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IS FAST DISSOLVING TABLETS SATISFY ITS ROLE: A BRIEF DISCUSSION

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ABSTRACT:
It is very well known fact that a drug can be administered through many different routes so as to produce a systemic pharmacological effect. The route of administration is considered as the path by which a drug is taken into the body for the treatment of various diseases and disorders. The main route of administrating a drug is the oral route which is the oldest and most commonly used because of its ease of administration, self-medication and avoidance of pain as compared to parental route. Oral drug delivery remains the preferred route of drug delivery. Despite of the tremendous advancement in oral route some of the people find difficultly in swallowing tablet and other oral dosage form, so in order to troubleshoot all these problem associated with oral route, fast dissolving drug delivery systems (FDDS) were first came into existence in 1970. Oral fast-dissolving tablets, are an examples of a few existing technologies which having the potential to accommodate various physicochemical, pharmacokinetic and pharmacodynamic characteristics of drugs. Since emergence it captures the major portion of tablets and capsules from the market, thus it satisfies the role over Conventional Dosage forms.

Keywords: Fast dissolving tablets, Mechanism of superdisintegrants, Methodology, Replacement of conventional drugs.

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INTRODUCTION

The US Food and Drug Administration Center for Drug Evaluation and Research (CDER) defined in the 'Orange Book' as an ODT, "the solid dosage form contains medicinal substances, which disintegrates quickly normally within a few seconds, when it placed upon the tongue". The benefits of these dosage forms were highlighted by the adoption of the term, "Orodispersible Tablet", by the European Pharmacopoeia by which it completely described about a tablet that can be placed in the oral cavity where it dispersed fully by rapid rate before the process of swallowing[1].

In the recent decades, a variety of pharmaceutical research had been conducted for developing new dosage forms basically considered for quality of life. Most of these efforts had been focused on the ease of medication. Among all the various dosage forms developed to increase the ease of administration. The Fast Dissolving tablets (FDTS) are also known as Orodispersible tablets, Orally Disintegrating tablets, Mouth Dissolving tablets, Porous tablets, Fast Disintegrating tablets, Quick Disintegrating tablets, Rapid Dissolving tablets, Quick Melt tablets and Rapid Melt tablets. It is the most widely preferable commercial products for oral cavity in which an attractive site for the administration of drugs takes place because of ease of the administration. Various dosage forms such as Tablets, Capsules, and Liquid preparations are administered orally. In the last decade, Rapid Disintegrating tablet (RDT) technologies that made the tablet disintegrate in the mouth cavity without chewing and through additional water intake had drawn a great deal of attention on RDTs. The RDT are also widely known as fast melting, fast dispersing, rapid dissolving, rapid melt, and quick disintegrating tablets. All RDTs are approved by the Food and Drug Administration (FDA) and classified as orally

disintegrating tablets. The European Pharmacopeia recently adopted the term orodispersible tablet for the tablet that dispersed or disintegrated within 15 seconds to 3 minutes in the mouth before swallowing it. Thus the tablet disintegrated into smaller granules or melts in the mouth from a hard solid matter to a gel like structure and it allow easy swallowing by patients. Basically the disintegration time for the good RDTs varies from several seconds to about a minute. These tablets provide benefits particularly for pediatric and geriatric populations who have problem in swallowing conventional tablets and capsules. On further addition, pediatric patients may suffer from ingestion problems as these results in the underdeveloped muscular and nervous control. Moreover, the patient traveling with little or no access to water and limit utility of orally administered conventional tablets or capsules. RDT results in the quick dissolution and rapid absorption by which it shows rapid onset of action. Then the drug candidates undergo pre-gastric absorption when formulated as RDTs and may show increased oral bioavailability. It mainly provide good stability, accurate dosing, easy manufacturing[1, 2].

From the past one decade, there had been an increased demand for more patient friendly and compliant dosage forms. As a result, the demand for the developing new technologies has been enhancing annually. Since the development cost of the new drug molecules are very high and efforts are now being made by pharmaceutical companies for focusing on the development of new drug dosage forms for existing drugs with improved safety and efficacy together with the reduced dosing frequency, and this will lead to the production of more cost-effective dosage forms[1].

For the most effective therapeutic agents used to produce systemic effects by the oral route and it still represents the preferred way of administration and also owing to its several advantages and high patient compliance compared to many other routes of administration.

At present tablets and hard gelatin capsules constitute a major portion of drug delivery systems that are currently available in the market. However, many of the patient groups such as the elderly, children, and the patient who are mentally retarded, uncooperative, nauseated, or on reduced liquid intake or diets having difficulties in swallowing these dosage forms and also those who are traveling or have little access to water are similarly affected by this[3].

To fulfill all these medical needs pharmaceutical technologists have developed a novel oral dosage form called as Orally Disintegrating Tablets (ODTs) which has disintegrated rapidly in saliva, usually in a matter of seconds, without the need to intake of water. The drug dissolution and absorption as well as onset of clinical effects and drug bioavailability may be significantly greater than those which are observed from conventional dosage forms.

Although the chewable tablets have been on the market for some time that they are not the same as the new ODTs. Patients for whom chewing is difficult or painful could use these new tablets easily for the treatment. ODTs can be used easily in the children who have lost their primary teeth but do not have complete use of their permanent teeth[4].

Recent market researches indicate that the more than half of the patient population preferred ODTs to other dosage forms and the most consumers would ask their doctors for ODTs (70%) and the purchase data of ODTs are also more than sufficient (70%) or preference of ODTs to regular tablets or liquids are also more (>80%)[5,6].

ODT products have been developed for the numerous indications ranging from migraines (for which rapid onset of action is important) to the mental illness (for which patient compliance is important for treating basically chronic indications such as depression and schizophrenia).

Despite of so much of the advancements in various delivery system that developed for administration of various drugs through the different routes such as oral, parental, transdermal and nasal etc. and the oral route is considered as the most preferred route of administration that includes painless, ease of administration, patient friendly and so on. Several new technologies had been developed for the oral delivery that is being available to address to improve the patient compliance. Fast dissolving drug delivery system (FDDS) is gaining the popularity in pharmaceutical companies as they are the new drug delivery technique in order to provide the patient with medicines without obstacles in swallowing. FDDS include tablets and films that are designed in such a way that they disintegrated and then swallowed without the need of water as compared to other conventional dosage forms. Films are the small polymeric strips which are placed on the mucosal surface and then rapidly dissolve within a fraction of seconds in order to release the active ingredients without the consumption of water[7].

HISTORY

Tablets mostly designed to dissolve at the buccal mucous membrane; they were treated as precursor to the ODT. This dosage form was used for drugs that had yield low bioavailability through the digestive tract but

were inconvenient to administer parentrally, like steroids and narcotic analgesics. For rapid systemic distribution absorption done by the cheek allowed the drug to bypass the digestive tract. Not all ODTs have buccal absorption and also many have similar absorption with bioavailability to standard oral dosage forms with the primary route remaining GI absorption.[6, 7]The major fact is that a fast disintegration time and a small tablet's weight can enhance absorption in the buccal area. The first ODT disintegrated through effervescence action rather than dissolution, and also were designed to make taking medicines more pleasant for children. This method was adapted to pharmaceutical use with the invention of microparticles containing a drug, which would be released upon effervescence of the tablet and swallowed by the patient. Dissolution became more effective than effervescence through improved manufacturing processes and ingredients (such as the addition of mannitol to increase binding and decrease dissolution time). Catalent Pharma Solutions (formerly Scherer DDS) in the U.K., Cima Labs in the U.S. and Takeda Pharmaceutical Company in Japan led the development of ODTs.

The first ODT form of a drug to get approval from the U.S. Food and Drug Administration (FDA) was a Zydis ODT formation of Claritin (loratadine) in December 1996. It was followed by a Zydis ODT formulation of Klonopin (clonazepam) in December 1997, and a Zydis ODT formulation of Maxalt (rizatriptan) in June 1998. FDA guidance issued in December 2008 was that ODT drugs should disintegrate in less than 30 seconds. This practice was under review by the FDA as the fast disintegration time of ODTs makes the Disintegration test too rigorous for some of the ODT formulations that were commercially available.

REQUIREMENTS OF FAST DISSOLVING TABLETS OR AN IDEAL FDT SHOULD HAVE

1. No Requirement of water for oral administration, yet dissolve / disperse/ disintegrate in mouth in the matter of seconds.
2. Having a pleasing mouth feel.
3. Have an acceptable taste masking property.
4. Harder and less friable by nature.
5. Leave minimal or no residue in the mouth after administration.
6. Exhibit low sensitivity to the environmental conditions (temperature and humidity).
7. Allow the manufacturing of tablet using conventional processing and packaging equipments[8].

ADVANTAGES OF FAST DISSOLVING TABLETS

1. Ease of administration to the patients who could not swallow such as the elderly, strokes victims and bedridden patients. Patients who should not swallow such as renal failure patients and also who refuse to swallow, such as pediatrics, geriatric and psychiatric patients.
2. Patient's compliance for the disabled bedridden patients and for travelling and busy people, who do not have the ready access to water.
3. Good mouth feel property of Mouth Dissolving Drug Delivery System (MDDDS) helps to change the basic view of medication as "bitter pill" and particularly for pediatric patients due to improve taste of bitter drugs.
4. Convenience of the administration and accurate dosing as compared to the liquid Formulations.
5. Benefits of liquid medication in the form of solid preparation.
6. More rapid drug absorption through the pre-gastric area i.e. mouth, pharynx and esophagus which may produces rapid onset of Action.
7. Pre-gastric absorption could result in the improved bioavailability, reduced dose and improved clinical performance by reducing the side effects.
8. New business opportunities like product differentiation, line extension and life-cycle management, exclusivity of product promotion and patent life extension[8].

SIGNIFICANCE

1. Orally disintegrating tablet offered all the advantages of solid dosage forms and liquid dosage forms along with the special advantages that include:
2. As ODTs are unit solid dosage forms, providing good stability, accurate dosing, easy manufacturing, small packaging size and easy handling by patients. No risk of obstruction in dosage form, which is beneficial for travelling patients who do not have access to water.
3. Easy to administer for pediatric, geriatric and institutionalized patients (especially for mentally retarded and psychiatric patients).
4. Rapid disintegration of tablet, resulting quick dissolution and rapid absorption which provide rapid onset of action.
5. Medication as "bitter pill" has changed by excellent mouth feel property produced by use of flavours and sweeteners in ODTs.
6. Bioavailability of drugs that are absorbed from mouth, pharynx, and oesophagus is increased.

7. Pregastric absorption of drugs avoids hepatic metabolism by reducing the dose and increasing the bioavailability[9,10].

CHALLENGES TO DEVELOP ODT

1. Rapid disintegration of tablets.
2. Avoid increase in the tablet size.
3. Had sufficient mechanical strength.
4. Minimum or no residue in the mouth.
5. Protection from the moisture.
6. Good packaging design.
7. Compatible with taste masking technologies.
8. Not affected by all the drug properties
9. No drug excipient interaction[11, 12].

THE NEED FOR DEVELOPMENT OF ODTS

The need for non-invasive delivery systems prevails due to patient's poor acceptance, incompliance with existing drug delivery regimens, limited market size for drug companies and high cost of drugs in disease management[11, 12].

1. Patient factors

Orally disintegrating dosage forms are exceptionally suitable for patients, who find solid dosage form inconvenient to swallow with a glass of water. These patients are the following:

- Pediatric and geriatric patients having difficulty in swallowing or chewing solid dosage forms
- Patients who are reluctant to take solid preparations due to fear of choking
- Patient with allergies who requires a more convenient dosage form than antihistamine syrup
- A middle-aged woman subjected to radiation therapy for breast cancer may be too nauseous to swallow her dose.
- A schizophrenic patient who may try to hide a conventional tablet under his or her tongue so as to avoid their daily dose of an atypical antipsychotic
- A patient suffering from motion sickness during the journey may have little or no access to water[12].

2. Effectiveness factor

The major aim of these formulations is increased bioavailability and faster onset of action. In some cases; where drug dissolves rapidly, its dispersion in saliva (in oral cavity) causes pregastric absorption from some formulations in buccal, pharyngeal and gastric regions. A pregastric absorption avoids first pass metabolism and it is advantageous to drugs that undergo first pass hepatic metabolism. Correspondingly, safety profiles may be improved for drugs which produce substantial toxic metabolites by first-pass hepatic metabolism and gastric metabolism[13].

3. Manufacturing and marketing factors

Emerging new drug delivery technologies and utilizing them in new product development nevertheless of its size; is crucial for pharmaceutical industries to survive. It is common for pharmaceutical manufacturers to develop a given drug entity in a new and improved dosage form as a drug nears the end of its patent life. A new dosage form allows a manufacturer to enlarge market exclusively. It allows unique product differentiation and extends patent protection, hence forth offering its patient population a more convenient dosage form. For instance Eisai Inc. launched Aricept ODT, a line extension of donepezil for Alzheimer's disease, in Japan in 2004 and in the U.S. in 2005 in response to a generic challenge filed in the U.S. by Ranbaxy. Merck's Japanese subsidiary launched Lipola M (simvastatin ODT), a line extension of its block-buster, Zocor, a cholesterol-lowering drug, in response to seventeen generic registrations of simvastatin applied for in Japan in 2004[14-16].

The development of a fast-dissolving tablet also provides an opportunity for a line extension in the marketplace; a wide range of drugs (e.g., neuroleptics, cardiovascular drugs, analgesics, antihistamines, and drugs for erectile dysfunction) can be considered candidates for this dosage form. Pharmaceutical marketing is another reason for the increase in available fast dissolving/ disintegrating products. As a drug entity nears the end of its patent life, it is common for pharmaceutical manufacturers to develop a given drug entity in a new and improved dosage form. A new dosage form allows a manufacturer to extend market exclusivity, while offering its patient population a more convenient dosage form or dosing regimen. In this regard, fast dissolving/ disintegrating tablet formulations are similar to many sustained release formulations that are now commonly available. An extension of market exclusivity, which can be provided by a fast-dissolving/disintegrating dosage form, leads to increased revenue, while also targeting underserved and undertreated patient populations. Although the cost to manufacture these specialized dosage forms exceeds that of traditional tablets, this additional cost is not being passed on to the consumer[17-19].

ADVANCED METHODOLOGY EMPLOYED FOR FAST DISSOLVING FORMULATIONS (Table 1)

- **Tablet Molding**- Molding process is of two types' i.e. solvent method and heat method. Solvent method involves moistening the powder blend with a hydro alcoholic solvent followed by compression at low pressures in molded plates to form a wetted mass (compression molding). The solvent is then removed by air-drying. The tablets manufactured in

this manner are less compact than compressed tablets and posses a porous structure that hastens dissolution. The heat molding process involves preparation of a suspension that contains a drug, agar and sugar (e.g. mannitol or lactose) and pouring the suspension in the blister packaging wells, solidifying the agar at the room temperature to form a jelly and drying at 30°C[18].

- **Lyophilization or Freeze-Drying**- Freeze drying is the process in which water is sublimed from the product after it is frozen. This technique creates an amorphous porous structure that can dissolve rapidly. A typical procedure involved in the manufacturing of ODT using this technique is mentioned here. The active drug is dissolved or dispersed in an aqueous solution of a carrier/polymer. The mixture is done by weight and poured in the walls of the preformed blister packs. The trays holding the blister packs are passed through liquid nitrogen freezing tunnel to freeze the drug solution or dispersion. Then the frozen blister packs are placed in refrigerated cabinets to continue the freeze-drying. After freeze-drying the aluminum foil backing is applied on a blister-sealing machine. Finally the blisters are packaged and shipped. The freeze-drying technique has demonstrated improved absorption and increase in bioavailability. The major disadvantages of lyophillization technique are that it is expensive and time consuming; fragility makes conventional packaging unsuitable for these products and poor stability under stressed conditions. (Figure 1)[18-20]

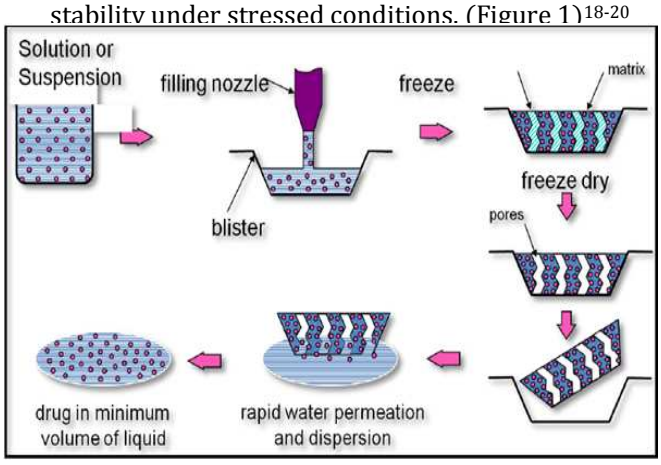

Fig. 1: Lyophilization or Freeze-Drying

- **Direct Compression**- Direct compression represents the simplest and most cost effective tablet manufacturing technique. This technique can now be applied to preparation of ODT because of the availability of improved excipients especially superdisintegrants and sugar based excipients:

1. **Superdisintegrants**- In many orally disintegrating tablet technologies based on direct compression, the addition of superdisintegrants principally affects the rate of disintegration and hence the dissolution. The presence of other formulation ingredients such as water-soluble excipients and effervescent agents further hastens the process of disintegration. For the success of fast dissolving tablet, the tablet having quick dissolving property which is achieved by using the superdisintegrant[21,22]. (Table 2)
2. **Sugar Based Excipients**- This is another approach to manufacture ODT by direct compression. The use of sugar based excipients especially bulking agents like dextrose, fructose, isomalt, lactilol, maltilol, maltose, mannitol, sorbitol, starch hydrolysate, polydextrose and xylitol, which display high aqueous solubility and sweetness, and hence impart taste masking property and a pleasing mouth feel. Mizumito et al have classified sugar-based excipients into two types on the basis of molding and dissolution rate. The mechanical strength of molded tablets is a matter of great concern. Binding agents, which increase the mechanical strength of the tablets, need to be incorporated. Taste masking is an added problem to this technology. The taste masked drug particles were prepared by spray congealing a molten mixture of hydrogenated cottonseed oil, sodium carbonate, lecithin, polyethylene glycol and an active ingredient into a lactose based tablet triturate form. Compared to the lyophillization technique, tablets produced by the molding technique are easier to scale up for industrial manufacture[21,23,24].

- **Nanonization**- A recently developed Nanomelt technology involves reduction in the particle size of drug to nanosize by milling the drug using a proprietary wet-milling technique. The nanocrystals of the drug are stabilized against agglomeration by surface adsorption on selected stabilizers, which are then incorporated into MDTs. This technique is especially advantageous for poor water soluble drugs. Other advantages of this technology include fast disintegration/dissolution of nanoparticles leading to increased absorption and hence higher bioavailability and reduction in dose, cost effective manufacturing process, conventional packaging due to exceptional durability and wide range of doses (up to 200 mg of drug per unit)[24, 25]. (Figure 2)

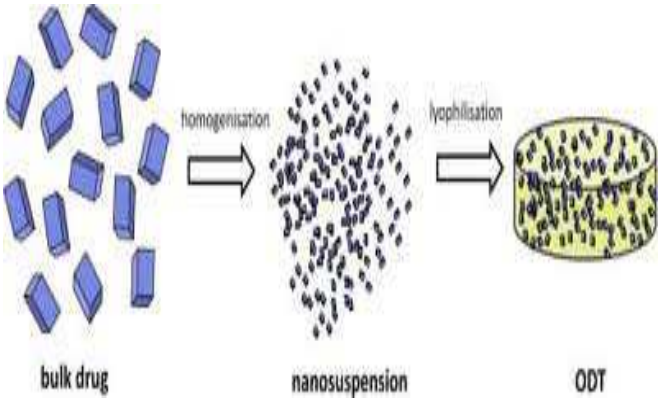

Fig. 2: Nanonization

Table 1: Tabulated form of different FDT technology platforms

Conventional Technology	Patented Technology
Direct Compression	Zydus
Tablet Molding	Lyoc
Freeze-drying	QuickSolv
Spray-drying	Orasol
Sublimation	FlashDose
Melt Granulation	Durasolv
Mass extrusion	Flashtab
	Wowtab
	Oraquick
	Advatab
	Ziplets

Table 2: Superdisintegrants employed in Formulations

S No.	Super disintegrants	Nature	Mechanism of Action	Brand Names
1.	Crosscarmellose	Modified cellulose or Cross linked Cellulose	Wicking due to fibrous structure swelling with Minimal gelling	Ac-Di-Sol Nymce 25 X Nymcel
2.	Crosspovidone	Cross linked PVP	Water wicking, swelling and possibly some deformation recovery	Kollidon Polyplasdone
3.	Aliginic acid NF	Cross linked Aliginic acid	Wicking action	Satialgine
4.	Sodium starch glycolate	Modified starch	Rapid and extensive swelling with minimal gelling	Explotab Primogel
5.	Sodium Alginate	Sodium salt of Alginic acid	Swelling	-
6.	Soy polysaccharides	Natural disintegrant	-	EMCOSOY
7.	Calcium silicate	-	Wicking action	-
8.	Ion exchange resin	Resins	-	Amberlite (IPR 88)

ODT MECHANISM OF SUPERDISINTEGRANTS

There are four major mechanisms for tablets disintegration as follows:

- **Swelling**- Perhaps the most widely accepted general mechanism of action for tablet disintegration is swelling. Tablets with high porosity show poor disintegration due to lack of adequate swelling force. On the other hand, sufficient swelling force is exerted in the tablet with low porosity. It is worthwhile to note that if the packing fraction is very high, fluid is unable to penetrate in the tablet and disintegration is again slows down[26,27]. (Figure 3)

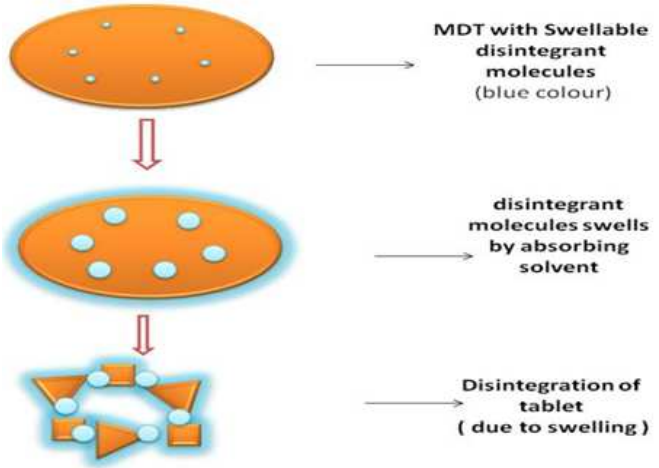

Fig. 3: Swelling Process

- Porosity and capillary action (Wicking)- Disintegration by capillary action is always the first step. When we put the tablet into suitable aqueous medium, the medium penetrates into the tablet and replaces the air adsorbed on the particles, which weakens the intermolecular bond and breaks the tablet into fine particles. Water uptake by tablet depends upon hydrophilicity of the drug /excipient and on tableting conditions. For these types of disintegrants maintenance of porous structure and low interfacial tension towards aqueous fluid is necessary which helps in disintegration by creating a hydrophilic network around the drug particle[26,27]. (Figure 4)

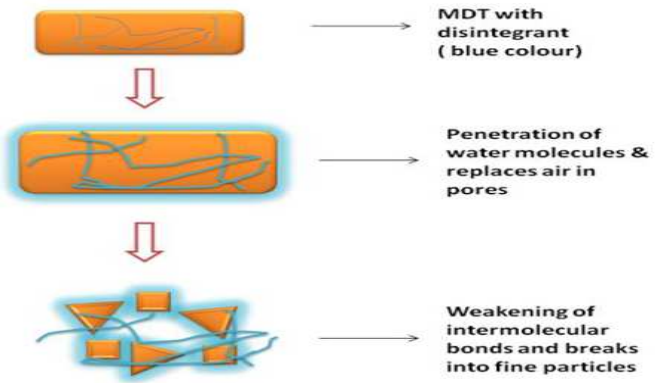

Fig. 4: Wicking Process

- Due to disintegrating particle/particle repulsive forces- Another mechanism of disintegration attempts to explain the swelling of tablet made with 'nonswellable' disintegrants. Guyot-Hermann has proposed a particle repulsion theory based on the observation that non swelling particle also cause disintegration of tablets. The electric repulsive forces between particles are the mechanism of disintegration and water is required for it. Researchers found that repulsion is secondary to wicking[26, 27]. (Figure 5)

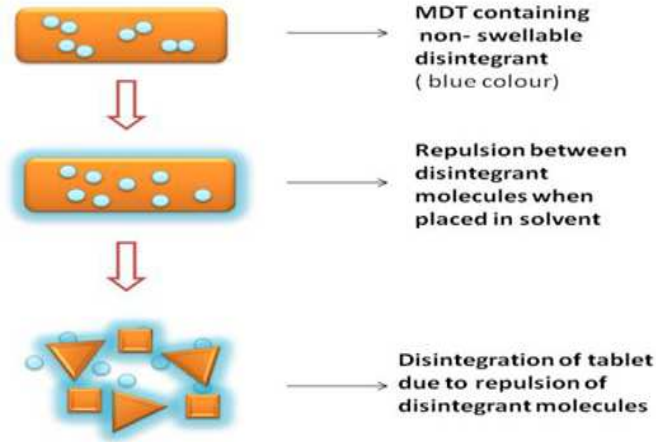

Fig. 5: Disintegrating particle/particle repulsive forces

- Due to deformation- During tablet compression, disintegrated particles get deformed and these deformed particles get into their normal structure when they come in contact with aqueous media or water. Occasionally, the swelling capacity of starch was improved when granules were extensively deformed during compression. This increase in size of the deformed particles produces a breakup of the tablet. This may be a mechanism of starch and has only recently begun to be studied[26,27]. (Figure 6)

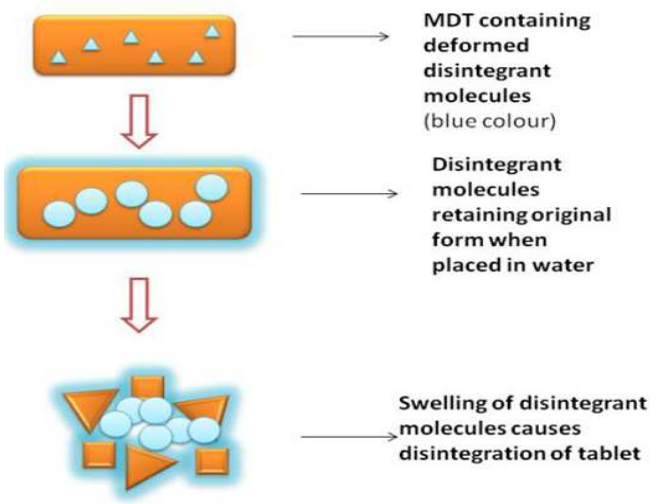

Fig. 6: Deformation Process

FDTS REPLACES CONVENTIONAL DOSAGE FORMS

Fast dissolving products provide improved compliance and convenience for patients. According to Technology Catalysts international (TCI), more than 200 branded and generic products have been commercially available on FDT formulations. These FDT prescription and over-the-counter products are approaching 10% of the global oral drug delivery market almost $4 billion. FDTs are potentially advantageous over conventional oral dosage forms with their improved patient compliance, ease of convenience, increased bioavailability and rapid onset of action which have drawn the attention of many manufactures throughout the past decade[28]. FDT formulation achieved by applying some of these technologies has sufficient mechanical strength and quick disintegration/dissolution properties in the mouth. There is a clear opportunity for new enhanced oral products arising within this market section. Approximately one third of the population primarily the geriatric and pediatric populations are suffering from swallowing difficulties which results in poor compliance with oral tablet and this will lead to reduced overall therapy effectiveness. Due to the constraints in the current FDT technologies as highlighted above, there is a prominent need to improve the manufacturing process for fast dissolving tablets. To fulfill these medical requirements, formulators have devoted considerable efforts for developing a novel type of tablet dosage form for oral administration, one that without the need of drinking water disintegrates and dissolves rapidly in saliva. The development of a fast-dissolving tablet also gives an opportunity for line extension in the market place; a wide range of drugs can be considered candidates for this dosage form. This will

lead to increase in revenue while also targeting underserved and under-treated patient population[29].

- Through the present investigation; solid dispersion of Olanzapine was made for the enhancement of its solubility. Further, by using solid dispersion, the mouth dissolving tablet (MDT) of Olanzapine was prepared to overcome the difficulty in swallowing[30, 31].
- Aceclofenac administration can be suggested twice daily as 100 mg orally in the treatment of rheumatoid arthritis. Geriatric patients may have difficulty in swallowing and chewing the tablet results in patient non compliance and ineffective dosing therapy. To overcome these problems mouth dissolving tablets present better option because they disintegrate and dissolve rapidly in saliva without need of drinking water. The development of a fast dissolving tablet also makes available an opportunity for a line extension in the market place[32].
- Sertraline Hydrochloride (HCl), the selective serotonin reuptake inhibitor (SSRI) is widely used in treatment of depression. Though Sertraline Hydrochloride is well absorbed after oral administration, there is a first pass metabolism leading to reduced bioavailability of the drug (44%). Therefore, the present investigation is related to the development of Fast Dissolving Tablets of Sertraline Hydrochloride that results in increased bioavailability[33].
- Chlorpromazine HCl is a potent anti-emetic drug. It acts by blocking D2-receptors in the Chemoreceptor trigger zone (CTZ) as well as antagonizing apomorphine induced vomiting. In the present study an attempt has been made to prepare fast dissolving tablets of Chlorpromazine HCl in the oral cavity with improved dissolution rate[34].
- Bitter taste of Etoricoxib can be successfully masked with aspartame and by using urea as hydrophilic carrier solubility of Etoricoxib is increased by kneading method. Well palatable and patient compliant Fast Dissolving Tablet can successfully be prepared. Optimized tablets show quick disintegration as well as rapid dissolution as compared to marketed tablets[35].
- Propranolol hydrochloride is a Antihypertensive drug, which undergoes extensive hepatic degradation (96%) which have poor Oral bioavailability (26%). To overcome this problem Orodispersible tablets of Propranolol hydrochloride are formulated and it avoids extensive first pass metabolism and improved dissolution efficacy, disintegration time resulting in improved bioavailability. The advantage of such formulation is that in case of hypertensive attack, patient can take the drug without the use of water[36].
- Ebastine is a second-generation non-sedating H1-receptor antagonist, which is indicated mainly in the treatment of allergic rhinitis and chronic idiopathic urticaria. The demand for mouth dissolving tablets has been increasing during the last decade, especially for geriatric and pediatric patients because of difficulties in swallowing. Currently available dosage forms are associated with lag time and delayed onset of action. However, aerosols and parenterals have rapid onset of action but strongly affect patient compliance. Thus an attempt was made to improve the onset of action of H1 anti-histaminic. Mouth dissolving tablets of ebastine were prepared using sublimable ingredients[37].
- Rosiglitazone and Sulfonylurea are prescribed in combination for the treatment of type-2 Diabetes Mellitus for long term therapy. During this therapy, it is noticed that there is uncontrolled increase in blood glucose level and the drug undergoes hepatic metabolism. Therefore mouth dissolving tablets of Rosiglitazone were prepared to overcome this unusual problem and to make use of the inherent advantages of the novel drug delivery system[38].

Table 3: For the market view of FDTs over conventional dosage forms

S No.	Drug	Conventional dosage forms	FDTS	Brand Name
1.	Piroxicam	Tablet present	present	Pfizer Inc., NY, USA
2.	Paracetamol	Tablet present	present	Cima Labs, Inc.
3.	Nimesulide	Tablet present	present	Panacea Biotech, New Delhi, India
4.	Acetaminophen	Tablet present	present	Bristol myers Squibb, NY, USA
5.	Ibuprofen	Tablet present	present	Ethypharm
6.	Domperidon	Tablet present	present	Olcare lab
7.	Cetrizine	Capsule present	present	Zosta pharma India
8.	Ondansetron	Tablet present	present	Sun pharma
9.	Famotidine	Tablet present	Present	Merck and Company, NJ, USA
10.	Mosapride Citrate	Tablet present	Present	Torrent Pharmaceuticals, India
11.	Rofecoxib	Tablet present	present	Lupin
12.	Loratadine	Tablet present	present	Wyeth Consumer Healthcare

FUTURE PROSPECTIVE FOR FDTS

Now days there are wide range of products available commercially in market, which are produced by the same technologies as employed in the manufacturing of fast dissolving tablets. Still there is broad area for research on this technology. Some of the major challenges like formulating a drug of bitter taste and moisture absorbing nature create problems for formulation scientist. When the dose of drug is large, it creates problem of enhanced disintegration time. The two points to be considered in case of FDTs are shortening the disintegration time and at the same time keeping other parameters in mind like friability, taste and mouth feel and tablet strength within the accepted range. These problems may be solved by using taste masking and super-disintegrating agents without significant increasing the weight and volume of final dosage forms (Table 3). There is also a scope to develop better packaging system to formulate FDTs more stable during handling[39-41].

REFERENCES

1. S. Dutta et al. Formulation of fast disintegrating tablets, Int J Drug Formulation & Research 201: 2 (1): 45-51.
2. S. Velmurugan and S. Vinushitha. Oral Disintegrating Tablets: An Overview, International Journal of Chemical and Pharmaceutical Sciences 1, (2): 1-12 (2010).
3. S. Sharma. New generation of tablet: Fast dissolving tablet, Pharmainfo.net 6 (1): 111-119 (2008).
4. L. H. Reddy, B. Ghosh, and Rajneesh. Fast dissolving drug delivery systems: a review of the literature, Indian Journal of Pharmaceutical Science 64 (4): 331-336 (2002).
5. S. V. Sastry, J. R. Nyshdham, J. A. Fix. Recent technological advances in oral drug delivery: A review, Pharmaceutical Science and Technology Today 3: 138-45 (2000).
6. D. S. Shukla, S. Chakraborty, and B. Mishra. Mouth dissolving tablets I: an overview of formulation technology, Scientia Pharmaceutica 76: 309-326 (2009).
7. B. P. Badgujar and A. S. Mundada. The technologies used for developing orally disintegrating tablets: a review, Acta Pharmaceutica 61 (2): 117-139 (2011).
8. R. Bradoo. Fast Dissolving Drug Delivery Systems, JAMA India 4 (10): 27-31 (2001).
9. S. Bhaskaran, G. V. Narmada. Rapid dissolving tablet a novel dosage form, Indian Pharmacist 1: 9–12 (2002).
10. A. Patidar et al. A review on: Recent Advancement in the development of rapid disintegrating tablet, International journal of Life Science & Pharma Research 1 (1): 7-16 (2011).
11. S. Kumari, et al. Fast dissolving Drug delivery system: Review Article, Journal of Pharmacy Research 3 (6): 1444-1449 (2010).
12. P. K. Mahaveer. Orally disintegrating tablets: A future prospectus, Int J Pharm Sci Bio 71-79 (2010).
13. S. Chandan et al. Orally disintegrating tablets: A Review, International Journal of Pharmacy and Life Sciences 1 (5): 250-256 (2010).
14. V. D. Kumar, I. Sharma, V. Sharma. A comprehensive review on fast dissolving tablet Technology, Journal of Applied Pharmaceutical Science 1 (5): 50-58 (2011).
15. B. G. Prajapati, N. Ratnakar. A Review on Recent patents on Fast Dissolving Drug Delivery System, Int J Pharm Tech Res 1 (3): 790-798 (2009).
16. A. Arunachalam. Fast Dissolving Drug Delivery System: A Review, Journal of Global Trends in Pharmaceutical Sciences 1(1): 92-110 (2010).
17. J. J. Hirani, D. A. Rathod, K. R. Vadalia. Orally Disintegrating Tablets: A Review, Tropical Journal of Pharmaceutical Research 8 (2): 161-172 (2009).
18. S. Shaikh, R. V. Khirsagar, A. Quazi. Fast Disintegrating Tablets: An Overview of Formulation and Technology, International Journal of Pharmacy and Pharmaceutical Sciences 2 (3): 1-20 (2010).
19. A. Arya, A. Chandra, V. Sharma, K. Pathak. Fast dissolving oral films: An innovative drug delivery system and dosage form, International Journal of Chem Tech Research 2 (1): 576-583 (2010).
20. M. D. N. Siddiqui, G. Garg, P. K. Sharma. A Short Review on "A Novel Approach in Oral Fast Dissolving Drug Delivery System and Their Patents, Advances in Biological Research 5 (6): 291-303 (2011).
21. A. Purvani, A. Wadhavani. Indion 414 as novel Superdisintegrants, Indian Journal of pharmaceutical sciences 61 (1): 117-119 (2000).
22. U. Mahajan. Fast Dissolving Tablet- An Overview of Formulation Technology, Indo Global Journal of Pharmaceutical Sciences 2 (2): 157-166 (2012).
23. Y. W. Chien. Novel drug delivery systems, 2nd ed. New York, Marcel Dekker Inc., 1992, 50: 139.
24. B. Vandana Patravale, and B. Namita Prabhu. Indian Journal of Pharmaceutical Sciences 233-235 (2005).

25. M. M. Patel and D. M. Patel. Fast dissolving drug delivery system: A Review, Indian Journal of Pharmaceuticals sciences 222-226 (2006).
26. A. F. Amin. Emerging trends in the development of orally disintegrating tablet technology, IJPRS 21-29 (2006).
27. V. A. Agrawal. Fast Disintegrating tablet as a New Drug Delivery system: A Review, Pharmacophore 2 (1): 1-8 (2011).
28. H. Seager. Drug delivery products and fast dissolving dosage forms, J Pharm Pharmacology 50: 375-382 (1998).
29. C. G. Wilson, N. Washington, J. Peach, G. R. Murray, J. Kennerley. The behavior of a fast dissolving dosage form (Expidet) followed by gscintigraphy, Int J Pharm 40: 119-123 (1987).
30. B. S. Kuchekar, B. C. Atul, H. S. Mahajan. Mouth dissolving tablets: A novel drug delivery system, Pharma Times 35: 7-9 (2003).
31. S. Bhardwaj et al. Formulation and evaluation of fast dissolving tablet of aceclofenac, International Journal of Drug Delivery 2: 93-97 (2010).
32. N. H. Indurwade, T. H. Rajyaguru, P. D. Nakhat. Novel approach fast dissolving tablets, Indian drugs 39: 405-409 (2002).
33. Y .Bi, H. Sunada. Preparation and Evaluation of a Compressed Tablet Rapidly Disintegrating in Oral Cavity, Chem Pharm Bull 44: 2121-2127 (1996).
34. G. Gudask, et al. Formulation and evaluation of fast dissolving tablets of Chlorpromazine HCl, Journal of Pharmaceutical Science and Technology 2 (1): 99-102 (2010).
35. M. C. Gohel, G. Bansal, N. Bhatt. Formulation and Evaluation of Orodispersible Taste Masked Tablets of Famotidine, Pharma Biol. World 3: 75-80 (2005).
36. B. J. Roser and J. Blair. Rapidly soluble oral solid dosage form, method of making same and compositions thereof, US Patent 5: 762, 961 (1998).
37. L. Dobetti et al. Fast melting tablets: Developments and technologies, Pharm Tech 44 (2001).
38. S. Pradeep Kumar et al. Design of mouth dissolving tablets of rosiglitazone maleate by using novel coprocessed Superdisintegrants, Journal of Pharmacy Research 5 (5): 2977-2982 (2012).
39. D. Bhowmik, B. Chiranjib, K. Pankaj, R. M. Chandira. Fast Dissolving Tablet: An Overview, Journal of Chemical and Pharmaceutical Research 1 (1): 163-177 (2009).
40. P. Virely, R. Yarwood. Zydis, A novel- Fast dissolving dosage form, Manuf Chem 61: 36–37 (1990).
41. L. Lachmann, H. A. Liebermann, J. L. Kiang. The theory and practice of Industrial Pharmacy, 3rd ed., Bombay, Varghese Publishing House, 1998, pp. 430-440.