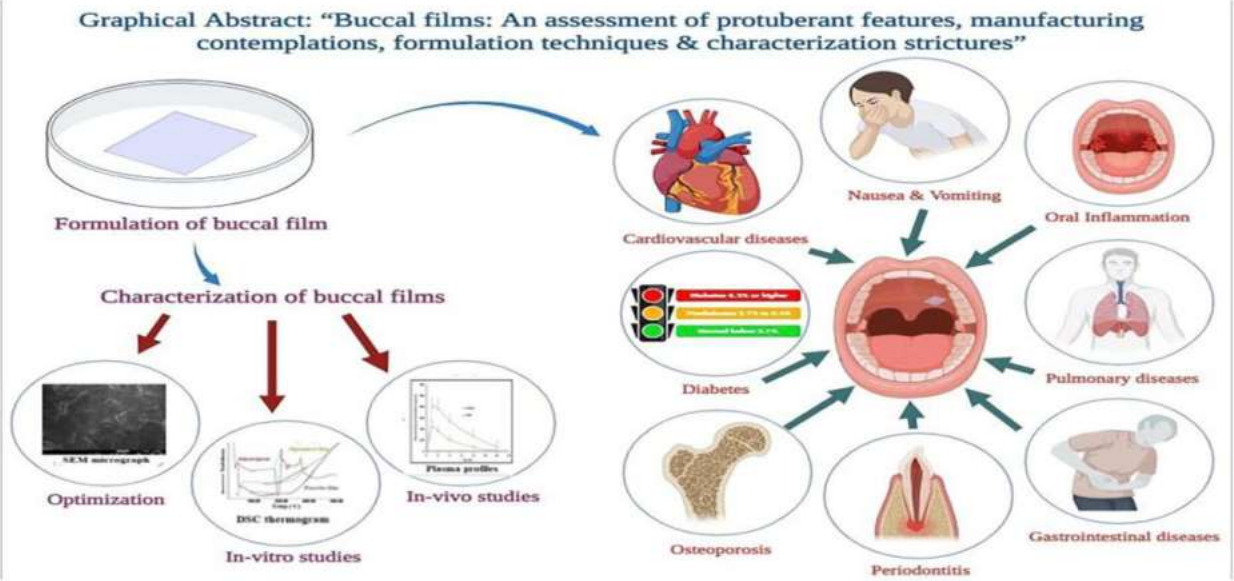
Mucoadhesive Buccal drug delivery systems offer a promising route for systemic drug delivery by avoiding first-pass metabolism and enhancing bioavailability. This review focuses on the formulation and evaluation of Mucoadhesive Buccal tablets of Sumatriptan Succinate, a drug used in the treatment of migraines, employing natural Bioadhesive gums such as guar gum, xanthan gum, and tragacanth. Various evaluation parameters, formulation techniques, and bioadhesion mechanisms are discussed.Mucoadhesive buccal tablets of sumatriptan succinate were prepared with an objective of enhanced bioavailability using chitosan in varying concentration alone and in combination with natural gums like xanthan and acacia as secondary polymers by direct compression method. The preformulation study using FTIR spectroscopy revealed the compatibility of drug and polymer. The tablets were evaluated for hardness, thickness, weight variation, friability and drug content concluded that all these parameters were in acceptable range of pharmacopoeia specification. The tablets were studied for surface pH, swelling index, *in vitro* drug release, *ex vivo* residence time, mucoadhesion, *ex vivo* permeation and also the effect of chitosan concentration on these parameters was studied.

**KEYWORDS:** Introduction**,** Mucoadhesive Drug Delivery System in Oral Cavity, Materials and Methods,

## 1. INTRODUCTION

Buccal drug delivery involves the administration of drugs via the mucosal membranes lining the cheeks. The Buccal route provides direct access to the systemic circulation and avoids gastrointestinal degradation and hepatic first-pass metabolism. Sumatriptan Succinate is a selective serotonin receptor agonist used in acute

migraine therapy. Due to its short half-life and poor oral bioavailability (~15%), buccal delivery systems have been investigated to enhance its therapeutic effect. Oral route has been the most popular and successfully used for controlled delivery of drugs because of convenience and ease of administration,




Greater flexibility in dosage form design (possible because of versatility of g.i. anatomy and physiology ) and ease of production and low cost of such a system. Buccal drug delivery system has the potential to fill an unmet need in migraine care by providing direct access to the systemic circulation through the internal jugular vein bypassing the first pass metabolism leading to high bioavailability. Moreover, the buccal cavity is easily accessible for self medication and drug absorption is terminated in case of toxicity by removing the dosage form from the buccal cavity.

**MUCOADHESIVE DRUG DELIVERY SYSTEM IN ORAL CAVITY**

Drug delivery through the oral cavity's membranes can be split into the following categories:

1) Sublingual Delivery: Drugs are injected into the bloodstream through the mucosal membrane lining the bottom of the mouth.

2) Buccal Delivery: By inserting the drug between the gums and cheeks, medications are released through mucosal membrane into the systemic circulation.

3) Local Delivery: Medication is placed in the mouth. Buccal Bioadhesive Dosage Form Classification:

1. Buccal Bioadhesive Tablets.

2. Buccal Bioadhesive semisolids.
3. Buccal Bioadhesive patch and films.

4. Buccal Bioadhesive Powders.

**1**. Buccal Bioadhesive Tablets: Dry dose forms known as buccal bioadhesive tablets must be moistened before being applied to the buccal mucosa. Bioadhesive polymers and excipients are already used in the formulation of double and multi-layered pills.

These tablets are solid dosage forms that were made by directly compressing powder. Depending on the excipients included in the dosage form, they can be put in contact with the oral mucosa and allowed to adhere or dissolve. They have the ability to multi-directionally deliver drugs to the mucosal area or the oral cavity.

**2**. Buccal Bioadhesive Semisolids: The finished powdered natural or synthetic polymers are then dispersed in polyethylene or an aqueous solution to create buccal bioadhesive semisolid dosage forms, such as are base.

**3.** Buccal Bioadhesive Patch and Films: Buccal bioadhesive patches come in a round or oval shape and are constructed of multilayered thin films or two-ply laminates. They primarily have a bioadhesive polymeric layer and an impermeable backing layer that allow drugs to move unidirectionally across the buccal mucosa. The drug is mixed with an alcohol solution of the bioadhesive polymer to create buccal bioadhesive sheets.

**4**. Buccal Bioadhesive Powders: The buccal bioadhesive powder dose forms for Nifedipine are sprayed onto the buccal mucosa and contain a combination of bioadhesive polymers and the medication to reduce diastolic blood pressure

## MATERIALS AND METHODS:

### Preformulation study:

The drug-polymer and polymer-polymer interaction was studied by FTIR spectrometer (Shimadzu 8400-S, Japan). Two percent (w/w) of the sample with respect to a potassium bromide disc was mixed with dry KBr. The mixture was ground into a fine powder using an agate mortar and then compressed into a KBr discs in a hydraulic press at a pressure of 10000 psi. Each KBr disc was scanned 16 times at 2 mm/sec at a resolution of 4 $cm^{-1}$ using cosine apodization. The characteristic peaks were recorded.

### PREPARATION OF BUCCAL TABLETS:

Direct compression method was employed to prepare buccal tablets of sumatriptan succinate using chitosan, xanthan gum and gum acacia as polymers. All the ingredients including drug, polymer and excipients were weighed accurately according to the batch formula (Table 1) and mixed in a blender. The powder blend of each formulation was compressed by using different punches (8 mm and 9 mm) according to their weights on a single stroke tablet punching machine (Rimek

Minipress II MT, Ahmedabad) at a pressure of 0.5 ton and turret speed of 2 rpm to form a buccal tablet.

**Table 1: Formulation of mucoadhesive buccal tablet of sumatriptan succinate Ingredients Formulation code**

| mg/tablet | F1 | F2 | F3 | F4 | F5 | F6 | F7 | F8 | F9 |
|---|---|---|---|---|---|---|---|---|---|
| **Sumatriptan** | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| **Chitosan** | 25 | 50 | 75 | 25 | 50 | 75 | 25 | 50 | 75 |
| **Xanthan gum** | --- | --- | --- | 50 | 50 | 50 | --- | --- | --- |
| **Gum acacia** | --- | --- | --- | --- | --- | --- | 150 | 150 | 150 |
| **PVP K30** | 8 | 8 | 8 | 10 | 10 | 10 | 15 | 15 | 15 |
| **Lactose** | 55 | 40 | 25 | 52 | 37 | 22 | 52 | 37 | 22 |
| **MCC** | 34 | 24 | 14 | 35 | 25 | 15 | 30 | 20 | 10 |
| **Mg. stearate** | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| **Talc** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **Total** | 150 | 150 | 150 | 200 | 200 | 200 | 300 | 300 | 300 |

**EVALUATION OF BUCCAL TABLETS:**

Hardness, thickness, friability, weight variation and drug content

The hardness of the tablets was determined using Monsanto Hardness tester. It is expressed in Kg/cm2. Three tablets were randomly picked from each formulation and the mean and standard deviation values were calculated. The thickness of three randomly selected tablets from each formulation was determined in mm using a Screw gauge. The friability of tablet was determined by using Veego Friabilator as per IP procedure of friability. It is expressed in percentage (%). Twenty tablets were initially weighed ($W_{initial}$) and transferred into friabilator. The friabilator was operated at 25 rpm for 4 minutes or run up to 100 revolutions. The tablets were weighed again ($W_{final}$). The percentage friability was then calculated by,

$F = W_{initial} - W_{final} / W_{initial} \times 100$.

The weight variation test was performed as per IP. The weight of each of 20 individual tablets was determined by dusting each tablet off and placing it in an electronic balance. The weight data from the tablets were analyzed for sample mean and percent deviation.

Five tablets were powdered and the powder equivalent to 50 mg of drug was extracted with distilled water and then filtered. The drug content was estimated spectrophotometrically at 220 nm.

| Formulae (mg) | Hardness (kg/cm2) | Thickness (mm) | Weight variation | Friability (%) | Drug content (%) | Surface pH |
|---|---|---|---|---|---|---|
| **F1** | 4.8±0.02 | 2.80±0.00 | 149.6±0.99 | 0.79±0.01 | 100.09±0.56 | 6.96±0.09 |
| **F2** | 4.6±0.07 | 2.83±0.06 | 148.8±0.99 | 0.67±0.01 | 102.73±0.46 | 7.01±0.17 |
| **F3** | 4.3±0.05 | 2.87±0.06 | 149.8±0.38 | 0.57±0.01 | 98.75±0.88 | 6.95±0.79 |
| **F4** | 5.6±0.07 | 2.97±0.06 | 199.6±0.17 | 0.46±0.01 | 103.36±0.83 | 7.04±0.06 |
| **F5** | 5.3±0.05 | 3.01±0.01 | 201.0±0.40 | 0.72±0.01 | 101.09±4.00 | 7.00±0.10 |
| **F6** | 5.1±0.02 | 2.95±0.00 | 200.0±0.20 | 0.56±0.02 | 99.75±0.38 | 6.94±0.09 |
| **F7** | 6.3±0.05 | 2.93±0.06 | 299.7±0.95 | 0.51±0.01 | 98.87±0.41 | 6.79±0.25 |
| **F8** | 6.1±0.02 | 2.90±0.00 | 300.2±0.97 | 0.46±0.01 | 99.09±0.26 | 6.91±0.18 |
| **F9** | 5.8±0.04 | 2.96±0.02 | 300.4±0.95 | 0.41±0.01 | 99.22±0.29 | 6.68±0.26 |

**SURFACE PH:**

The tablet was allowed to swell by keeping it in contact with 1 ml of phosphate buffer pH 6.8 for 2 h at room temperature. The pH was determined by bringing the glass electrode in contact with the tablet surface and allowing equilibrating for 1 min.

**SWELLING INDEX:**

The swelling index of the buccal tablet was evaluated in phosphate buffer pH 6.8 The initial weight ($W_1$) of the tablet was determined and then tablet was placed in 6 ml phosphate buffer pH 6.8 in a Petridis and then was incubated at 37 ± 1°C. The tablet was removed at different time intervals, blotted with filter paper and reweighed ($W_2$). The swelling index is calculated by, Swelling index = $100 (W_2-W_1) / W_1$

**INVITRO DRUG RELEASE STUDY:**

The study was carried out in USP XXIII tablet dissolution test apparatus-II (Electrolab), employing paddle stirrer at 50 rpm and 250 ml of phosphate buffer pH 6.8 as dissolution medium maintained at 37±0.5ºC. The tablet was supposed to release drug from one side only hence a one side of tablet was fixed to glass disk with cyanoacrylate adhesive. The disk was placed at the bottom of the dissolution vessel. At different time interval 5 ml of sample was withdrawn and replaced with fresh medium. The samples were filtered and analyzed for sumatriptan succinate at 220 nm using Shimadzu-1700 spectrophotometer.

**EXVIVO RESIDENCE TIME:**

The exvivo residence time for buccal tablet was determined using a locally modified USP disintegration apparatus as reported by Nakumara *et al*[15]. The medium was composed of 800 ml phosphate buffer pH 6.8 maintained at 37$^0$. A segment of sheep buccal mucosa (3 cm) was glued to glass slab. The tablet surface was hydrated using phosphate buffer pH 6.8 and then the hydrated surface was brought in contact with the mucosal membrane. The glass slab was vertically fixed to the tablet was completely immersed into the buffer solution at the lowest point and was out at the highest point. The time necessary for complete erosion or detachment of the tablet from the mucosal surface was recorded.

**CONCLUSION:** This review of mucoadhesive buccal drug delivery systems is likely to be a helpful piece for the competent design of newer or novel mucoadhesive dosage forms. Mucoadhesive dosage form has numerous uses, including the development of novel mucoadhesives, device layout, permeation enhancement, and mucoadhesion mechanisms. With the advent of a large number of new drug molecules as a result of medication discovery, mucoadhesive drug delivery will play an increasingly important role in delivering these molecules.

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