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FORMUALTION AND IN VITRO CHARACTERIZATION OF SUSTAINED RELEAE MUCOADHESIVE BUCCAL TABLET

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Abstract:

Ropinirole HCL is a para-sympathomimetic or cholinergic agent, used to treat mild to moderate dementia caused by Parkinson disease. It is subjected to an extensive hepatic first pass metabolism with systemic bioavailability of 36%. Its short half-life being 3-4 hours. The objective of the present study is to develop sustained release mucoadhesive buccal tablet for Ropinirole HCL to overcome poor bioavailability (below 50%) due to extensive first pass metabolism, poor permeability from the GIT and shorter half-life (2-6 hr.) by reducing the dosing frequency. Direct compression method was used to prepare buccal tablet. The prepared formulations were characterized for pre & post compression studies. The results of FTIR study revealed that there is no physical or chemical interaction between drug and polymer. Formulation Batch A-2 was selected as optimized batch which contain Ropinirole HCL (1 mg), HPMC-K4M (15 mg), Mannitol (100 mg), Magnesium stearate 2%. The optimized batch was showed evaluation result as, Weight Variation (250.81±1.56), Hardness (5.36±0.359) kg/cm^2, Diameter (12.08±0.15), Thickness (3.141±0.005) mm, Friability (0.623±0.001), Drug Content (98.81±1.45) %, Muccoadhesive strength (21.69±0.24) gm and Muccoadhesive force studies (1.10±0.1) Dyne. It was concluded that the prepared of Sustained release Muccoadhesive Buccal tablet of Ropinirole HCL may prove to be potential candidate for safe and effective Sustained release drug delivery over an extended period of time which can reduce dosing frequency.

Key World: Buccal Tablet, Polymers, Muccoadhesive tablets, Buccal Administration.

INTRODUCTION:

Among the various routes of drug delivery, oral route is the most suitable and most widely accepted one by the patients for the delivery of the therapeutically active drugs. But, after oral drug administration many drugs are subjected to presystemic clearance in liver, which often leads to a lack of correlation between membrane permeability, absorption and bioavailability. In recent years, significant interest has been shown in the development of controlled drug delivery to, or via mucous membranes by the use of mucoadhesive polymers. Within the oral mucosal cavity, the buccal region offers an attractive route for administration of the drug of choice. Buccal routes of drug delivery offer distinct advantages over oral administration for systemic drug delivery. Such as possible bypass of first pass effect, avoidance of pre-systemic elimination within the GI tract. These factors make the oral mucosal cavity a very attractive and feasible site for systemic drug delivery. Moreover, rapid onset of action can be achieved relative to the oral route and the formulation can be removed if therapy is required to be discontinued. It is also possible to administer drugs to patients who are unconscious and less co-operative Considering the low patient compliance of rectal, vaginal, sublingual and nasal drug delivery for controlled release, the buccal mucosa has rich blood supply and it is relatively permeable.

Mucoadhesive drug delivery systems are delivery systems, which utilize the property of bioadhesion of certain polymers. Bioadhesion is defined as an ability of a material to adhere a particular region of the body for extended period of time not only for local targeting of drugs but also for better control of systemic delivery. Successful buccal drug delivery using buccal adhesive system requires at least three of the following.

(a)A mucoadhesive to retain the system in the oral cavity and maximize the in timacy of contact with mucosa,

(b) A vehicle that release the drug in a controlled fashion under the condition sprevailing in them out hand

(c) Strategies for overcoming the low permeability of the oral mucosa.

The buccal mucosa lines the inner check and buccal formulations are placed in them out between the upper gingival (gums) and cheek to treat local and systemic conditions. The buccal route provides one of the potential routes for typically large, hydrophilic and unstable proteins, oligonucleotides and polysaccharides, as well as conventional small drug molecules. Various mucoadhesive devices such as tablets, film, patches, discs, strips, ointments and gel have been recently developed.[5]

1. Oral Mucosal Sites [2,3,4] :Within the oral mucosal cavity, delivery of drugs is classified into three categories,

2. Sublingual Delivery: is the administration of the drug via the sublingual mucosa (the membrane of the ventral surface of the tongue and the floor of the mouth) to the systemic circulation.

3. Buccal Delivery: is the administration of drug via the buccal mucosa (the lining of the cheek) to the systemic circulation.

4. Local Delivery: for the treatment of conditions of the oral cavity, principally ulcers, fungal conditions and periodontal disease

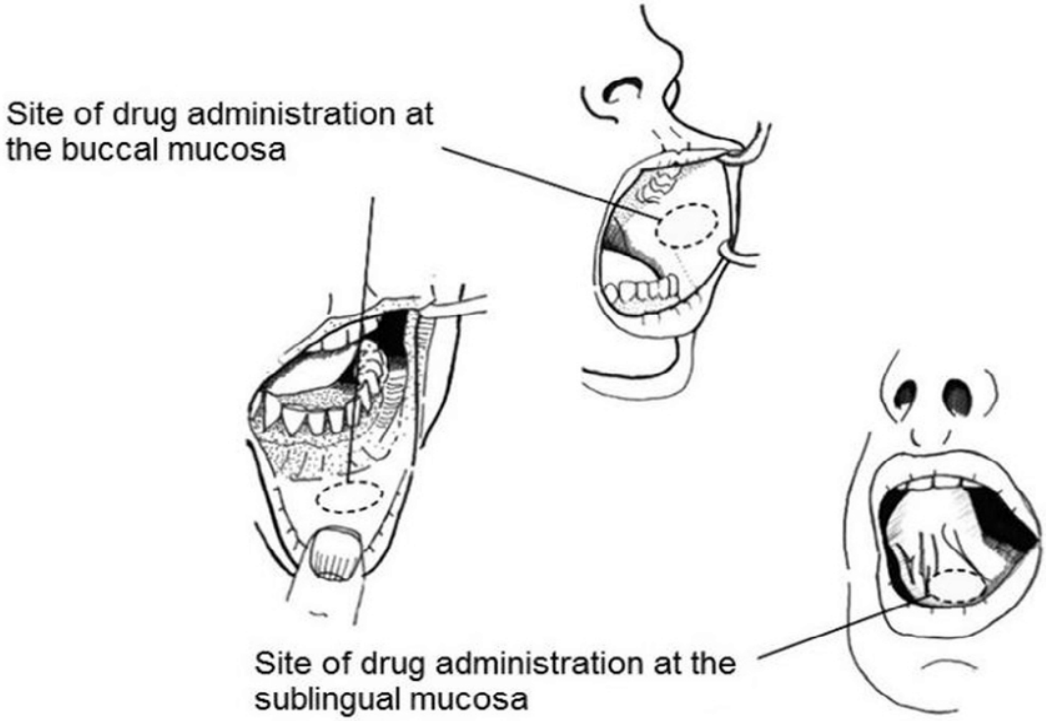

Figure1. The administration of tablet via buccal route

5. Advantages of Buccal Drug Delivery System [2,3,4]

The advantages of buccal drug delivery system are[2]

1. Enhancement of Bioavailability:

Oral route is the most suitable and most widely accepted one by the patients for the delivery of the therapeutically active drugs. But, after oral administration many drugs are subjected to presystemic clearance in liver, which often leads to decreased in oral bioavailability. The buccal drug delivery system enhance the oral bioavailability by avoiding the first pass hepatic metabolism of the drug and providing the intimate contact between tablet and the buccal mucosa,resulting there by in high drug flux and reduce the amount of drug required to achieve therapeutic efficacy. Therefore drugs, which show poor bioavailability via the oral route, can be administered conveniently.

Ex. Drugs, which are unstable in the acidic environment of the stomach or are destroyed by the enzymatic oral alkaline environment of the intestine.

2. Sustained Drug Delivery: -

Some active pharmaceutical ingredients' (API's) have intrinsically long halflives and are thus inherently long lasting and may only require once daily oral dosing to achieve a suitable therapeutic effect. However the vast majorities of API'shave relatively short half-lives and are thus shorter acting and require multiple daily dosing from conventional immediate release dosage forms to achieve a constant and sustained therapeutic effect. If doses are administered too frequently minimum toxic concentrations may be reached with the result that unwanted side effects become prevalent, whereas infrequent dosing may lead to sub-therapeutic blood levels

being achieved. The term sustained release is a broad expression that describes drug delivery in systems where the API is released in a controlled manner, at a predetermined rate, duration or location to achieve and maintain optimum therapeutic blood levels of an API. The API is either dispersed in a soluble or insoluble matrix or as solid particles, or as a solution that has been encapsulated by an outer rate controlling polymeric membrane from which the drug will be release in a controlled fashion.

3. Rapid Onset of Action:

A relatively rapid onset of action can be achieved relative to the oral route and the formulation can be removed if therapy is required to be discontinued. The buccal mucosa has rich blood supply and is relatively permeable and large contact surface of the oral cavity contributes to rapid and extensive drug absorption. The extent of perfusion is more therefore quick and effective absorption is possible. It is useful particularly for administration of antianginal drugs.

4. Improved Patient Compliance:

Poor patient compliance increases the chances of missing the dose of a drug with short half life for which frequent administration is necessary. The buccal drug delivery systems have added advantages over immediate release dosage form. These include reduction of dosing frequency by administering the drug once or twice a day. Since thefrequency of drug administration is reduced, patient compliance can be improved and drug administration can be more convenient due to reduction of gastrointestinal side effects. Also causes less fluctuation of plasma drug level and leads to more uniform drug effect and lesser total dose. Improve the patient compliance due to the elimination of pain associated with injections. Nausea and vomiting are greatly avoided.

5. Increased Ease of Drug Administration: -

The buccal route provides one of the potential routes for typically large, hydrophilic and unstable proteins, oligonucleotides and polysaccharides, as well as conventional small drug molecules. Easy access to the membrane sites so that the delivery system can be applied, localized and removed easily.

6. Reduction of GI Irritation:

Several drugs cause irritation and damage to the gastric mucosa through direct contact, increased stimulation of acid secretion or through interference with the protective mucosal layer

e.g. NSAIDs, especially the salicylates.

Such problems can be overcome by non-exposure of the drugs to the gastrointestinal fluids.

7. Enhancement of Solubility and Dissolution Rate:-

Presence of saliva facilitates both drug dissolution and subsequent permeation by keeping the oral mucosa moist. The buccal mucosa has been supplied with dense network of blood capillaries and having large contact surface of the oral cavity contributes to rapid and extensive drug absorption. Moreover the use of permeation enhancers in buccal dosage forms enhances the solubility and dissolution rate through the buccal mucosa.

8. High Margin of Safety: -

Increased margin of safety of highly potent drugs due to better control of plasma levels. Reduction in fluctuation in steady state levels and thus maintaining drug concentration within a therapeutically effective window, therefore better control of disease condition and reduced intensity of local or systemic side effects. Can be used in case of unconscious and less co-operative patients.

9. Economical: - Reduction in health care costs through improved therapy, shorter treatment period, less frequency of dosing and reduction in personnel time to dispense, administer and monitor patients made the buccal drug delivery systems cheaper.

10. Limitations of Buccal Drug Delivery System [2,3,4] The limitations of buccal drug delivery system are:

❖ Low permeability of the buccal membrane, specifically when compared to the sublingual membrane results in low bioavailability. The buccal mucosa is considerably less permeable than the sublingual area, and is generally not able to provide the rapid absorption and good bioavailability seen with sublingual administration. The total surface area of the membranes of the oral cavity available for drug absorption is 170 cm^2 of which -50 cm^3 represents non-keratinized tissues, including buccal membrane.

❖ One of the major disadvantages associated with buccal drug delivery is the low flux which results in low drug bioavailability. Various compounds have been investigated for their use as buccal penetration enhancers in order to increase the flux of drugs through the mucosa. Since the buccal epithelium is similar in structure to other stratified epithelia of the body, enhancers used to improve drug permeation in other absorptive mucosa have been shown to work in improving buccal drug penetration.

❖ Only those drugs which are absorbed by passive diffusion can be administered by this route. e.g. Small molecules such as butyric acid and butanol, ionizable low molecular weight drugs such as acyclovir, propranolol, Rivastigmine and salicylic acid, large molecular weight hydrophilic polymers such as dextrans, and a variety of peptides including octreotide, leutinizing hormone releasing hormone (LHRH), insulin, and interferon have all been studied.

❖ Swallowing of saliva can also potentially lead to the loss of dissolved or suspended drug and ultimately the involuntary removal of the dosage form. The continuous secretion of the saliva (0.5-2 1/day) leads to subsequent dilution of the drug.

❖ The patient cannot eat/drink/speak.

- **OBJECTIVES:**

The objectives of present study are as follows;

1. To screen and select suitable polymer for buccal drug delivery.

2. To prepare buccoadhesive tablets using suitable polymer.

3. To perform in vitro characterization for buccoadhesive tablets.

4. To study mucoadhesive time for buccoadhesive tablets.

5. To perform dissolution study and observe release profile of buccoadhesive tablet.

❖ **DRUG PROFILE:**

- **Ropinirole hydrochloride –** Ropinirole hydrochloride is the hydrochloride salt form of ropinirole, a non - ergot dopamine agonist with antiparkinsonianproperty. Acting as a substitute for dopamine, Ropinirole hydrochloride bindsand activates dopamine D_2 and D_3 receptors within the caudate putamen in the brain, thereby improving motor function. Ropinirole hydrochloride is used alone or with other medicines to treat parkinson's disease. Ropinirole tablets are also used to treat a condition called Restless Legs Syndrome.

- **Synonyms –** ReQuip

- **Chemical Structure -**

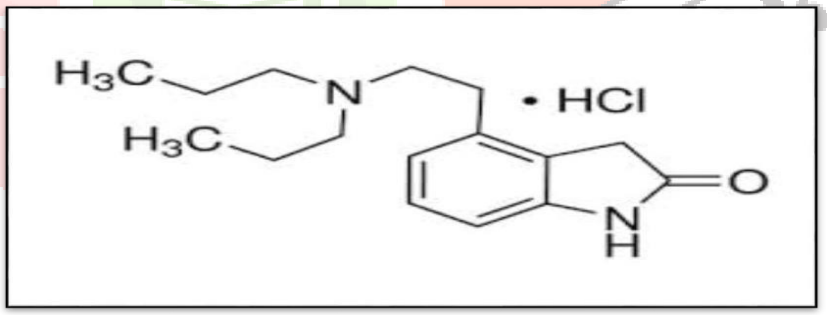

Figure No. 1 – Structure of Ropinirole Hydrochloride

- **Chemical Name –** 4-[2-(dipropylamino)ethyl]-1,3-dihydroindol-2-one

- **Category –** Ropinirole hydrochloride belongs to the class called dopamineagonists.

- **Molecular Formula –** $C_{16}H_{24}N_2O.HCl$

- **Molecular Weight –** 296.83 g/moles

- **Melting Point –** 243 – 250°C

- **Description –**

- **Colour –** Off White to Yellow

- **Odour –** Odourless

- **Texture –** Fine Powder

❖ **Method and Material :**

❖ **Material :**

Ropinirole hydrochloride are collected as a gift sample from Alembic pharmaceuticalslimited, Vadodara and HPMC K4M, HPMC K15M, HPMC K100M all are collected from Colorcon Asia Pvt.Ltd., Goa. And microcrystalline cellulose, Magnesium stearate, Mannitol,Talc are collected from S. D. Fine chemicals Ltd. Mumbai.

❖ **Method:**

- Selection of Method: -

Preparation Of Muccoadhesive Buccal Tablet was done by Direct Compression Method. Direct compression method can prepare good buccal tablet as compare to wet granulation technique.

- **Preliminary batch for formulation of mucoadhesive buccal tablet:**

Mucoadhesive Buccal tablets of Ropinirole hydrochloride were prepared by a direct compression method. Before going to direct compression, all the ingredients (drug, polymers, and excipients) were screened through sieve no. 60. All the ingredients were thoroughly blended in a glass mortar with a pestle for 15 minutes. After sufficient mixing magnesium stearate was added and again mixed for additional 2-3 minutes. The mixture is compressed using a g 9mm punch on a rotary tablet punching machine.

- **Preliminary Formulation of Mucoadhesive buccal tablet**

Name of ingredients	**Quantity Taken (mg)**								
	A1	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**	**A8**	**A9**
Ropinirole HCl(drug)	1	1	1	1	1	1	1	1	1
HPMC K4M	**15**	**-**	**-**	**25**	**-**	**-**	**35**	**-**	**-**
HPMC K15M	-	15	-	-	25	-	-	35	-
HPMC K100M	-	-	15	-	-	25	-	-	35
Mannitol	100	100	100	100	100	100	100	100	100
MCC	72	72	72	62	62	62	52	52	52
Magnesium stearate	7	7	7	7	7	7	7	7	7
Talc	5	5	5	5	5	5	5	5	5
Total	200	200	200	200	200	200	200	200	200

❖ **Evaluations –**

1. Pre – compression study:

- **Determination of Bulk density-**

Apparent bulk density can be determined by pouring preserved bulk powder into a graduated measuring cylinder via a large funnel and measuring the volume and weight of the powder. Bulk density can be calculated by the following formula.[88]

Where,

V_o – Bulk Volume

$$\text{Bulk Density} = \frac{\text{Weigh}}{\text{Bulk Volum}(V_o)}$$

- **Determination of Tapped density-**

Tapped density can be determined by pouring preserved powder into a graduated measuring cylinder via a large funnel and tapping 100 times on a wooden plank and measuring the volume and weight of the powder. Tapped density can be calculated by the following formula.[88]

$$\text{Tapped Density} = \frac{\text{Weight}}{\text{Tapped Volume (Vt)}}$$

Where,

V_t – Tapped Volume

- **Compressibility Index (or) Carr's index (I) –**

An indirect method of measuring powder flow from bulk densities was developed by Carr. The percentages compressibility of a powder was a direct measure of the potential powder arch or bridge strength and stability. Carr's index of each formulation was calculated according to the equation given below.[88]

$$\text{Carr's Index (\%)} = \frac{TD - BD}{TD} \times 100$$

Where,

TD = Tapped density BD = bulk density

- **Hausner's ratio –**

Hausner's ratio indicates the flow properties of the powder and is measured by the ratio of Tapped density to bulk density. It is the ratio of tapped density and bulk density. Hausner's found that this ratio was related to interparticle friction and, as such, could be used to predict powder flow properties. Generally, a value less than 1.25 indicates good flow properties, which is equivalent to 20% of Carr's index.[88]

$$\text{Hausners Ratio} = \frac{\text{Tapped Density}}{\text{Bulk Density}}$$

- **Angle of repose-**

The angle of repose is the maximum angle that the plane of powder makes with the horizontal surface on rotation. The angle of repose is helpful in the assessment of flow properties of particles which could be further related to packing densities and mechanical arrangements of particles. The angle of repose of granules was determined by the fixed funnel and free-standing cone method. The accurately weighed granules were taken in a funnel. The height of the funnel was adjusted in such a manner that the tip of the funnel just touched the apex of the heap of the granules. The granules were allowed to flow through the funnel freely onto the surfaces. The diameter of the powder cone was measured and the angle of repose was calculated using the following equation[88].

$$\text{Tan } \theta = \frac{h}{r}$$

Where,

h = height of the powder heap

r = radius of the powder heap

θ = is the angle of repose

- **Post Compression Parameters:**

1. Weight Variation-

Twenty tablets are selected at random, individually weighed in a single pan electronic balance and the average weight is calculated. The uniformity of weight is determined according to I.P. specification. As per IP not more than two of individual weights should Deviate from average weight by more than 5% and none deviate more than twice that Percentage.[88]

2. Hardness-

The Monsanto hardness tester was used to determine the hardness of the tablet. The tablet was held between a fixed and moving jaw. The scale was adjusted to zero; the load was gradually increased until the tablets fractured. The value of the load at that point gives a measure of the hardness of the tablet. Tablet requires a certain amount of strength or hardness and resistance to friability to withstand mechanical shocks of handling in manufacture, packing, and shipping. Three tablets from each batch are used for the hardness test and the results are expressed in Kg/cm2.[88]

3. Friability-

Friability is the measure of tablet strength. Roche-type friabilator was used for testing the friability using the following procedure. Twenty tablets were weighed accurately and placed in the tumbling apparatus that revolves at 25 rpm dropping the tablets through a distance of six inches with each revolution. After 4 min, the tablets were weighed and the percentage loss was determined.[88]

$$\% \text{ Friability} = \frac{\text{Initial Weight} - \text{Final Weight}}{\text{Final Weight}} \times 100$$

4. Thickness-

The thickness of three randomly selected tablets from each formulation was determined in mm using a Digital thickness tester. The average values were calculated.[88]

5. Drug Content Uniformity-

Ten tablets from each formulation were taken, crushed, and mixed. From the mixture 10 mg of Ropinirole hydrochlorideequivalent of the mixture was extracted thoroughly with 100 mL of pH 6.8 phosphate buffer. The amount of drug present in each extract was determined using a UV spectrophotometer at 279 nm. This procedure was repeated thrice and this average was chosen.[88]

$$\% \text{ Drug Content} = \frac{\text{Absorbance}}{\text{Weight Taken}} \times 100$$

6. In-vitro Mucoadhesive Study [68]

In evaluation of adhesion, it is important to use uniform surfaces that allow the formation of reproducible adhesive bonds. In present study, sheep buccal mucosa was used as a model mucosal surface for bioadhesion testing. Mucoadhesive strength of the tablets was measured on a modified two-arm physical balance. The sheep buccal mucosa was used as biological membrane for the studies. The sheep buccal mucosa was obtained from the local slaughter house and stored in Kreb buffer solution at 4°C from the time of collection and used within 3 hrs of procurement. The membrane was washed with distilled water and then with phosphate buffer pH 6.8 at 37°C. The sheep buccal mucosa was cut into pieces and washed with Kreb solution. At time of testing a section of sheep buccal mucosa (c) was secured keeping the mucosal side out, on the upper glass vial (B) using rubber band and aluminium cap. The diameter of each exposed mucosal membrane was 1 cm. The vial with

the sheep buccal mucosa (C) was stored at 37°C for 10 min. Then one vial with section of sheep buccal mucosa (C) and another vial were fixed on height adjustable pan (E). To a lower vial a tablet (D) was placed with the help of adhesive tape, adhesive side facing downward. The height of the lower vial was adjusted so that a tablet could adhere to the sheep buccal mucosa on the upper vial. A constant force was applied on the upper vial for 2 min, and then connected to the balance. Then the weight on right side pan was slowly added in an increment of 0.5 till the two vials just separated from each other. The total weight (g) required to detach two vials was taken as a measure of mucoadhesive strength. From this, the force of adhesive was calculated.

Force of adhesion (N) = Mucoadhesive strength/100 X 9.81

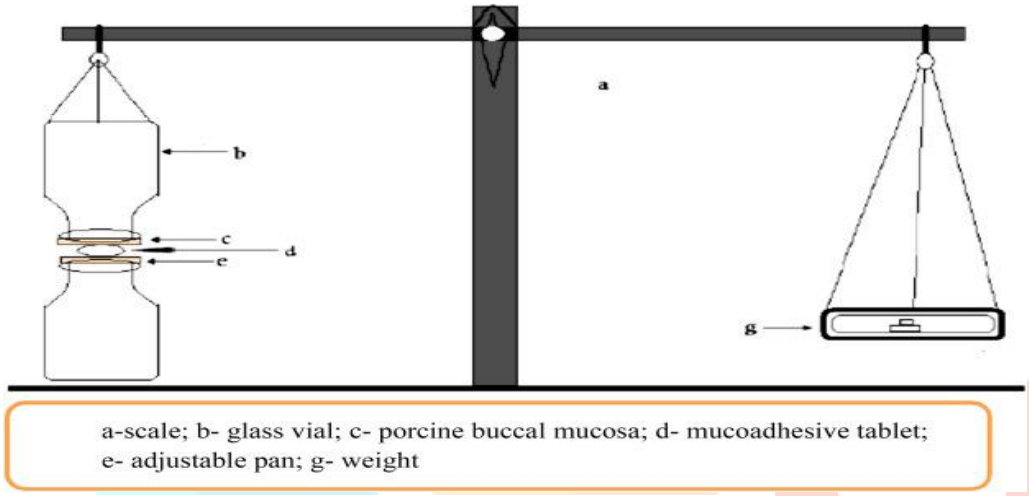

Figure 19: Measurement of bioadhesive strength.

a-scale; b-glass vial; c-sheep buccal mucosa; d-Mucoadhesive tablet; e-adjustable

7. Ex-vivo Residence Time 91:

The ex-vivo residence time was determined using a modified USP dissolution apparatus. The dissolution medium was composed of 900 ml of phosphate buffer of pH 6.8 inaintained at 37℃ 2°C. A segment of sheep buccal mucosa each of 3 cm length was ghed to glass slide. Three tablets of each formulation were hydrated using 2 ml phosphate buffer pH 6.8 and then hydrated surface was brought in to contact with the mucosal membrane. The glass slide was vertically fixed to tablets was completely immersed in the buffers solution. The paddle of the dissolution apparatus was adjusted at a distance of 5 cm from the tablet and rotated at 50 rpm. The time for complete erosion or detachment from the mucosa was recorded.

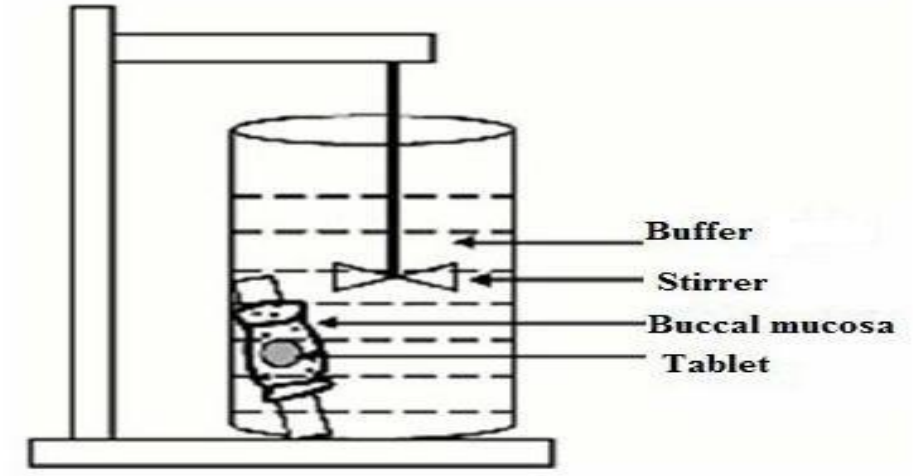

Figure : Schematic representation of ex-vivo Residence Time.

8. Swelling Study-

Swelling of tablet excipient particles involves the absorption of a liquid increasing weight and volume. Liquid uptake by the particle may be due to saturation of capillary spaces within the particles or hydration of macromolecule. The liquid enters the particles through pores and binds to large molecules, breaking the hydrogen bond and resulting in the swelling of particles. The extent of swelling can be measured in terms of % of weight gain by the tablet. [88]

$$\text{Swelling Index} = \frac{Wt - Wo}{Wo}$$

Where S.I. = Swelling index Wt = Weight of tablet at time t

Wo = Weight of tablet before placing in the beaker

9. Screening of Sustained Release Muccoadhesive Buccal Tablet By using combination of different Polymer.

Hydroxypropylmethylcellulose was used with all Polymers. Hydroxypropylmethylcellulose was combine with different different grades of different concentration of Polymer. Sustained release tablets were prepared by employing direct compression technique as per formulations mentioned in Table. The drug, Ropinirole hydrochloride, (1mg/tablet) polymers, Hydroxypropylmethylcellulose, magnesium stearate and talc were screened through 60 mesh sieve. All the ingredients were weighed in a precise manner. The ingredients were subjected to mixing for a period of 10 min. In final stage, magnesium stearate was added and the mixture was mixed for further 5 min. The granules were then squashed into tablets by direct compression method using the single- punch tablet compression machine (CPMD 3-10 Cahmach Machinery) using flat beveled punch.

Fabricated granules were evaluated for their bulk density, tapped density, cars index, hausners ratio, and angle of repose.

❖ **Result and discussion:**

Formulation of Sustained Release Muccoadhesive Buccal Tablet By Using Of Different Polymer

- ***Preliminary batch for screening of polymers combinations***

▪ **Pre compression Study**

Table No.4 - Pre - compression study of preliminary batch

Batch	**Bulk Density (g/cm^3 ± SD)**	**True Density (g/cm^3 ± SD)**	**Carr's Index (% ± SD)**	**Hausners Ratio (± SD)**	**Angle of Repose (θ ± SD)**
A1	0.345 ± 0.013	0.421 ± 0.017	18.52 ± 0.72	1.22 ± 0.106	28.32 ± 1.19
A2	0.294 ± 0.042	0.368 ± 0.039	19.24 ± 0.98	1.23 ± 0.024	25.57 ± 1.44
A3	0.366 ± 0.049	0.421 ± 0.043	13.09 ± 0.71	1.15 ± 0.037	22.19 ± 1.61
A4	0.318± 0.016	0.511 ± 0.012	22.32 ± 0.67	1.29 ± 0.095	28.17 ± 1.26
A5	0.415 ± 0.046	0.504 ± 0.038	18.10 ± 0.44	1.22 ± 0.025	24.69 ± 1.38
A6	0.389 ± 0.085	0.455 ± 0.026	14.54± 0.33	1.20 ± 0.041	25.45 ± 1.14
A7	0.368 ± **0.022**	0.414 ± 0.013	11.81 ± 0.42	1.12 ± 0.048	27.42 ± 1.26
A8	0.382 ± 0.097	0.459 ± 0.021	15.76 ± 0.32	1.18 ± 0.092	27.15 ± 1.24
A9	0.349 ± 0.062	0.349 ± **0**.013	17.17 ± 0.74	1.22 ± 0.0212	28.85 ± 1.45

n = 3

- Discussion –

It was observed that the **Bulk Density** of formulations from A1 to A9 was in the range of (0.345 ± 0.012- 0.349± 0.062) gm/cm^3. All formulations have good flow properties.

It was observed that, **Tapped Density** of formulations from A1 to A9 was in the range of (0.421 ± 0.010- 0.425 ± 0.097) gm/cm^3. All formulations have good flow properties.

It was observed that **Carr's Index** of formulations from F1 to F9 was in the range of (11.81 ± 0.42- 19.24 ± 0.98) %. All formulatihave has good flow properties.

It was observed that **Hausner's Ratio** of formulations from F1 to F9 was in the range of (1.15 ± 0.035- 1.18 ± 0.093). All formulations have good flow properties.

It was observed that the **Angle of Repose** of formulations from F1 to F9 was in the range of (28.25 ± 1.17- 28.85 ± 1.20) θ . All formulations have good flow properties.

- **Post Compression Study**

- Result

Table no. 5 – Post–compression study.

Batch	Wt. variation (± SD)	Hardness (± SD)	Diameter (± SD)	Thickness (± SD)	Friability (± SD)	Drug Content
A1	251.96±2.3559	5.06±0.251	12.013±0.156	3.130±0.010	0.586±0.0025	99.20±2.34
A2	250.81±1.5560	5.36±0.359	12.08±0.156	3.141±0.005	0.623±0.0018	98.81±1.45
A3	250.82±1.564	5.66±0.115	12.24±0.156	3.145±0.018	0.66±0.0019	98.48±143
A4	249.6±2.141	5.76±0.054	12.07±0.176	3.252±0.013	0.703±0.0025	99.08±1.43
A5	250.5±1.803	**7.03**±0.051	**12.09**±0.158	3.144±0.011	0.773±0.0021	98.46±1.46
A6	252.06±1.216	**7.20**±0.019	**12.06**±0.146	3.139±0.008	0.51±0.0025	91.13±086
A7	251.78±0.548	**8.3**±0.07	**12.06**±0.115	3.148±0.017	0.50±0.0018	98.57±067
A8	252.43±1.532	**8.56**±0.155	**12.06**±0.156	3.152±0.015	0.51±0.0017	98.72±1.54
A9	250.08±0.628	5.16±0.05	12.013±0.156	3.148±0.019	0.523±0.009	99.03±0.38

- Discussion –

1. The **Average Weight** of all Bucco-adhesive tablets within formulation was found to be uniform. This indicates uniform filling of the die cavity during tablet compression. Since the average weight of all tablets was almost 250 mg, the test requirements are met if none of the individual tablet weights is less than 95% or more than 105% of the average weight.

2. The **Hardness** of all Bucco-adhesive tablets was found to be in the range of 249.6**±2**.141to 252.43**±1**.532kg/cm2. This ensures good mechanical strength.

3. The **Thickness** of all Bucco-adhesive tablets was found in the range of 3.130±0.01 to 3.252±0.01mm. There were no marked variations in the thickness of all formulations indicating uniform behavior of powder throughout the compression process.

4. The **Friability** of all Bucco-adhesive tablets was found to be in the range one 0.50±0.001 to 0.773±0.002 which indicates good friability.

5. The **Drug Content** of all formulations was found to be between 91.13±086 to 99.20±2.34. The values ensure good uniformity of drug content in the tablet.

- **Bioadhesive Parameters**

Table no. 6. Surface pH, Mucoadhesive strength, Force of adhesion, Mucoadhesive Time

Batch	**Surface pH**	**Mucoadhesive strength (gms)**	**Force of adhesion (N)**	**Mucoadhesive Time**
A1	6.01±0.13	28.52±0.76	2.08±0.1	10.40 ± 0.31
A2	5.12±0.11	21.69±0.24	1.10±0.1	6.53 ± 0.36
A3	6.12±0.16	39.54±0.75	2.09±0,2	7.48 ± 0.24
A4	5.42±0.13	38.96±0.88	3.08±0.1	7.54 ± 0.12
A5	5.36±0.15	21.28±0.88	3.11±0.1	9.05 ± 0.24
A6	6.33±0.22	24.13±0.30	2.04±0.2	7.43 ± 0.27
A7	6.10±0.13	35.67±0.32	3.05±0.2	8.45 ± 0.35
A8	6.08±0.18	28.02±0.85	2.07±0.1	7.45 ± 0.31
A9	7.07±0.15	30.56±0.35	1.10±0.3	9.50 ± 0.32

n=3

- **Discussion**

1. The **surface pH** of all Bucco-adhesive tablets was found to be in the range of 5.12±0.11 to 6.33±0.22 This ensures good surface pH.

2. The **Mucoadhesive strength** of all Bucco-adhesive tablets was found to be in the range of 21.28±0.88 to 38.36±0.88. This ensures good mucoadhesive strength.

3. The **Force of adhesion** of all Bucco-adhesive tablets was found to be in the range of 1.10±0.1 to 3.11±0.1. This ensures a good force of adhesion.

4. The **Mucoadhesive time** of all Bucco-adhesive tablets was found to be in the range of 7.45 ± 0.31to 8.45 ± 0.35. This ensures good mucoadhesive time.

- **Conclusion:**

The present study has been a satisfactory attempt to formulate Sustained release Muccoadhesive Buccal tablet of Ropinirole HCL with a view of improving sustained release of the drug. From the experimental results it can be concluded that, The various polymers were used for screening amongst them the Buccal tablet prepared by Hyadroxypropylmethylcellulose, shows good Muccoadhesive strength and Muccoadhesive Force.

Prior to formulation, preformulation studies were carried out in order to establish compatibility between drug and polymers by FTIR spectroscopy. The results of FTIR study revealed that there is no physical or chemical interaction between drug and polymer.

For the formulation biocompatible polymers Hydroxypropylmethylcellulose, was chosen in varying proportions with the drug. Direct compression method was used to prepare buccal tablet

The prepared formulations were characterized for their postcomprenion staties te. Wt. Vition, Hardness, Diameter, Thickness, Friability. Drug Content, Moccoadhesive e and Maccoadhesive force studies. Almost all the formulations showed fairly agtable values for all the parameters evaluated.

Formatted Buccal tablet were stable at the selected temperature and humidity in storage be 28 days. From the stability studies it was found that there was no significant change in the drug content and release characteristics. Hence, finally it was concluded that the prepared Sustained release Maccoadhesive Bucal tablet of Rivastigmine Tartrate may prove to be potential candidate for safe and effective Sustained release drug delivery ever an extended period of time which can mdace dosing frequency.

- **Future Scope:**

The design drug delivery system hold promises to further study ie. In vivo studie leading to IVIVC for commercialization.

There is hope for its scale up technology for commercialization as it can easily applicable for large scale production.

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