

# Crush And Dissolve Tablets And Capsules For Paediatric And In Nasogastric Tube Patients

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## Abstract

Oral drug delivery remains the most prevalent and preferred method due to its simplicity, non-invasive nature, and cost-effectiveness. However, for patients with dysphagia, particularly pediatric and critically ill individuals, the administration of solid dosage forms such as tablets and capsules presents significant challenges. This study aims to evaluate the availability and suitability of solid oral medications Medical services at Imam Muhammad bin Saud University for patients with swallowing difficulties, while identifying potential alternatives. Medications administered via intravenous, intramuscular, or rectal routes were excluded from the investigation. Data were gathered from pharmaceutical databases including LexiComp and referenced clinical guidelines such as the Handbook of Drug Administration via Enteral Feeding Tube (3rd edition) and the MOC Guidelines for Tablet Crushing in Patients with Swallowing Difficulties by Colchester Hospital University NHS. A total of 78 medications were initially reviewed, with 22 selected for further analysis based on their suitability for modification. Of these, 38% were sourced from LexiComp, while the remaining were derived from specialized clinical guidelines and institutional protocols. The findings underscore the necessity for healthcare providers to assess dysphagia and medication formulation compatibility when prescribing oral medications, particularly when liquid alternatives are unavailable. This research highlights the potential risks of modifying solid dosage forms and the importance of tailored drug delivery strategies to optimize therapeutic outcomes in patients with swallowing impairments.

## **Introduction :**

Oral medications are the most common and preferred route of drug delivery due to their simplicity, non-invasive nature, and cost-effectiveness. However, for patients who have difficulty swallowing, oral medications can pose a significant challenge. This is especially true for pediatric and ICU patients who may have developmental or neurological disorders that affect their ability to swallow. Oral medications are the most common form of drug administration, offering convenience and patient compliance. However, for individuals with dysphagia, swallowing difficulties can pose a significant challenge. While many oral medications are available in liquid form, there are instances where only solid dosage forms, such as tablets or capsules, exist. This can be a major hurdle for dysphagia patients, potentially leading to non-adherence to their medication regimen and compromising their treatment outcomes (1). The type of oral medication dosage form available can significantly impact a patient's ability to swallow. For patients with dysphagia, oral liquids are typically the preferred option as they are easier to swallow and can be adjusted to the patient's consistency preference. Smaller tablets may also be easier to swallow than larger tablets(4). In some cases, it may be possible to crush or open capsules and mix the contents with food or liquid. However, this should only be done under the guidance of a healthcare professional, as some capsules are not intended to be crushed or opened, and doing so may affect the drug's absorption or release profile (3). Several types of medications should not be crushed, as doing so can alter their release profile or effectiveness. Enteric-coated medications have a special coating that prevents them from dissolving in the stomach acid until they reach the small intestine. Crushing enteric-coated tablets can destroy the coating, causing the medication to be released in the stomach, which can lead to stomach upset or irritation. Modified-release tablets are designed to release the medication gradually over time, providing a sustained effect. Crushing modified-release tablets can disrupt this release mechanism, leading to an unpredictable release of the medication, which can increase the risk of side effects or reduce the medication's effectiveness (1) . If there is no suitable oral solution available, alternative routes of administration may be considered. These include enteral

nutrition tubes, parenteral administration, and rectal administration. Enteral nutrition tubes can be used to deliver medications directly into the stomach or intestines for patients with severe dysphagia. Parenteral routes, such as intravenous or intramuscular injection, may be necessary for some medications that cannot be administered orally or through enteral tubes. Rectal administration may be an option for some medications, particularly for pediatric patients or those with severe dysphagia

(2). The lack of liquid formulations for these essential medications can significantly impact dysphagia patients' ability to manage their health conditions. Healthcare providers should carefully consider the patient's swallowing difficulties when selecting medications and explore alternative options, such as crushing tablets or using liquid formulations of similar medications, whenever possible. Crushing capsules or tablets is generally not recommended unless specifically instructed by a healthcare professional. Crushing or opening capsules or tablets can damage the drug coating, alter the drug's release profile, and potentially reduce its effectiveness or increase the risk of adverse effects. When crushing or opening capsules or tablets is necessary, it should be done with care and attention to detail. The medication should be crushed thoroughly and completely, and the crushed powder should be mixed with a small amount of food or liquid immediately before administration(5).

#### **Method :**

During this research, we collected all the medications available in the Medical services at Imam Muhammad bin Saud University . All medications given via intravenous or intramuscular injections and suppositories were excluded in this research . All solid medications that are given orally, such as pills and capsules, have been listed. As for medications that are in liquid form and given orally, they have been mentioned for information only. In the search method, pharmaceutical search engines were adopted, namely LexiComp, Such-and-such Book, and approved British protocols.

Some medicines are manufactured locally, but their compositions are similar to the original ( brand ) product, and the data was based on them.

#### **Result :**

The 78 medications listed in Medical services, Imam Muhammad bin Saud University for investigation and evaluation if there is any process to take it as oral liquid ,22items were conducted in our research and included in this review. 38% of listed item was obtained from tertiary recourse lexicomp and 34 of these medications (38%) was obtained from handbook of drug administration via enteral feeding tube - third edition , and MOC GUIDELINES FOR TABLET CRUSHING IN PATIENTS WITH SWALLOWING DIFFICULTIES

, Colchester Hospital University NHS and the remaining item were obtained from nhsguideline for crushing and dissolved.

GENERIC_NAME	DOSEGE FORUM	ACTION
Alfuzosin 10 mg	Tablet	yes can be crush <sup>(6)</sup>
Allopurinol 100 mg	Tablet	can be crush and prepared as extemperanous preparation <sup>(7)</sup>
Aluminium Hydroxide+Magnesium Hydroxide 200 mg	Chewable tablet	chewable
Amitriptyline Hydrochloride 25 mg	Tablet	Crush the tablet and mix with water <sup>(8)</sup>
Amlodipine 5 mg	Capsule	Can be opened and dissolve or prepared as extemperanous preparation <sup>(7)</sup>
Amoxicillin 500 mg	Capsule	yes can be open and dissolve , and there is ready-made suspension <sup>(6)</sup>
Amoxicillin+Clavulanic Acid 1 gm	Tablet	there is ready-made suspension
Aripiprazole 5 mg	Tablet	Abilify tablets will disperse within 10 minutes <sup>(8)</sup> .
Atenolol 50 mg	Tablet	can be crush and prepared as extemperanous preparation <sup>(7)</sup>
Atomoxetine 10 mg	Capsule	capsule can be opened and mixed with milk or water <sup>(6)</sup>
Azithromycin 250 mg	Capsule	Crush tablet into a fine powder and disperse in 10 mL , there is ready-made suspension <sup>(7)</sup>
Betahistine Dihydrochloride 16 mg	Tablet	Crush the tablet and mix with water <sup>(6)</sup>

Bisacodyl 5 mg	Coated tablet	change to suppositories <sup>(6)</sup>
Bisoprolol Fumarate 5 mg	Tablet	Crush the tablet and mix with water <sup>(6)</sup>
Cabergoline 0.5 mg	Tablet	Crush the tablet and mix with water <sup>(6)</sup>
Calcium Carbonate 600 mg	Tablet	Crush the tablet and mix with water <sup>(7)</sup>
Candesartan Cilexetil 16 mg	Tablet	Crush the tablet and mix with water <sup>(6)</sup>
Carbamazepine 200 mg	Cr Tablet	change to immediate release item
Cefixime 400 mg	Capsule	there is ready-made suspension
Chlorzoxazone + Paracetamol 250 mg	Capsule	No data
Cinnarizine 25 mg	Tablet	yes can be crush <sup>(6)</sup>
Ciprofloxacin 500 mg	Tablet	Can be crushed and dissolve or prepared as extemporaneous preparation <sup>(7)</sup>
Clomifene (Clomiphene) Citrate 50 mg	Tablet	Crush the tablet and mix with water <sup>(8)</sup> .
Dapagliflozin 10 mg	Tablet	Crush Forxiga or Qtern tablet and mix with water <sup>(8)</sup>
Diclofenac Sodium 100 mg	Tablet	no data
Diosmin 500 mg	Tablet	no data
Domperidone 10 mg	Tablet	can be crushed and there is ready made product <sup>(9)</sup>
Doxycycline 100 mg	Capsule	you can crush the tablet <sup>(7)</sup>
Dutasteride 0.5 mg	Capsule	change to finasteride <sup>(6)</sup>
Dydrogesterone 10 mg	Tablet	no data

Esomeprazole 20 mg	Tablet	isperse the tablet in half a glass of water and stir until the tablet disintegrates <sup>(8)</sup> .
Ezetimibe 10 mg	Tablet	can be crush <sup>(6)</sup>
Famotidine 20 mg	Tablet	Can be crushed and dissolve or prepared as extemperanous preparation <sup>(7)</sup>
Ferric Hydroxide Polymaltose 100 mg	Tablet	change to oral solution
Ferrous Sulfate+Folic Acid 150 mg	Capsule	no data
Fluconazole 50 mg	Capsule	Can be opened and dissolve or prepared as extemperanous preparation <sup>(7)</sup>
Fluoxetine 20 mg	Capsule	Open the capsule and disperse the contents in water <sup>(8)</sup> .
Folic Acid 1 mg	Tablet	you can crush the tablet <sup>(6)</sup>
Furosemide 40 mg	Tablet	Can be crushed and dissolve or prepared as extemperanous preparation <sup>(7)</sup>
Gabapentin 400 mg	Capsule	Can be opened and dissolve or prepared as extemperanous preparation <sup>(7)</sup>
Glibenclamide (Glyburide) 5 mg	Tablet	you can crush the tablet <sup>(6)</sup>
Hydrochlorothiazide 25 mg	Tablet	Can be crushed and dissolve or prepared as extemperanous preparation <sup>(7)</sup>
Hyoscine (Scopolamine) Butylbromide 10 mg	Tablet	you can crush the tablet <sup>(6)</sup>

Ibuprofen 400 mg	Tablet	there is ready made preparation
Isotretinoin 20 mg	Capsule	Place the capsule in a 50 mL oral dispenser and add warm water or warm milk (37 °C) to cover the capsule. Wait 2 to 3 minutes until the capsule is soft, and then drink the milk or water with the softened capsule <sup>(8)</sup> .
Isotretinoin 20 mg	Tablet	no data
Itraconazole 100 mg	Capsule	Can be opened and dissolve or prepared as extemperanous preparation <sup>(7)</sup>
Levothyroxine (Thyroxine) Sodium 0.025 mg	Tablet	you can crush the tablet <sup>(7)</sup>
Lipase+Amylase+Protease+Pepsin+Dehydrocholic Acid+Cellulose Capsule	Capsule	Viokace brand only
Lisinopril 5 mg	Tablet	Can be crushed and dissolve or prepared as extemperanous preparation <sup>(7)</sup>
Meclozine+Vitamin B6 (Pyridoxine) 25 mg	Tablet	no data
Mecobalamin 500 mcg	Tablet	no data
Meloxicam 15 mg	Tablet	you can crush the tablet <sup>(6)</sup>
Metformin Hydrochloride 500 mg	Tablet	you can crush the tablet <sup>(6)</sup>
Methyldopa 250 mg	Tablet	you can crush the tablet <sup>(9)</sup>
Metronidazole 500 mg	Tablet	Can be crushed and dissolve or ready made availbe <sup>(9)</sup>

Mirtazapine 30 mg	Tablet	you can crush the tablet <sup>(6)</sup>
Montelukast Sodium 10 mg	Tablet	you can crush the tablet <sup>(6)</sup>
Multivitamins Tablet	Tablet	ready made availbe
Nitrofurantion 100 mg	Capsule	ready made availbe , some capsule can be open <sup>(6)</sup>
Olanzapine 5 mg	Coated tablet	Some brands disperse within 5 minutes. Zyprexa brand does not disperse easily <sup>(8)</sup> .
Omeprazole 20 mg	Capsule	extemepranous preparation , use the MUPS tablet <sup>(7)</sup>
Paracetamol 500 mg	Tablet	you can crush the tablet , ready made available <sup>(7)</sup>
Prednisolone 5 mg	Tablet	you can crush the tablet <sup>(6)</sup>
Pregabalin 75 mg	Capsule	you can open the capsule <sup>(9)</sup>
Propranolol 10 mg	Tablet	you can crush the tablet, ready made available <sup>(6)</sup>
Quetiapine 100 mg	Tablet	Crush the immediate-release tablet and mix with water. <sup>3</sup> If the person cannot swallow thin fluids, crush the tablet and mix with a spoonful of yoghurt or apple puree <sup>(8)</sup>
Risperidone 2 mg	Tablet	you can crush the tablet <sup>(6)</sup>
Solifenacin Succinate 5 mg	Tablet	the tablet may be crushed, but



		bitterness may impact palatability <sup>(7)</sup>
Tadalafil 5 mg	Tablet	Crush the tablet and mix with water. If the person cannot swallow thin fluids, crush the tablet and mix with a spoonful of yoghurt or apple puree <sup>(8)</sup> .
Tetracycline 250 mg	Capsule	extemepranous preparation available <sup>(7)</sup>
Thiamine(Vit B1)+Pyridoxine(Vit B6)+Vitamin B12 (Cyanocobalamin) 250 mg	Tablet	no data
Tramadol Hydrochloride 50 mg	Capsule	yes can be open the immediate release
Valaciclovir 500 mg	Tablet	The crushed tablet has a very unpleasant taste <sup>(8)</sup> .
Valsartan+Hydrochlorthiazide 80 mg	Tablet	no data
Venlafaxine 75 mg	Capsule	For Efexor-XR brand only, Open the capsule and mix the pellets with a spoonful of apple puree <sup>(8)</sup> .
Vitamin D3 (Cholecalciferol) 50000 iu	Capsule	use liquid preparation
Vitamin D3 (Cholecalciferol) 50000 iu	Tablet	use liquid preparation

### Discussion:

The study addresses an essential challenge in clinical practice: ensuring proper administration of oral medications for pediatric and nasogastric tube (NGT) patients who have swallowing difficulties or specific medical conditions. The findings emphasize the necessity of alternative formulations and preparation methods to optimize drug administration for these vulnerable populations.

The results show that among the 78 medications evaluated, many can be modified or prepared as extemporaneous solutions, but this process requires adherence to stringent guidelines. Crushing tablets or opening capsules, while practical in some cases, can compromise the drug's pharmacokinetics, efficacy, and safety. For example, medications such as enteric-coated and modified-release tablets should not be altered without professional oversight, as this could lead to adverse effects or suboptimal therapeutic outcomes.

This study highlights several key issues. First, the unavailability of liquid formulations for essential medications remains a significant barrier, particularly for pediatric and ICU patients. Although alternatives such as crushing or dissolving are available, these approaches are not universally applicable, as evidenced by medications like modified-release drugs or those with special coatings. For instance, the study notes that medications like enteric-coated drugs lose their protective function when crushed, potentially causing gastric irritation.

Second, the study underscores the critical role of healthcare providers in medication administration. Proper knowledge and training are essential to ensure that medications are modified safely. Moreover, reliance on trusted pharmaceutical resources, such as LexiComp and specific handbooks, provides a robust framework for making informed decisions regarding medication modifications.

Finally, the data collected from this study serve as a vital reference for clinical settings, particularly in institutions like Medical services at Imam Muhammad bin Saud University, where such practices are implemented. By identifying medications that can safely be altered for use in NGT patients, this research aids in bridging gaps in treatment and ensuring patient safety and adherence to prescribed regimens.

Implications for Future Research and Practice:

- There is a pressing need for the pharmaceutical industry to develop and prioritize liquid formulations for essential medications.
- Healthcare institutions should invest in training programs for staff on the safe modification of dosage forms.
- Further research should explore the impact of crushed or dissolved medications on patient outcomes, particularly in pediatric and ICU settings.

This study provides a foundational reference for improving medication administration in challenging scenarios, emphasizing the importance of individualized patient care and adherence to evidence-based practices.

### **Conclusion:**

This study highlights the significant challenges associated with administering oral medications to pediatric and nasogastric tube (NGT) patients, particularly those with swallowing difficulties. By evaluating 80 medications, the research identifies practical solutions, including the modification of dosage forms when necessary and appropriate. The findings emphasize the importance of adhering to professional guidelines to maintain the safety and efficacy of altered medications.

The results underscore the need for healthcare providers to possess a thorough understanding of the pharmacological implications of modifying drug forms. Furthermore, they highlight the necessity for the pharmaceutical industry to develop more liquid formulations to address this critical gap in patient care.

Ultimately, this research serves as a valuable resource for healthcare professionals, providing evidence-based recommendations for optimizing medication administration in vulnerable patient populations. It also underscores the importance of continuous education and collaboration among healthcare teams to enhance patient safety and treatment outcomes.

### **References:**

1. Taylor S, Glass BD. Altering dosage forms for older adults. *Aust Prescr.* 2018 Dec;41(6):191- 193. doi: 10.18773/austprescr.2018.063. Epub 2018 Dec 3. PMID: 30670887; PMCID: PMC6299174.
2. Tillott H, Barrett D, Ruan J, Li V, Merrick S, Steed H, Morrissey H, Anthony Ball P. Survey of nurses' knowledge and practice regarding medication administration using enteral tubes. *J Clin Nurs.* 2020 Dec;29(23-24):4614-4622. doi: 10.1111/jocn.15498. Epub 2020 Sep 29. PMID: 32954598.
3. Mercovich N, Kyle GJ, Naunton M. Safe to crush? A pilot study into solid dosage form modification in aged care. *Australas J Ageing.* 2014 Sep;33(3):180-4. doi: 10.1111/ajag.12037. Epub 2013 May 13. PMID: 24521076.
4. Perrie Y, Badhan RK, Kirby DJ, Lowry D, Mohammed AR, Ouyang D. The impact of ageing on the barriers to drug delivery. *J Control Release.* 2012 Jul 20;161(2):389-98. doi:

- 10.1016/ j.jconrel.2012.01.020. Epub 2012 Jan 24. PMID: 22289435.
5. Swedrowska M, Ingham S, Tomlin S, Forbes B. Recommendations delivery via pediatric nasogastric tubes. *Int J Pharm.* 2021 Feb .594:120151;1 doi: 10.1016/j.ijpharm.2020.120151. Epub 2020 Dec 15. PMID: 33338568.
  6. Clifton, M. (2018). Moc guidelines for Tablet crushing in patients with swallowing difficulties [PDF]. Colchester Hospital Foundation University NHS Trust.
  7. UpToDate Lexidrug. UpToDate Inc.
  8. Australiana guideline: <https://www.ausdi.com>.
  9. Bradnam V. (2015). *Handbook of Drug Administration via Enteral Feeding Tubes*, Pharmaceutical Press.