



CODEN [USA]: IAJPBB

ISSN : 2349-7750

**INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES**

SJIF Impact Factor: 7.187

<https://zenodo.org/records/10305320>Available online at: <http://www.iajps.com>

Review Article

**LUBRICANTS TO IMPROVE ORAL MEDICATION
SWALLOWING AND COMPLIANCE****Ketaki Jawalekar^{1*}, Mohit Bajaj¹, Krishna Vaishnav¹, Anuj Deshmukh²,
Shreyash Padmawar¹**¹Student, Vidyabharti college of pharmacy, Amravati.²Assistant Professor, Vidyabharti college of pharmacy, Amravati.**Abstract:**

Medication lubricants are thick liquids or gels that are designed to aid swallowing of solid oral dosage forms. Tablets and capsules are placed within a spoonful of the product for swallowing. The aim of this study was to describe and compare commercially available medication lubricants in terms of textural suitability for patients with dysphagia. Twelve medication lubricants were characterised according to the International Dysphagia Diet Standardisation Initiative (IDDSI) framework. Apparent viscosity, yield stress, thickness consistency, and various texture features were compared. Gloup Forte was the only medication lubricant classified as IDDSI level 4 (pureed/extremely thick) at room (24 °C) temperature. Four other Gloup products were IDDSI level 3 (liquidized/moderately thick) at room temperature but testing at 4 °C or pouring from the container instead of using the pump dispenser resulted in classification as IDDSI level 4. The IDDSI Flow test would have classified Medi Spend and Slo Tablets as IDDSI level 3, but their very low yield stress led to these fluids flowing too quickly through the prongs of a fork and so these were classified as <3. Severo was IDDSI level 2. Heyaxon and the two versions of Magic Jelly tested contained lumps, and Swallow Aid had exceptionally high viscosity, hardness, adhesiveness, and gumminess, classifying them as IDDSI Level 7 (“regular textures”) and therefore as unsuitable for people with dysphagia according to IDDSI. This study provides valuable information to help with the selection of a safe medication lubricant with appropriate thickness level suited to each individual with dysphagia.

Keywords: *Dysphagia, swallow, Lubricant, Compliance, Hygroscopic.*

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Please cite this article in Ketaki Jawalekar et al, *Lubricants To Improve Oral Medication Swallowing And Compliance*, Indo Am. J. P. Sci, 2023; 10 (11).

INTRODUCTION:

Because of the potential differences in their physiological and cognitive reactions, acceptance in medicine is important for both young and elderly patients. Although oral administration is the most popular method of drug delivery, adherence can be impacted by issues such as polypharmacy, caregiver-induced child recalcitrance, and swallowing difficulties. Expectancy is rising as a result of new pharmacological therapies and advancements in modern healthcare. Although solid oral dosage forms are practical, they may cause swallowing problems that force the patient to stop taking their medication as directed. The swallowing function of elderly individuals may be compromised by ageing and long-term illnesses, which may affect how well-to-take medications is. Acceptability is influenced by palatability and swallowability¹.

1Dysphagia

Dysphagia is the ability to swallow, which makes it more difficult to get food or liquid from your Mouth to your stomach. Dysphagia can cause discomfort. Swallowing is not always possible. Occasionally having trouble swallowing such as when you eat too quickly or don't chew your food Thoroughly, typically



Fig. 1: Swallowing Difficulty

nothing to worry about. However, chronic dysphagia can be a serious medical problem that has to be treated. Dysphagia can occur at any age, but it's more common in older adults. The cause of swallowing problem varies and treatment depends on cause².

Signs and symptoms associated with dysphagia can include:

- 1) Pain while swallowing
- 2) Inability to swallow
- 3) A sensation of food getting stuck in the throat or chest or behind the breastbone
- 4) Drooling
- 5) Food coming back up (regurgitation)
- 6) Frequent heartburn
- 7) Food or stomach acid backing up into the throat
- 8) Weight loss

9) Coughing or gagging when swallowing³

Treatment for dysphagia

1. Oropharyngeal dysphagia (high dysphagia) treatment Effective treatment for Oropharyngeal dysphagia might be difficult since it frequently stems from a Neurological Condition. Parkinson's disease treatment may have a positive effect on patients with the Condition⁴.

Swallowing therapy : Therapy for swallowing will be provided in conjunction with a speech and language therapy. The person will pick up new techniques for proper swallowing. Exercises will help the muscles and their reaction time⁵

Diet-Some foods, liquids, or mixtures of them can be swallowed easily. It is important to have a Well-balanced diet in addition to the meals that are easy⁶.

Feeding through a tube : if the patient is at risk of pneumonia, malnutrition or dehydration they may need to be fed through a nasal tube (nasogastric tube) or Percutaneous Endoscopic Gastrostomy. These tubes are surgically implanted directly into the stomach and pass through a small incision in the abdomen⁷.



Fig. 3: Dysphagia Treatment and Management

Esophageal dysphagia (low dysphagia) treatment

Surgical intervention is usually required for esophageal dysphagia

Dilation- tiny balloon may be placed, inflated, and then removed if the esophagus needs to be made wider (due to a stricture)⁸

Botulinum toxin (Botox) frequently utilized when the esophageal muscles have stiffened up (achalasia). Strong twin botulinum can paralyze tight muscles, which reduces constriction

If cancer is the root of the patient's dysphagia, an oncologist will be consulted for therapy and the tumor may need to be surgically removed⁹.

Dysphagia in young people and older people

Dysphagia, a condition affecting both young children and elderly individuals, is a complex process involving bolus transfer and airway protection. The oral, pharyngeal, and esophageal phases of the deglutition process are the three primary stages. Major deglutition development occurs between 6 months and 3 years, with complete maturation often occurring by age 5 years. Pediatric dysphagia can have various medical developmental issues. Ageing is linked to a reduction in swallowing function, affecting all three phases of deglutition. The pharyngeal swallowing reflex takes longer to activate as people age, and bolus movement and clearance diminish¹⁰.



Fig 4: Addressing medication difficulties in primary care

Administration of solid oral dosage forms (SODF) by patents in dysphagia

Patents for Solid Oral Dosage Forms (SODF) in dysphagia are popular due to cost, accuracy, patient acceptability, and tastemasking. However, administering SODF to patients with dysphagia is challenging

Swallowing problems in patients.

The age at which children can safely swallow tablets and capsules is debated, with early literature suggesting 6 months as the general age for suitable dosage forms¹¹.

Lubricants and Lubrication

Friction and Lubrication Definition

Friction

When one body moves or has a tendency to move over the surface of another body, friction, Which is defined as an opposing force, created between the surfaces of contact. Kinetic or sliding Friction interaction of two moving or sliding surfaces Friction caused by

cylindrical and spherical Objects rolling across a surface is known as rolling friction¹².

Lubricants

Lubricants help to ensure that tablets are ejected smoothly and without breaking or cracking by Reducing friction between the tablet and the surface. This also helps to lessen the ejection form. One of the crucial excipients in is lubricant. Lubricant forms a film at the interface between Tablet and die wall and punch face¹³.

swallow Lubricants in tablet formulation reduce friction between the tablet and the surface, reducing ejection force and ensuring clean ejection without cracking or breakage. Magnesium stearate (MgSt) is a popular lubricant, but it deteriorates tablet strength and reduces dissolution. Alternatives have been investigated to improve lubrication performance without compromising dissolution and compaction properties. Lubricant mixing with granules improves granule flow and ejectability¹⁴.

Mostly used Lubricants are

1. Magnesium stearate (MgSt)
2. Sodium lauryl sulfate (SLS)
3. Poloxamers¹⁵

Magnesium stearate (MgSt) is a widely used lubricant due to its high lubrication efficiency. It can reduce ejection force and punch sticking, but its sensitivity depends on formulation properties. MgSt's low bonding strength makes bonding weak, but new surfaces favor bonding between free MgSt particles. This could affect biopharmaceutical performance.

Sodium lauryl sulphate (SLS),

Sodium lauryl sulfate (SLS), also known as sodium dodecyl sulfate (SDS), is a synthetic Alkaline anionic surfactant used in tablets to enhance dissolution of poorly water-soluble drugs It does not decrease the effective tablet-solvent interfacial area during dissolution and Improves water penetration into tablets, leading to greater dissolution performance . SLS Can also be used as an emulsifying agent and is used in marketed tablet products like Brufen, Janumet, Nexavar, Risperdal, Sustiva, and Tarceva¹⁶.

Poloxamers

Poloxamers are non-ionic triblock copolymers with a central hydrophobic block of polypropylene glycol and two hydrophilic polyethylene glycols. They are freely soluble in water and have a high HLB value up to 30. Two commonly used commercially available poloxamers are Poloxamers 188 and 407.They have

greater lubrication efficiency than other water-soluble lubricants but lower than MgSt. Systematically evaluated, both poloxamers showed acceptable efficiency for excipients like microcrystalline cellulose and lactose¹⁷.

Classification Of Lubricants

On the basis of its physical state, we can classify the lubricants as follows:

Hydrophobic lubricant

Hydrophobic lubricants are insoluble in water.

-Hydrophobic lubricants are lipophilic.

-These are most commonly used lubricants because they are most effective to reduce sticking and picking. They are effective in low concentration¹⁸.

-Hydrophobic lubricants have all three main characteristics meaning true lubricant role, anti-adherent and glidant effects.

Examples of Hydrophobic lubricants

-Magnesium Stearate

-Calcium Stearate

-Zinc Stearate

-Talc

Hydrophilic lubricant

-Hydrophilic lubricants are water-loving.

-Hydrophilic lubricants are not as good lubricants as Hydrophobic lubricants.

-They do not possess an anti-adherent and glidant effect.

The layer formed by hydrophilic lubricants is not too strong so it does not affect the disintegration and dissolution profile of the product¹⁹.

Examples of Hydrophilic Lubricants

Sodium Stearyl Fumarate

-Sodium Lauryl Sulphate

Magnesium lauryl

Sulphate -Sodium Benzoate

Types of lubrication

Considering the nature of motion between moving or sliding surfaces, there are different types or mechanisms by which the lubrication is mainly achieved by mainly²⁰

1. fluid lubrication

2. boundary lubrication

1. Fluid Lubrication:

In fluid lubrication, a layer of fluid is located between and separates the moving surfaces of the solids from each other and thus reduces the friction. Fluid

lubricants are seldom used in tablet formulations. However, liquid paraffin has been used, such as in formulation for effervescent tablets.

2. Boundary Lubrication:

Boundary lubrication is considered as a surface phenomenon, as here the sliding surface is separated by only a very thin film of lubricant. The nature of the solid surface will, therefore, affect the friction. In boundary lubricants. The friction coefficients and wear of the solids are higher than with fluid lubrication²¹.

Mechanism of lubrication

The lubrication mechanism between tablets and die walls is achieved by incorporating a lubricant in formulation. Two major types of lubricants used in the pharmaceutical industry are fluid lubricant and boundary lubricant. Fluid lubrication involves a fluid layer between solid surfaces, resulting in low friction coefficient and good performance. Boundary lubricant forms a thin discontinuous film on solid surfaces, disrupting interaction and decreasing friction. Its low shear strength makes it easy to slide upon shearing. The total frictional force, F , is calculated by reducing the fraction of asperities junctions and low shear strength²².

$F = A(aS_s + (1-a)SL)$

Characteristics Of a Good Lubricants

Low Shear Strength-Want the lubricant to hear during blending not the granules or other excipients in the formulation.

-No side effect

-Able to form a "durable layer" over the surface covered.

-Non-Toxic

-Chemically Inert

-Palatable

Unaffected by Process Variable

-Have Minimal Adverse Effects on the Finished Dosage Form.

Safe to use²³

Application of Administration Aids and Devices

Films and jelly

A dry film formulation offers easy swallowing by turning into a jelly instantly in the mouth by absorbing saliva. The film consists of an active drug layer and two gelling layers. However, this technology may be difficult for older patients with xerostomia due to increased medication use. A drug-containing oral jelly was developed for this purpose.

Oral jelly

Oral jellies, semi-solid food aids, are commonly used by older patients for administration due to their rheological properties, allowing for better swallowing experiences. Viscous oral jellies reduce aspiration and choking cases in patients with dysphagia. A study in Japan found a swallowing aid with an upper part and a bottom part.

Pill Glide

Pill Glide is a flavored spray designed to improve swallowing of Soda-Dimer (SODF) by creating a mucosa-coated surface. It has been shown to improve swallowing experiences in adolescents, but is recommended for all ages struggling with SODF swallowability, including older patients²⁴.

Solid Oral Dosage Forms (SODF) Coating Devices

Med Coat is an administration aid device that allows patients to apply coatings to their Solid Oral Dosage Forms (SODF) before swallowing. It contains maltitol, vegetable fats, gelatin, sugar esters, citric acid, and lemon additives for taste masking and saliva stimulation²⁵

Techniques for increasing swallowability

A study in Germany examined the effectiveness of swallowing large tablets and capsules using two different methods: the “pop-bottle” method and the “lean-forward” technique. The pop-bottle method involves placing the tablet on the tongue, tightly closing the lips around the opening of a plastic bottle, and swallowing in a swift suction movement. The “lean forward” technique involves swallowing capsules in an upright position with the head bent forward. The study found that both methods significantly improved swallowing experience for Sodium-dissolved fluid (SODF) administration. However, these methods require training and are highly dependent on the patient’s characteristics, potentially restricting their use in general practice. Physician approval is required for these techniques, as there is an expected risk of aspiration in older patients with dysphagia. Despite advancements in drug delivery, the oral route remains the preferred route for administering therapeutic agents due to its low cost, accurate dosage, self-medication, pain avoidance, and versatility. However, tablets and capsules are the most popular dosage forms, but dysphagia, or difficulty swallowing, is a significant drawback²⁶.

Oral Dispersible Tablets.

Oral dispersible tablets, also known as mouth-dissolving tablets, are uncoated tablets that disperse easily within three minutes before swallowing.

Despite advancements in drug delivery, the oral route remains the preferred method due to its low cost, ease of administration, accurate dosage, self-medication, pain avoidance, and versatility. These tablets are particularly useful for pediatric and dysphagia patients, as they dissolve or disintegrate in the oral cavity without the need for water or chewing. However, dysphagia, a difficulty in swallowing, affects around 35% of the general population and is associated with conditions like Parkinson’s, motion sickness, elderly patients, children, mentally disabled individuals, and water availability. Fast dissolving tablets are gaining prominence as new drug delivery systems, offering improved patient compliance and convenience.

Limitations, Salient features, Advantages, Disadvantages of

ODT Limitations of ODT:

1. Most of times soluble diluents used for formulating might render hygroscopic dosage which may lead testability issues.
2. The tablets may leave unpleasant taste and/or grittiness in mouth if not formulated properly.
3. Specialized packing might be required for hygroscopic and light sensitive drugs. Precautions to be taken while administering immediately after removing from pack.
4. Light sensitive drugs, ODTs may not be suitable as no option for film coating²⁷.

Salient features of ODT:

The risk of choking or suffocation during oral administration of conventional formulation due to physical obstruction is avoided, thus providing improved safety. Rapid drug therapy Intervention . After oral administration they should leave minimal or no residue in mouth. It should be dissolved or disintegrate in mouth within few seconds. High drug loading should be allowed. They should be compatible with taste masking and other excipients. They should be less sensitive to environmental conditions such as humidity and temperature. The mouth feel should be pleasant²⁸.

Advantages of ODT:

Ease of administration to patients who refuse to swallow a tablet, such as pediatric, geriatric, mentally ill, disabled and uncooperative patients.

Rapid dissolution of drug and absorption may produce rapid onset of action. Progastrin absorption can result in improved bioavailability, and as a result of reduced

dosage, improved clinical performance by reducing side effects.

No need of water to swallow the dosage form, which is highly convenient feature for patients who are travelling and do not have immediate access to water. Convenience of administration and accurate dose as compared to liquids. Some drugs are absorbed from the mouth, pharynx and esophagus as the saliva passes down into the stomach; in such cases bioavailability of drugs is increases.

Good mouth feel property of ODTS helps to change the psychology of medication as “bitter pill” Particularly in peditrics’ patients.

Ability to provide advantages of liquid medication in the form Of solid preparation²⁹.

Disadvantages of ODT:

Rapid disintegrating tablets are hygroscopic in nature so must be kept at controlled environment i.e., humidity and temperature.

For properly stabilization and safety of stable product, ODT requires special packaging.

Usually have insufficient mechanical strength. Hence, careful handling is required.

Leave unpleasant taste and/or grittiness in mouth if not formulated properly³⁰

Patient compliance

Patient compliance refers to the patient’s adherence to the scribe’s instructions, calculated as a percentage of prescribed doses and number of medications. Non-compliance refers to the patient’s fault and inappropriate use of medication. Reasons for non-compliance include painful administration routes, difficulty swallowing, long-term therapy, forgetfulness, cost, poor instructions, and side effects. Painful administration routes or difficulty swallowing can lead to non-compliance. Long-term and multi-drug therapy may also result in non-compliance. Forgetfulness can also lead to non-compliance. Cost is another factor, as many expensive medicines are not in stock in hospitals, making it difficult for patients from low-income backgrounds to comply. Poor instructions and side effects can also contribute to non-compliance³¹.

The following are ten strategies that providers can use to boost medication compliance

Understand each patient’s medication taking behaviour

To better understand patients’ medication-taking behaviour’s, ask about their difficulties in filling, taking, or affording their prescribed medications. Create a blame-free environment for open communication, as providers need to recognize the problem.

Talk about side effects

Providers should educate patients about potential side effects, explaining how to prevent adverse reactions, and the likelihood of resolving them. Patients should be empowered to ask questions and reiterate important points³².

Write it down

Patients often struggle with verbal instructions, so it’s crucial to provide written instructions like medication calendars, pill cards, schedules, or charts³³

4.Collaborate with patients

What time of the day would be best for the patient to take their medications?

Consider the financial burden of the patient

Healthcare professionals can help patients manage financial burdens by connecting them with assistance programs, pharmaceutical companies, and affordable generic drugs, preventing medication discontinuation.

Assess health literacy

Assess health literacy, ensuring individuals understand basic health information and services, including when, how, and why to take medications, and not assume they understand³⁴.

Reduce complexity

Reducing drug regimen complexity, such as offering combination products or prescribing medications with once-daily dosing, increases patient compliance with medication usage.

Follow up with patients

Follow up with patients by sending reminders via various channels and scheduling follow-up appointments to discuss medication compliance, ensuring they understand the importance of taking prescribed medication even when symptom-free³⁵.

CONCLUSION:

Technologies for improving the swallowability of SODF have been developed and tested throughout the years; nevertheless, these often require preparative steps by the patient and, as such, remain very dependent on user’s handling capabilities. When

considering the older, patients; this might further increase the therapeutic complexity and lead to non-compliance or medication errors. But these new technologies help in patients' medication and swallowing. Commercially available products that are designed to assist people to swallow solid dose medications vary considerably in viscosity, yield stress, flow, and texture properties. Any of these commercial products may be useful for those who simply have an aversion to swallowing tablets and capsules whole or find it difficult to achieve using water, and the thickness and texture properties are of no concern for these people.

ACKNOWLEDGEMENTS

I am very thankful to Mr. Anuj Deshmukh, Assistant Professor of Vidyabharti College of Pharmacy, Amravati for encouragement and providing the necessary facility for completion of this work.

Disclosure of conflict of interest

The authors have no conflict of interest to declare.

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