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Review on: Mouth Dissolving Tablet

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Abstract

Mouth dissolution tablets are pharmaceutical formulations designed for rapid disintegration in the oral cavity, providing quick release and absorption of active ingredients. These tablets are particularly beneficial for patients with swallowing difficulties, such as the elderly or paediatric populations. The formulation typically includes a combination of excipients that promote rapid disintegration, such as super disintegrants, and may utilize as a taste-masking agents to enhance palatability. In order to ensure stability and uniformity, the production process frequently uses methods like freeze-drying or direct compression. The quicker start of action, easier delivery without the need for water and enhanced patient compliance are some of the main benefits of mouth dissolving tablets.

They are commonly used for delivering various therapeutic agents, including analgesics, antihistamines and antiemetics Ongoing research focuses on optimizing formulation strategies and exploring new active ingredients to expand the application of mouth dissolution tablets in modern therapeutics.

Keywords - Mouth dissolving tablet, Fast dissolving tablet, Lyophilization, Disintegration.

INTRODUCTION

The "United States Food and Drug Administration" (USFDA) defines an active or medical dose in a solid dosage formulation as anything that is intended to be placed on the tongue and quickly breaks in a matter of seconds. Guidelines for quickly dissolving pills, like Fast-dissolving tablets also called mouth-dissolving tablets, are any kind of dosage form that dissolves, disintegrates, or releases in the mouth with no need for water. In general, all fast-dissolving tablets require materials which can cover up the unpleasant tasting. The subject exists in the suspended state and then will retract the imbibed soluble and non-soluble constituents through the action of the osmotic salivary induced. It has been determined that quicker absorption and dissolution (just for the unionized form of the medication) lead to a quicker start of action.[1] Fast-dissolving pills are often thought to dissolve in less time than a minute. The recent development in innovative drug delivery systems aims to enhance not only the safety but also the efficiency of the therapeutic molecule by offering a proper administration dosage form. Preparation of fast-dissolving tablets is one of the ways to provide an earlier onset of action. Fast-acting, or mouth-dispersing, tablets are created for both younger and older patients, as well as for active users who are often on the go, busy and can be absent when oral fluid is available.

Actually, hand tremors often develop in elderly patients and this makes it very difficult for them to handle the conventional oral dosage forms like pills, suspensions, solutions and capsules. There

are five methods that can be employed in formulating fast dissolving tablets direct compression, sublimation, freeze-drying, spray-drying and wet granulation.[2]

Figure 1*: *Mouth dissolving tablet

Patients traveling with minimal to no surplus water are also included. Restrict the use of oral convectional tablet capsules. A mouth-dispensing pill dissolves quickly and absorbs quickly, resulting in a prompt start of action. Furthermore, pharmaceutical candidates that are formulated as mouth-dispersing tablets may exhibit high oral bioavailability due to pre-gastric absorption. It offers efficient manufacturing, precise dosing and outstanding stability.[3] Super disintegrants, which are particularly beneficial for boosting the tablet's bioavailability and disintegration property in saliva, are added to the tablet to accelerate its dissolution. Three ways are primarily used to add disintegrants to the tablets. These are partially extra-granular and intragranular as well as extra-granular and intragranular. Mouth dissolving tablet usually, disintegrates in less than a minute. The methods for creating Mouth Dissolving tablet that are commonly applied are tablet moulding, dry granulation, solid dispersion and direct compression. The most common, simple, economical method for using MDT is direct compression.

MDTs are commonly used in an emergency situation

Nausea from traveling
Parkinson's disorder
Aged and paediatric patients
Unconsciousness patient
Mentally disabled patients
The lack of water

Mouth Dissolving Tablet these are the tablets which dissolve quickly in mouth without the help of the water. Mouth dissolving tablet as shown action within matter of seconds. Major component of MDT dissolves in mouth within a time period of (3-15) minutes. Some of the key products are Super disintegrants and agents that include up tastes.[4].

Characteristic of MDT'S

Have the capacity to deal with high drug loading.
Compatible with taste masking and other excipients.
Feel easy in the mouth.
After oral ingestion, leave little to no residue in the mouth.
Be strong enough to endure the rigors of manufacturing and handling subsequent to manufacture.

Show that you are not very sensitive to outside forces like humidity and temperature.
Be adaptable and take into account the machinery already in place for packaging and processing.
A low-cost formulation of tablets that enables their production utilizing both traditional equipment for packaging and processing.

Figure 2*: *Orally Disintegration Tablet

Benefits of Mouth Dissolving Tablet

No prior administration of water is required before taking the tablet. [5]
Easy to administer to young, old, or mentally retarded children.
More accurate dosage compared to liquids.
Quickly dissolves and takes in, resulting in a faster onset of action. Certain drugs have greater bioavailability when absorbed through saliva from the mouth, throat, and oesophagus and eventually reach the stomach. [6]
More convenient than liquid drugs in terms of dosing [7]
Easy to transportation.
Less first pass metabolism leads to higher bioavailability, which reduces the dose cost side effects.
There is no risk of breathing problems from a physical blockage when ingested, therefore Provides increased safety.

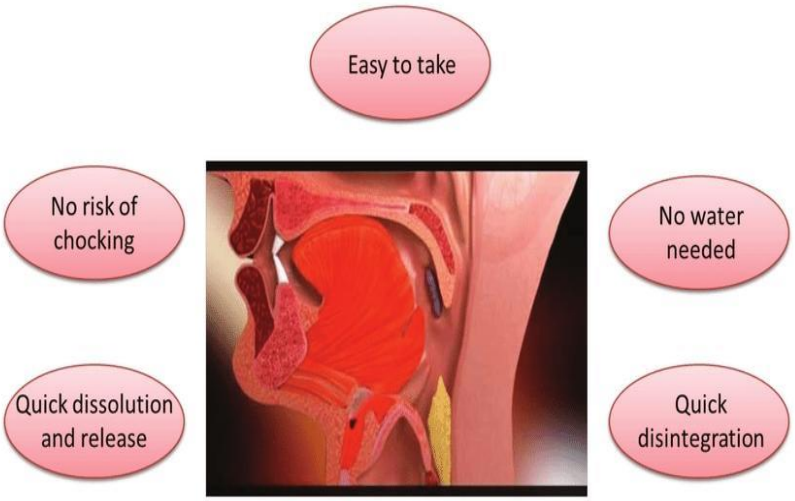

Figure 3*: *Advantages of Mouth Dissolution Tablet

Disadvantageous MDT

MDT requires special packing so as to stabilize the product in proper as well as safe manner.

Stability Issues

Mouth dissolving tablet are prone to moisture and temperature, which may impact shelf life as well as strength.

Taste Masking

Some products have a taste that is extremely bad, so it becomes really difficult to swallow them.

Dose limitation

Mouth dissolving tablet cannot hold high dosages because they have to be held in small dimensions.

Potential of Overdose

Dissolution occurring too quickly can lead to fast absorption, raising the possibility of adverse responses.

Gastrointestinal Irritability

Some patients may develop irritation or discomfort in the mouth or throat.

Mechanism of Action

Formulation

These tablets often include agents like mannitol or aspartame for sweetness and to enhance mouthfeel. They may also contain disintegrants that promote rapid dissolution.

Mouth Environment

When placed in the mouth, saliva starts to interact with the tablet. The moisture and mechanical action of chewing or moving the tablet around help it to dissolve.

Dissolution

As the tablet dissolves, the active ingredients are released and absorbed through the oral mucosa, allowing for quicker onset of action compared to traditional tablets that are swallowed.

Absorption

Some active ingredients can be absorbed directly into the bloodstream through the tissues in the mouth, bypassing the gastrointestinal tract.

This formulation makes them suitable for patients who have difficulty swallowing or for situations requiring rapid drug action.

Onset of action of Mouth Dissolution Tablet

Absorbed directly through the oral mucosa, leading to quicker onset of action.

Rapid Dissolution

They dissolve fast in the mouth without using water hence enhancing the convenience.

Simple to use

Especially for patients such as the elderly or children who have difficulty swallowing.

Taste Masking

Commonly flavoured to make it more palatable and mask a bad taste.

Fast Absorption

It can be absorbed directly through the oral mucosa, thus leading to a quicker onset of action.

Formulation Flexibility

Can be designed for various drug types, including those that require precise dosing.

Stability

Designed to maintain stability and efficacy over time, even without the need for conventional preservatives.

Convenient Packaging

Usually available in unit-dose packaging, making them easy to carry and consume on the go.[8]

Various Method Used in Mouth Dissolution Tablet

Tablet Moulding

With this technology, the tablet dissolves and disintegrates very rapidly because water-soluble components are used. The powder blend is moulded into a tablet by being hydrated with a hydroalcoholic solvent and using a compression pressure that is lower than ordinary tablets. Drying or air is then used to remove the solvent. Because of their porous shape, moulded tablets dissolve more readily. There are two major problems associated with the mask: poor masking power and mechanical strength. The mechanical strength of the tablet can be improved with binders like poly vinyl pyrrolidone, sucrose or acacia.

Van Scoik 3 avoided the undesirable taste masking property of the taste maskers by including particulate dosage forms of drug. The particulate dosage forms were produced by applying a spray for solidifying a molten blend triturate form consists of sodium bicarbonate, lecithin, hydrogenated cottonseed oil, the active ingredient and polyethylene glycol into a lactose-based tablet triturate form [9]

Direct Compression Method

Using this method, tablets are compressed directly from the drug and excipient mixture, without any prior preparation. Wet granulation prior to treatment is not necessary because the mixture needs to have adequate bonding and flow properties under pressure. Seldom are medications directly compressible into reasonably sized pills. The kind of disintegrant and how much of it are crucial. In addition, the distribution of particle sizes, contact angle, distribution of pore sizes, hardness of the tablet and water absorption capacity should be taken into account. These elements all influence how things break down. Disintegrant addition technique is inexpensive and simple to apply in an industrial setting [10]

Parent fast-dissolving multi-particle tablets use one swelling agent, either microcrystalline cellulose or modified starch and a carboxymethyl as a disintegration agent. In under 60 seconds the tablets will dissolve in the tongue. Fast dissolving tablets have been produced employing Gas Evolving disintegrants. A pair of US patents pertaining According to CIMA Labs, OROSOLV and DURASOLV, two processes of disintegration, are a source of carbon dioxide Michaelson 8 has described the tablet preparation by the synergistic mixture of carbonic acid, A metal that dissolves in water and alginic acid [11]

Spray Drying

Spray dryers are used widely in biochemical and pharmaceutical processing. Since the solvent of the process evaporates fast, spray drying may produce a fine powder which is highly porous. Spray drying can make quickly soluble pills by spray drying them. This method, which is according to a particle support matrix, involves spray-drying an aqueous composition that includes a support matrix and additional additives to create a small extremely porous powder that can be combined with the active elements and pressed into tablets [12]. Allen has used spray drying to create fast-dissolving pills. According to the literatures, the tablets created by this technology will crumble in 20 seconds.

Freeze Drying or Lyophilization

The drug is contained in a freeze-dried and a matrix soluble in water to form a unit that spreads in the mouth quickly. The final formulation may include some more excipients, including the matrix and active ingredients, that may further enhance the quality of the final product or optimize the process properties. Because saliva flows through the lyophilized mass fast and breaks it down once it reaches the mouth, lyophilization can be utilized to create tablets that are extremely porous in an open matrix network. These include of colourings, flavours, preservatives, wetting agents,

suspending agents and antioxidants. For freeze-drying formulations, tasteless, tiny particle size, chemical stability, water insoluble, and low dose are the ideal medicinal properties [13]

Using the medicine hydrochlorothiazide as a model, Corveleyn and Remon evaluated the effects of many compositions as well as process variables on the qualities of lyophilised rapidly dissolving tablets. The authors reported that maltodextrins may be a useful additive in the preparation of lyophilized tablets that have a fast dissolution character. The process of lyophilization is rather laborious and relatively expensive. Other disadvantages are brittleness, which do not allow the use of conventional packaging and low shelf stability stored in tough conditions. [14]

Sublimation Technology

These mixtures are then compressed into the form of tablets along with other tablet excipients, such as urea, naphthalene, urethane and bicarbonate. After that, volatiles are removed through sublimation, generating a porous structure.

Koizumi used the sublimation method in preparing very porous compressed tablets; these dissolved immediately in saliva. The tablet matrix material used was mannitol; camphor was used to sublimation of the material. Imination of camphor for pores in the tablets was done through sublimation for thirty minutes at 80^0 C in a vacuum.[15]

Makino demonstrated the potential of using water as a pore-forming agent to prepare an oral dosage form that could rapidly dissolve in the oral cavity. The mixture containing the active and sugars, like (glucose, mannitol, xylitol) etc. was processed into a tablet form that contained 1/3% w/w of water impregnated into it. After removing the water content, the finished product presented with high porosity and excellent performance. [16]

Ingredients Mostly Used in Mouth Dissolution Tablet

A medicine excipient is a inert substance use simply as transportation for a pharmaceutical's active ingredient. Many times, an "active ingredient “such as acetylsalicylic acid is difficult to give and absorb by the body in these cases, it is dissolved in or combined with an excipient. Excipients can also be employed to give weight to formulations containing very potent active agents so that convenience and accuracy in dose are achieved. In the manufacturing process, excipients can be used to help in managing the active agent in question besides being used in single or dose quantities. Excipients are used to stabilize the active component. This makes the material that is active" and, more particularly, stability over time enough to give the product a competitive shelf life compared to other products. Formulation of excipients is often, therefore a trade secret. Pharmaceutical codes demand identification and assurance of the safety of every ingredient in medicines, including the outcomes of their chemical breakdown. This is the reason for the minimal use of feasible amounts of excipients, only when they are absolutely necessary.

Marketed Formulation of Mouth Dissolving Tablet

Trade Name	Active Drug	Manufacturer
Mosid MD	Mosapride	Torrent pharma
Vomidon MD	Domperidone	Olcare Lab
Nimulid MTD	Nimesulide	Panacea Biotech.India
Zontec MD	Cetrizine	Zosta pharma India
Lonazep	Olnazepine	Sun Pharma
Ondem Md	Ondansetron	Alkem Pharma
Esulide MD	Nimusulide	Doff Biotech

Table 1*: *Marketed product of mouth dissolving tablet

Super Disintegrant

The basic concept of preparing MDTs is by the use of disintegrants. The fundamental reason that MDTs occupy the primary role in dissolution and disintegration lies in the fact that these formulations consist of disintegrants. Selecting the suitable disintegrant at the suitable concentration is important for the fast disintegration along with a high rate of dissolution Super disintegrants dissolve faster because of the synergistic effect of the formulation's swelling and water absorption. The system becomes more water-soluble and easily dispersed as a result of superdisintegrant swelling increasing the carrier's wetted surface and helps the main method of manufacturing MDTs is the use of disintegrants. MDT dissolves and disintegrates mainly because of which accelerates disintegration and dissolution. A proper application of ideal concentration of suitable disintegrant is essential to obtain quick disintegration with high dissolution rates. Because the swelling and water absorption effects are the mixed effects of super disintegrants with formulation, super disintegrants dissolve quickly. It is because the swelling of the super disintegrant expands the wetted surface of the carrier, improving the wettability and dispersibility of the system.

Based on the critical disintegrant concentration, the optimum superdisintegrant concentration can be determined. The superdisintegrant concentration is inversely proportional to the disintegration time of the tablets below this concentration, while the disintegration time is almost constant or increases when the superdisintegrant concentration is above the critical concentration. Some of the types of disintegrants include sodium starch glycolate, crospovidone, microcrystalline cellulose (Ac/di/sol) crosscarmellose sodium and pregelatinized starch.

Sugar based excipients

The aqueous solubility and sweetness of sugar-based materials provide a pleasant mouth feel and a good tasting mask. However, all sugar-based materials do not have a fast-dissolving rate and good compressibility or compactability. However, technologies are developed to use the sugar-based excipients in the formulation of fast dissolving tablets [17]. Other ingredients that are often used are water-soluble (diluents, lubricants, antistatic agents, plasticizers, binders, colors and flavours) [18]

Anti-adherent

Anti-adherents are used in order to prevent powder (granules) from sticking onto tablet punches, minimizing adhesion of powder towards punch faces. They also prevent pills from sticking. The most frequently used is magnesium stearate.[19]

Binder

The main functions of binders are that they provide volume to low active dosage tablets and ensure that tablets and granules can be produced with the required mechanical strength. Usually, binders are

Saccharides and Their Derivatives

Lactose and sucrose are disaccharides.

Polysaccharides and their derivatives, including starches, cellulose or modified cellulose, such as microcrystalline cellulose and cellulose ethers like hydroxypropyl cellulose (HPC) and sugar alcohols like xylitol, sorbitol.

Proteins: Gelatin; examples of synthetic polymers are PVP and PEG.

Binders may be classified according to their use: In wet granulation processes, solution binders are dissolved in a solvent, such as alcohol or water. Examples include polyvinylpyrrolidone, Gelatin, cellulose, cellulose derivatives, starch, sucrose and polyethylene glycol.

Disintegrants

When disintegrants wet, they swell and dissolve and cause the tablet's active parts to be released for absorption after breaks down in the digestive system. These are the disintegrant types:

Facilitators of water absorption.

Tablet fragmentation supports.

They protect the tablet.

Rapidly disintegrates Tablet small pieces upon contact with water, which helps break down.

Examples of disintegrants are Modified starch is sodium starch glycolate. Croscarmellose sodium is cross-linked sodium carboxymethyl cellulose. Crospovidone is cross-linked polyvinylpyrrolidone.

Flavours

The possibility that a patient can complete a course of therapy can be increased by using flavors to cover up any unacceptable taste of the active substances Synthetic or natural flavorings, including fruit extracts, are available. For example, you might use peppermint, cherry or anise to mask an unpleasant bitter taste. You can use a peach, apricot or liquorice flavor to upscale a savory product. You could employ the flavor of raspberry or liquorice to improve a product that is a bit sour. You might apply the flavour of vanilla in case of products being too sweet.

Sweetener

Aspartame

An artificial sweetener with fewer calories.

Sucralose

A sugar-based non-caloric sweetener.

Stevia

Known for having no calories, stevia is a naturally occurring sweetener derived from the stevia plant.

Sorbitol

A sugar alcohol which adds moisture and sweetness.

Xylitol

A different sugar.

Evaluation of Mouth Dissolving Tablet

Once a rule has been developed, the quality of the blends' physicochemical qualities often controls the tablet's quality. When mixing there are a number of formula and process variables that could have an effect on the final blend's qualities.

The following are different characteristics of blends tested:

Bulk density

“Density can be regarded as mass per unit volume.” Particle size, the distribution of and the adhesion tendency are the principal factors that determine the bulk density of a powder. There exist two types of bulk density. The outcome is that due to particles being packed to leave large spaces between their surfaces, the powder obtained is light powder and bears low bulk density. This is because there is a movement of smaller particles in between, resulting in a heavy powder with high bulk density. Larger ones Speaking of container size concerning the dimensions handling, transporting and storing raw materials and blends, bulk density is very important. An important scale of the mixing equipment. Here's a general procedure for determining bulk density or conversely, its inverse bulkiness. An accurately measured 50 cm^3 sample (mix) is placed in a 100 ml graduated cylinder. Three drops are permitted to fall through the height of one inch as the

cylinder is allowed to fall on a solid wood surface that falls freely after intervals of two seconds. Then the bulk density is calculated by dividing the weight sample in grams by the final volume in cubic centimetre.

Hardness

'Monsanto hardness testers' are used to measure table hardness. The hardness tester is used in the determination of the amount of force that has to break a tablet. Since increased hardness moves tablet breakdown MDTs usually manufactured with a softer surface than ordinary tablets. An effective oral dissolving formulation is obtained by finding a good equilibrium between its mechanical durability and disintegration time [20]

Friability

The friability of MDTs is higher than that of traditional tablets due to efforts to shorten the breakdown time. Zydis and other dosage formulations are extremely brittle. The mechanical strength of the tablet is gauged by its friability. A tablet that is more friable might break apart when being handled, transported or packaged. The approach that follows is used to determine the friability using the" Roche friabilator."

Figure 4*: *Roche Friabilator

Wetting Time

The dosage form 'wetting time' and contact angle have a direct link with one another. To identify the contributing factors to tablet disintegration, it should be evaluated. The disintegration velocity increases with decreasing wetting time. In an incredibly tiny Petri dish measuring 6.5 cm in diameter, a tablet gets immersed in 6 ml of water and the duration in seconds needed for the tablet to become fully saturated is measured.[21]

Disintegration test

Since fast-dissolving tablets have to dissolve without water, their disintegration times need to be changed. For this application, a 10 cm Petri dish is filled with 10 ml of water. The tablet is gently placed in the middle of the Petri dish and it takes some time to finally crumble to dust-like pieces [22]

***Figure 5**: Disintegration test apparatus*

Water Absorption Ratio

Tissue paper should be twisted before being placed in a small Petri dish with six cc of water. To find out how long it will take for a tablet to become fully saturated, spread it out on paper. Next, the wet saturated pill is weighed [23]

In vivo Dissolution Test

Six tablets, were placed on the instrument designed in I.P.[1996]Distilled water at 37° ± 2°C was used as disintegration medium and the time in seconds up to that point at which the tablet had fully dissolved with no residual mass remaining in the equipment was noted.

Figure 6*: *In vivo Dissolution test apparatus

In Vitro Dispersion time

The "USP paddle" conduct could be used to carry out in vitro dissolution investigations in 900 ml of dissolving fluid that is kept at 37±0.5°C at a speed of 50 rpm. Refer to a monograph before selecting a dissolving medium. The sample should be removed at designated times following staining with Whatman filter paper and spectrophotometric examination at a certain wavelength. After each sampling, an equivalent volume of freshly heated medium (heated to 37°C) is injected back into the dissolving solution to maintain the same volume throughout the test. Research on dissolving is conducted using.[24]

Reason for using mouth dissolving tablet

Rapid absorption
Easy for use
No need for water
Rapid onset of action
Improve compliance
Taste masking [25]

MTD s with patented test masking technology

The purpose of mouth dissolving tablets with unique test masking technology is to adequately mask the taste of the active substances, hence increasing their palatability. Usually, this approach entails covering the active ingredients with a barrier that keeps their flavor hidden until it dissolves in the tongue. These tablets can be helpful for providing nutrients or prescription drugs in a covert and comfortable manner. [26]

Future Aspect in MDT'S

Growing Demand

MDTs are expected to be more widely used as consumer preferences change in flavor of more practical dose forms, especially among pediatric and elderly populations.

Technological Developments

MDT efficacy and patient acceptability can be increased by formulation technology advancements such better flavor masking and quicker breakdown rates.

Expanded Applications

To serve more customers, MDTs may provide over-the-counter items, vitamins and supplements in addition to conventional pharmaceuticals.

Personalized Medicine

To more effectively satisfy the needs of each patient, tailored MDTs may be created, which would improve therapy results and adherence.

The development of MDTs may receive greater regulatory support as the regulatory environment changes, which would stimulate investment and research in this field.

Partnerships and Collaboration

In order to create innovative MDT formulations and delivery systems, pharmaceutical companies may partner with technology businesses more frequently.[27]

CONCLUSION

Mouth dissolving tablets are among the most promising drug delivery systems, providing considerable advantage, particularly in patients who cannot swallow the ordinary tablets as they have failed or their absorption will take place rapidly because of the onset of rapid effect. The formulation of these makes them disintegrate very quickly in the mouth, hence greatly increasing their bioavailability, as well as compliance with patients. As research and technology evolve, MDTs are expected to rise in more therapeutic applications with new pharmacotherapy solutions.

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