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Review Article

Review on Sublingual Tablets – A Promising Formulation for Instant Action

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ABSTRACT

The current article is focused on ideal characteristics, patented technologies, significant features and formulating methods including the use of superdisintegrants, which achieve rapid onset of action, better patient compliance and increased bioavailability. Sublingual tablets dissolve instantaneously, releasing the drug, within a few seconds without the need of water and chewing. The objective behind this review was to summaries the benefits of sublingual formulation, mechanism of action, advantages of route of administration, factors affecting permeability of drug, various in vitro evaluation parameters and commercially available sublingual dosage forms. Different sublingual technologies address pharmaceutical industries and patient needs to enhanced lifecycle and appropriate dosing for pediatric, geriatric, psychiatric patients also patients with dysphagia. Consequently, many scientific techniques including freeze drying, molding, spray drying, sublimation, direct compression, mass extrusion, melt granulation method etc. have been employed for development of sublingual tablets. Due to its better stability and bioavailability, the sublingual route could be considered as a promising alternative to oral and parenteral routes.

INTRODUCTION

Oral administration is route where a pharmaceutical ingredient or substance will be taken through the mouth. Many medicinal products are taken by mouth because they have good systemic effect by reaching different parts of the body with the help of blood. Tablet involves compressed solid dosage form containing pharmaceutical substances with or without excipients. This pharmaceutical medicamentare soliddosage form with flat or biconvex circle like structures, prepared by compression of drug or combination of drugs, with or without diluents and excipients. They vary in shape and different in size and weight, depending on number of pharmaceutical substances used in formulation and depended on mode of administration. Whereverin permeability, the sublingual cavity (i.e., the floor of mouth) is more accessible and

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absorbable than other places of mouth. Sublingual administration means placing a tablet under the tongue. Drug delivered by oral mucous membrane is considered to be a promising alternative to the oral route and other routes too. These tablets disintegrate and dissolve rapidly in saliva due to interaction with our salivary enzymes without a need of water and gives fast onset of action which have problems like dysphasia (difficulty in swallowing) is a common problem, especially in geriatrics, pediatric patients who are mentally retarded, uncooperative, nauseated or on reduced liquid intake/diets have difficulties in swallowing these dosage forms. This review deals with mechanism of action, benefits as well as factors associated with this route and evaluation tests included in dosage form. Despite of recent advancements in other drug delivery the oral route remains most preferable and best route for administration of medications because of low cost and treatment which also leads to high levels of patient compliance. [1, 2]

SUBLINGUAL GLANDS

Sublingual Glands or salivary glands are present in the floor of mouth underneath the tongue which produce mucin and help to promote production of saliva in mouth. These secretions of glands are kept lubricated the inner area of mouth, which is important for chewing and swallowing food. A secretion of salivary enzymes mixed with food as it is chewed, making the material slippery and easily swallowed. Because of the salivary content of the chewed food, it can move without difficulty into the throat and also in digestive tract. [1, 3]

Drugs having short or infrequent dosing regimen could be delivered successfully through sublingual route because of high permeability and rich blood supply, this route produces a rapid onset of action with enhanced bioavailability with patient compliance. High content of saliva in chewed food helps the food to move without any difficulty from mouth to stomach. Saliva secretion plays an important roles in shaping the principle and physiological environment of oral cavity with the fluid volume, pH and composition. Saliva secretion has been promoted by 3 major salivary glands which are parotid, submaxillary and sublingual glands. Salivary enzymes regulates oral microbial flora by maintaining the oral pH and enzyme activity. Sublingual glands are known for their viscous saliva and enzymatic activity whereas parotid and sub maxillary glands produced watery secretion. Saliva facilitates swallowing and prevents chemical reaction of the teeth. Approximately 0.5-2.0L of saliva has been secreted by these gland. However, the volume of saliva which is available constantly is around 1.1ml, thus it provides a relatively low fluid volume which occurs low drug release from mouth compared to GIT. If we compared the GI fluid and saliva, saliva is relatively less viscous and flow rate of saliva is depends on 3 factors like the time of day, the type of stimulus and the degree of stimulation. [1, 3]

SUBLINGUAL DRUG DELIVERY

Sublingual region means under the tongue also called pharmacological route of administration through which drugs diffused into the blood stream through tissues of sublingual region. By this route direct contact of drugs with oral mucosa which leads the drug to come directly into systemic circulation which leads to enhance bioavailability and permeability of formulation. Dysphagia (difficulty in swallowing) which is a common problem of all age groups, children, and elderly persons with uncooperative or persons on reduced liquid intake have difficulties in swallowing etc. It is promising approach for overcoming this type of problems. The drug goes to hepatic first pass metabolism which results to increase bioavailability of drug medication. Sublingual drug delivery is convincing approach to remove this problems. The drug permeated by this area is 5 to 10 times higher than other delivery

system and easy to surpass hypodermic injection. So, low saliva is mainly appropriate which result in tablet breakage in this area. Thus, veins return from these region enters to systemic circulation, by passing presystemic drug elimination. [1, 3]

- Most drugs have properties that certainly act on the performance of sublingual medications like solubility, crystal morphology, particle size, hygroscopicity, compressibility and bulk density of drug.
- Some drugs undergo extensive first pass metabolism which results in poor bioavailability of its oral dosage forms, that kind of drugs are suitable for sublingual dosage form.
- Drugs which are not given in parenteral preparation are given by sublingual route of administration.

SUITABILITY OF DRUG FOR PREPARATION OF SUBLINGUAL TABLET [1]

- No bitter taste.
- Dose lowers than 50 mg.
- Small to moderate molecular weight.
- Good stability in water and saliva.
- Partially not ionized at the oral cavity pH.
- Drugs undergoes extensive first pass metabolism which results in poor bioavailability are suitable for sublingual dosage form.
- Drugs not given in parenteral preparation. Should have lower bioavailability.

MECHANISM OF DRUG ABSORPTION

Some drugs are absorbed by submucosal region will be increased when carrier pH is increasing (more acidic) and decreased with a lowering pH (more alkaline) of mouth. The cells of epithelium tissue and epidermis are capable of absorbing drugs by endocytosis (the uptake of particles by a cell itself) or by engulfing particles which is usually large area of absorption. Various elements of drug molecule can influence the amount of permeation through membrane (Lipid solubility, degree of ionization, pKa of the drug, pH of the drug solution, presence of saliva, membrane property and molecular weight with amount of drug). Wherever, drugs has disadvantages also(hepatic first pass metabolism and enzymatic degradation within gastrointestinal tract). This factors also grow the interest by increase therapeutic agents through various transmucosal routes and helps in providing a therapeutic amount of the drug to the target site of body to achieve and maintain the desired concentration in body. The submucosal region is difficult for placement of device because it decrease the tariff of smooth muscles or no mobile mucosa and also always washed by some quantity of saliva but besides that sublingual administration gives fast onset of action. Moreover, the absorption of drugs by heavy vascular lining of mouth passes the drug through the sublingual or buccal capillaries and veins from jugular veins and superior vena cava directly into heart and arterial circulation, by avoiding the liver metabolism, thus it avoids hepatic first pass metabolism. [1, 3]

It is believed that more acidic medium of the salivary glands, with arrangement of vasodilatation, makes easier absorption with uptake in blood stream. Mouth area is lined with whole lining ofmucous membrane which is place under a cover of squamous epithelium and have mucous glands. The salivary glands have lobules of cells through this saliva secreted by salivary ducts in mouth. Three types of salivary glands are parotid, submandibular and sublingual gland which is located on the floor of the mouth. The more acidic taste is, greater secretion of salivary enzymes output which help to avoid prospective harm to acid-sensitive tooth (enamel) by bathing the mouth in abundant neutralizing fluid. The sublingual artery travels ahead to salivary glands, and supplies to the neighbouring muscles and to

the mucous layer of the mouth, tongue and gums. [1]

SUBLINGUAL FORMULATION [1, 3]

Fast disintegrating sublingual tablets:

The tablets which disintegrate or dissolve rapidly in patient's mouth are convenient for the elderly patients or young children with swallowing difficulties and in situations where potable liquids are not available. Fast disintegrating tablet means a solid dosage form that contains medicament and disintegrates rapidly without water when kept under the tongue. The drug released, dissolved, and dispersed into the saliva and absorbed in sublingual region. It offers improved convenience and are frequently preferred over conventional solid oral dosage forms. Sublingual tablet lead to notable improvement over current treatment options for specific patients. The European medicinal agency committee of medicinal products for human use (CHMP) described sublingual tablets as having-great advantage for children. The size, disintegrating time and taste play important role in commercial potential of formulation. A fast-disintegrating time reduces any choking hazard and will also make it harder to split out the dose.

Bioadhesive sublingual Films:

This is latest concept of sublingual film based on collective mixtures consisting of water-soluble carrier covered with small particles of substances and bioadhesive polymer. With this it is possible to obtain a rapid dissolution in combination with bioadhesive reduction of drug in the oral cavity.

Sublingual spray:

This are formulation in which drug is dissolved or dispersed in a solvent and filled in the container with metered valve and on deposition a suitable dose of drug delivered through valve in a sublingual area.

Lipid matrix sublingual tablets:

Lipid matrix sublingual tablets is dosage form using promotion in sublingual and liposomal technologies to create a medication that put forward faster and more complete absorption than other traditional oral routes of drug delivery. This dosage form is quick, convenient and consistent for many orally administered drugs.

Sublingual vitamin tablets:

The sublingual vitamin that all doctors offers is vitamin B_{12} (cyanocobalamin). Vitamin-B_{12} is very helpful in our body's metabolism only taken by mouth.

Sublingual immunotherapy:

It is a type of immunotherapy that have liquid drops of allergen extracts delivered by in sublingual form. Sublingual immunotherapy is very much helpful in case of Seasonal allergic conjunctivitis [SAC] and Perennial allergic conjunctivitis [PAC] whom are spreading at much faster rate among persons who are working in industries and Allergen specific immunotherapy [SIT] for the patients with severe allergic conjunctivitis or asthma and this involves monthly vaccination lasting for 3 years and also have side effects such as anaphylactic reactions.

ADVANTAGES [1, 3]:

- Rapid onset of action is achieved as it different from other routes. In case of elimination of required therapy, the formulation has to be removed.
- Liver is surpassed and drug protected from acid attack with digestive enzymes of the middle gastro intestinal tract.
- Increase patient compliance because of elimination of associated pain with injections.
- Administration of drugs in senseless condition or incapacitated patients; battermode of administration as compared to other medications.
- Ease to administered to those patients who are unable to swallow a tablet, e.g., paediatric, geriatric and psychiatric patients.

- The main advantage of this dosage form it protect drug from degradation which occur due to pH and digestive enzyme in GIT.
- The main advantage of this dosage form it protect drug from degradation which occur due to pH and digestive enzyme in GIT.
- Low dosage gives high efficacy and also decreases risk of side effects.
- The wide contact surface area gives fast and extensive drug absorption. Hence, instant action in emergency conditions e.g., asthma.
- Fast absorption and highest blood levels due to high vascularization of area and hence mainly functional for the delivery of antianginal drugs.
- They also present the advantage of providing fast dissolution or disintegration in the oral cavity, without the need for water or chewing.

FACTORS AFFECTING SUBLINGUAL ABSORPTION [1, 3]:

- **Lipid solubility of drug:** the drug should be absorbed fully through this route and drug have slight higher lipid solubility than other required for GI permeation it is mainly for passive permeation.
- **Saliva pH or pKa:** Since, pH of saliva is 7. So, pH results for absorption of drug which are unionized. Also, the absorption by mucosa have pKa greater than 2 for acidic medium and less than 8 for basic medium.
- **Mouth epithelial mucosa thickness:** As thickness of sublingual epithelium mucosa (100-200µm) is minimum. So, the permeation of drugs is faster due to thinner epithelial mucosa. Hence, absorption of drug in low volume of saliva is easy.
- **Partition coefficient:** Molecules by suitable oil and water partition coefficient are instantly absorbed by sublingual mucosal epithelial cells. The oil and water partition coefficient in range of 40 to 2000 is adaptablefor optimum drugs.
- **Binding to oral mucosa:** Systemic availability of drug that bind to mucosal membrane is poor.
- **Solubility in saliva:** Plus to high lipid solubility, the drug is soluble in aqueous oral fluids. Hence, biphasic solubility of drug is necessary for absorption.

MANUFACTURING TECHNIQUES USED IN PREPARATION OF SUBLINGUAL TABLETS [1]:

This formulation have selection of proper excipients of blank taste that shall ultimately result in a rapid disintegrating sublingual tablet by increasing their dissolution and disintegration of active ingredients. The different types of techniques which are used for preparation of sublingual tablets are as follows:

- **Direct compression method:** This method is commonly used in commercial manufacturing industries of sublingual tablets because it is easy and cost-effective method, as it exhibit basic substances that can be mixed well and do not require more distant granulation steps preceding to lubrication and compression. This method have good automatic strength and promotable fast disintegration. The immediate compressedsublingual medicated formulation having quickest soluble superdisintegrants, binders and lubricants. They also involves dried binder, surface activeagent, artificial sweeteners, and flavouring agents. Sugar-based excipient are widely used as bulked agent due to their heavy water solubility, sweet property and appreciable oral feel. Almostall sublingual formulations involve some saccharide-based material. The suitable amount of disintegrant are critical situation to get a fast disintegration and dissolution rate.

Several novel advancements of comprising disintegrants and other soluble and/or insoluble excipients for fast dissolution and propermechanical strength are noted.

Advantages:

1. Reduced production cost and time.
2. Product stability can be improved.
3. Less number of equipments are required, less process validation.
4. Suitable for the process of water and moisture sensitive APIs.
5. The chances of batch-to-batch variation are negligible.
6. Dry process.
7. Low labour inputs.
8. Lower consumption of power.

- **Compression molding method:** The tablets which are manufactured by this method exhibit rapid disintegration and dissolution rate, which is usually within 5 to 10 seconds. This type of tablets goes through special challenges during handling and shipping because of poor mechanical strength and may require special packaging. The potential strength of the tablets may increase by applying a satisfactory binder. But, the binder substance should be optimized to prevent any harmful effects on disintegration and dissolution rate of tablets. This method mainly provided soluble excipients to make quick and complete dissolution, and taste modifiers for patient acceptance. Molded tablets have been prepared directly from a molten matrix, in which the drug is dissolved or dispersed (heat molding) in a substance, or by evaporating the solvent from a drug solution or suspension at room temperature (no vacuum lyophilization).

Advantages:

1. It is simpler process
2. It involves lower tooling costs.
3. It is a great for producing large items and thicker parts.
4. It can be a good choice for insert molding and multicolour molding.
5. It is cost effective for short production runs.

- **Freeze drying method:**This process is costly, time consuming, and obtains tablets of poor mechanical strength due to this the process is not commonly used to manufacture sublingual tablets. Wherever, it has itself major advantages over other methods, so the tablet made by this technique have heavy porosity and disintegrate immediately. The process help to lower the temperature of the product in an aqueous medium below freezing rate, followed by applying a high-pressure vacuum. To remove the water in the form of a vapours, and collected as ice on a condenser, a measured temperature is raised and applied throughout the drying process. The formulation temperature at sublimation interface and it collapse atlowered temperature are critical to make a freeze-dried cake of best quality composition of dosage form. This method retains the structure and prevents the formulation for storage or transport. The forming tablet are usually low in weight and have heavily porous structures which have fast dissolve or disintegrate. It may result in a formulation with an amorphous structure, and leads to an enhanced dissolution rate. However, tablets manufactured by freeze drying method have poor stability at a major temperature and humidity.

Advantages:

1. Minimum damage to heat labile material.
2. Creation of porous friable structures.
3. Speed and completeness of rehydration.
4. Freeze-drying not cause shrinkage or toughness of material when dried.
5. The flavours and nutritional content may remain unchanged, made the method popular for saving food.

- **Spray drying method:** In this process, highly porous and fine powder can be produced and processing solvent can be evaporated during process. Spray dryers are widely used in pharmaceutical and biochemical processes also can be used to prepare rapidly disintegrating tablets or chewable tablets by using support matrix such as hydrolysed and non-hydrolysed gelatin and other components like Mannitol as bulking agent, sodium starch glycolate, Crosscarmellose sodium as disintegrants, acidic material like citric acid and alkali like sodium bicarbonate to enhance disintegration and dissolution rate. The tablet made from this method, can disintegrate in less than 20 seconds in a solution.
- **Sublimation method:** The key of rapid disintegration for orally disintegrating tablet is the presence of a porous structure in the tablet matrix. Conventional compression of tablet that have highly water-soluble excipients often did not dissolve fastly because of low porosity of matrix structured tablets. Hence, to make porous matrix, volatile substances are used for the process of sublimation. The volatile material was then removed by sublimation method and that results in formation of a porous matrix (approximately 30%).
- **Mass Extrusion method:** This technique involves softening of the active blend using the solvent mixture of water-soluble polyethylene glycol and methanol and expulsion of softened mass through the extruder or injection to get a cylindrical shaped extrude which are lastly cut into even parts using heated blade to form tablets. This process can also help to coat granules of bitter drugs to mask their taste.

Advantages:

1. Low cost per part.
2. Flexibility of operation.
3. The hot extrusion post mechanical preparation are easy.
4. Continuous operation
5. High production volumes.
6. Good mixing.
7. Excellent mechanical property resulted in cold extrusion.

EXCIPIENTS USED IN SUBLINGUAL DOSAGE FORM [1, 2, 4]:

USFDA defined that sublingual tablets as "A solid formulation that have medicinal pharmaceutical substance, which disintegrates fastly, mainly within a seconds or minutes, when deposited under the tongue". Some selected excipient may not have any interaction with the active ingredients or any other excipient. As ingredients of sublingual tablet mainly exhibits at least one disintegrant, diluent and lubricant. Excipients are chemical substance of low importance involved to a very important substances in modern drug technology.

1. **Binders:** Binders which are used in sublingual dosage forms consist of few groups, such as wetting agents (that can lower the surface tension of a liquid, e.g., polysorbates, sorbitan esters), dry binders (e.g. Pregelatinized starch, cross linked polyvinylpyrrolidone), solution binders (e.g., polyvinylpyrrolidone, cellulose derivatives), soluble in water/ethanol mix agents (e.g., polyvinylpyrrolidone).The desired disintegration time can be obtained using a suitable concentration and type of binder, in appropriate proportions with the disintegrants. They are also used in order to increase the mechanical strength of the tablet. Such properties usually contain polymers with disordered structure.Thebinder group can be classified many substances: ethanol, acetone, isopropyl alcohol, gelatin, gum Arabic, sucrose, glucose, potato starch, and zinc or ethyl cellulose.For example: - Polyvinylpyrrolidone (PVP) is a hygroscopic, odourless white powder is easily soluble in

most polar solvents, both inorganic and organic, however is not soluble in nonpolar solvents. Garekani et al. studied the result of different features of PVP (from 2000 to 50000) on property of Paracetamol medication. Tablets manufactured by PVP 10000 and 50000 have increased resistance beyondcrushing, even after having increased pressure of compressed force. The best dispersion of the active substance had tablets containing polyvinylpyrrolidone 10000. The weakest results were observed in the tablets containing PVP 2000.

2. **Fillers:** Fillers are the substances used to produce tablets with desired size and mass. Excellent fillers should have an acceptable flowability, density, low moisture absorption, chemical difference and taste influenced by patients. Common fillers are: lactose, mannitol, glucose, sodium chloride, cellulose and starch derivatives. For example, tablets containing lactose had improved physical properties, such as hardness and abrasion resistance, but simultaneously their disintegration time is extended. The other author demonstrates that tablets with lactose have better storage properties that have relative to heat, but tablets with xylitol disintegrate instantly in oral cavity. Mannitol is a sweet taste sugar alcohol derived from manna from Fraxinus ornus, but now is produced synthetically. In the drug technology it is often added to sublingual tablets as a filler and binder (5-25%). But it cannot be used in patients with anuria and congestive heart failure.
3. **Disintegrants or Superdisintegrants:** Disintegrants used to accelerate the disintegration time of the tablets. Substances that cause a very rapid disintegration of the tablet, by repeatedly increasing of its mass are called superdisintegrants. They are usually added in an amount of 1-10%, e.g.: croscarmellose, crospovidone and sodium starch glycolate. Tablets containing sodium starch glycolate disintegrated after 4.2 min. After about 3.4 min. disintegrated tablets composed of polyplasdone XL, only a little later disintegrated tablets with polyplasdone-XL-10 (3.6 min). Ideal disintegrants should have the following characteristics: poor solubility, good hydration capacity and flow properties, and inability to form complexes with drugs.

Properties of a Superdisintegrants:

- Poor gel formation.
- Hydration capacity should be good.
- Molding and flow property should be good.
- Should not form complex with drugs.
- Should be compatible with other excipients.
- Should not be toxic.
- Should be inert.

4. **Anti-adherents:** These substances are used to increase its Flowability, reduce friction and improve the properties of powders during the tablet's compression. These substances prevent sticking of the tablet to the compression matrix. Most of them is water-repellent, and therefore prevent adhesion of powder particles during tableting, reducing the friction. Antiadherents are mostly used in amount to 1%, as too large amount may modify the disintegration time, solubility, and bioavailability of the tablets. This includes magnesium stearate, colloidal silica, talc and starch. Magnesium stearate is the most frequently antiadherents used (as well as calcium and aluminium stearate) in tablets. Sodium stearyl fumarate is widely used as an antiadherent agent in tablets and capsules at a concentration of 0.5-2%. It is less hydrophobic than magnesium stearate and stearic acid.

5. Lubricants: These materials are used to provide lubrication to the formulation. This are Stearic acid & Magnesium stearate. Used in the range of 1 to 5% and reduces the friction between the surface of die wall and tablet, thus preventing the sticking and picking properties of formulation.

6. Sweeteners and sugar-based excipients: This type of excipients is used to provide sweetness to the dosage form. For e.g., Dextrose, Sugar, Fructose, Aspartame, Sodium saccharine, Sucralose and sugar alcohols. This helps to enhance good mouth feel and pleasant taste hence, enhancing patient's compliance.

7. **Flavouring agent:** This type of agents used to impart flavour to the tablet. For e.g., Peppermint flavour, Cooling flavour, aromatic flavour oil, vanilla, citrus oils & fruit essences.

EVALUATION INVOLVES IN SBLINGUAL TABLETS [1, 2, 3, 4]:

According to pharmacopoeias evaluation parameters of tablets are as followed:

- **Angle of repose**: This method is performed by funnelling method; the powdered blend was poured through the funnel fixed at a position 2 cm above the plane. And powder was poured until the upper tip of blend touch the lower tip of funnel.
  $\theta = \text{Tan}^{-1} h / r$,
  Where θ = angle of repose, h = height of heap andr = radius of base of heap circle.
- **Bulk density:** Precisely weighed all amount of powder was passed through sieve #60 and transferred in measuring cylinder. Value measured by volume occupied by powder without any tapping on cylinder so the formula given below:
  BD = weight of powder/ Bulk volume.
- **Tapped density:** The procedure is same as bulk density after that the measuring cylinder were tapped for 100 times then measured the tapped volume occupied by blend powder**.**
  TD = Wt. of powder / Tapped volume.
- **Carr's Index (CI):** Calculated by this formula
  CI= (TD-BD) ×100 / TD.
- **Hausner's Ratio (HR):** ratio that correlated the flowability of powder - **HR = TD / BD**
- **Weight variation:** randomly select and weight 20 tablets from each batch on digital weighing balance and note net weight then calculate weight of each tablet by its average. As per I.P acceptable limits:
- **Friability:** 20 tablets of each batch were weighed and then tested by friabilator at speed 25 rpm for 4 min. Then weighed and calculated.

$$\% \text{ Friability} = \frac{(\text{Initial wt.} - \text{wt. after friability})}{\text{Initial wt.}} \times 100$$

- **Hardness test:** used to test diametrical crushing strength of tablets. Monsanto hardness tester was used to determine the hardness of tablets. The tablet was placed between 2 jaws and the scale jaw moves towards by pushing it against fixed jaw until the tablet breaks. The load at which the tablet fails across the diameter is then recorded.
- **Thickness:** By verniar caliper.Vernier Caliper was used to measure diameter of each tablet. It was measured by simply placing the tablet in between the jaws of verniar caliper and slide the scale arm to press the tablet against the stationary arm then the reading displayed was noted.
- **Wetting Time (WT) and Swelling Index (SI):** A piece of tissue paper folded twice and placed in petri dish containing 6ml of water, placed on paper and time required for complete wetting was measured by stop watch.
  $SI = [(W_a - W_b) / W_b] \times 100$,
  W_b= weight before wetting, W_a= weight after wetting.

- ***In Vitro* Disintegration Study:** 4 tablets were taken from each formulation and dissolve in 4 different test tubes in 600 ml of phosphate buffer 6.8 pH in disintegration apparatus and the whole assembly was placed in phosphate buffer pH 6.8 at 37±0.5◦c with beats added into the test tubes. The apparatus was started moving up and down in buffer to disintegrate tablets then time was noted of tablet disintegration in solution.
- ***In Vitro* Dissolution Study:** *In vitro* drug release rate of Meclizine Hydrochloride sublingual tablets was carried out using United State Pharmacopoeia (USP) dissolution testing apparatus (paddle method). The dissolution test was carried out using 900 ml of 6.8 pH phosphate buffer. A sample of 5ml solution was withdrawn from dissolution apparatus at 5, 10, 15, 20, 25, and 30 min. The samples were replaced with fresh dissolution. The samples were filtered through filter paper and analysed by UV spectrophotometer and percentage drug release was calculated.

CONCLUSION

The sublingual tablet offers numerous significant advantages over conventional dosage forms because of improved efficacy, bioavailability, and rapid onset of action, better patient compliance and acceptance. It can be prepared in several ways and product performance depends upon the drug suitability and excipients selection in the delivery system. Due to the availability of various formulation techniques, good patient compliance and huge potential, several products have already been commercialized. Although more, market size and popularity of sublingual dosage form will surely become larger in future. It is also emphasized that newer scientific and technological innovations should be undertaken for the emergence of promising and versatile dosage form with novel performance and characteristics.

REFERENCES

1. Thulluru A., Mahammed N., C. Madhavi, K. Nandini, S. Sirisha, D. Spandana (2019)Sublingual Tablets - An Updated Review. Asian Journal of Pharmaceutical Research 9(2): 97-103.
2. Sarkhejiya NA, Patel VP and Pandya DJ. (2013) Sublingual delivery: A promising approach to improve bioavailability. Pharmaceutical Science Monitor; 4(2): 3870-89.
3. Hooda R, Tripathi M and Kapoor K. (2012) A review on oral mucosal drug delivery system. Pharma Innovation; 1(1):13-19.
4. Jaiswani R., Prakash A., Mishra D. K., D. K. J. (2014) Sublingual Tablets: An Overview. Journal of Drug Delivery Research; 3(4): 10-21.
5. P. Prathusha and Kamarapu P. (2017) A Review on Sublingual Tablets. Journal of Formulation Science & Bioavailability; 1(1): 1-2.
6. K. P. Nibha, Pancholi S. S. (2012) An overview on: Sublingual route for systemic drug delivery. Advance Drug Delivery Reviews; 2: 913-23.
7. N. Narang, Sharma J. (2011) Sublingual mucosa as a route for systemic drug delivery. International Journal of Pharmacy and Pharmaceutical Sciences; 3(2): 18-22.
8. Khan A. B., Kingsley K., Caroline P. (2017) Sublingual Tablets and the Benefits of the Sublingual Route of Administration. Journal of Pharmaceutical Research; 16(3): 257-67.
9. Sah S., Badola A., Kothiyal P. (2016) Sublingual Tablets: An Overview. Indian Journal of Pharmaceutical and Biological Research; 4(2): 20-26.
10. N. Narang, Sharma J. (2011) Sublingual mucosa as a route for systemic drug delivery. International Journal of Pharmacy and Pharmaceutical Sciences; 3:18–22.

11. Vats K. A., H.G.Shivakumar, Chaudhari C.A. (2016) Sublingual Drug Delivery:An Extensive Review, International Journal for Pharmaceutical Research Scholars; 5(1): 9-19.
12. Makwana Saroj and Kharadi R. (2018) A Review on Sublingual Formulation, World Journal of Pharmacy and Pharmaceutical Sciences; 7(9): 1300-1306.
13. Saroha K. (2014) A Review on Sublingual tablets. Asian Journal of Pharmaceutical Research; 8(1): 98–111.
14. Singh Manisha, Chitranshi N., Pal S. A., Arora V., Siddiqi W. A. (2012) An Overview on fast Disintegrating Sublingual Tablets, International Journal of Drug Delivery; 4(4): 407-417.
15. Bind A. K., Gnanarajan G. and Kothiyal P. (2013) A Review: Sublingual Route for Systemic Drug Delivery, International Journal of Drug Research and Technology; 3(2): 31-36.
16. Labhade S., Malode C., Rawal V., Rupvate S. (2019) A Review on Sublingual Drug Delivery System, Journal of Drug Delivery and Therapeutics; 9(3):684-688.

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