REVIEW ARTICLE

An Overview of Natural and Synthetic Superdisintegrants Used for Sublingual Drug Delivery

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ABSTRACT

This review gives a comparative overview of natural and synthetic superdisintegrants used for sublingual drug delivery systems. In the formulation of sublingual tablets, superdisintegrants play an essential role because they proved quick disintegration and drug absorption. The aim of this review is to focus on the disintegration characteristics, mode of action, and formulation implications of natural and synthetic superdisintegrants. To identify studies evaluating the use of superdisintegrants in sublingual tablets, an extensive literature search was conducted across multiple scientific databases. The Preferred Reporting Items for Systematic reviews and Meta-Analyses guidelines were followed in evaluating the study's quality and risk of bias. The findings indicate that natural superdisintegrants tend to provide more environmentally friendly (biodegradable) products with lower toxicity levels than their synthetic counterparts, while the synthetic options generally have improved mechanical properties and are reproducible. Both types have useful applications within the sublingual dosage form. Selecting between these options will be based on the intended performance criteria of the formulation at hand. Future studies should focus on integrating both forms as well as standardizing the evaluation methods for the hybrid formulations so that all sublingual drug delivery systems can be optimized consistently.

Key words: Sublingual route, natural excipients, synthetic excipients, tablet disintegration, PRISMA guidelines

INTRODUCTION

The way a drug is delivered has a major influence on how quickly and effectively it produces its therapeutic effect. Although oral and parenteral routes are widely used, injections such as intramuscular, subcutaneous, and intravenous administration are not always suitable for every patient or clinical situation. In case where rapid action is needed or when avoiding first-pass metabolism is important, alternative routes can offer clear advantages and improve overall treatment outcomes.[1] In addition to producing effects within the oral cavity, the sublingual route also enables drugs to enter the systemic circulation. In this approach, the medication is placed beneath the tongue, where it gradually dissolves and diffuses through the richly supplied mucosal tissue into the bloodstream.[2,3] This mode of delivery offers several practical benefits compared with traditional oral or injectable routes, such as quicker absorption, avoidance of first-pass metabolism, and greater comfort for patients who prefer non-invasive options.[4] When a rapid therapeutic response is required, the sublingual route becomes particularly valuable. Drugs such as nitroglycerin, used in the management of acute angina, are commonly given sublingually because they enter the bloodstream quickly and provide prompt relief from symptoms.[4,5]

MATERIALS AND METHODS

A systematic literature search was conducted to find pertinent studies comparing natural and synthetic superdisintegrants used in sublingual tablet formulation. Keywords such as "Natural Superdisintegrant," "Synthetic Superdisintegrants," "Sublingual Tablet," and "Tablet Disintegration" were used to search electronic databases

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such as PubMed, ScienceDirect, Google Scholar, and Scopus. To capture recent developments in the field, the research was restricted to articles published in the past 20 years (2005–2025).

This review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Figure 1 presents the PRISMA flow diagram, outlining the identification, screening, eligibility, and inclusion of studies considered for this review.

SUBLINGUAL MUCOSA: STRUCTURE AND RELEVANCE IN DRUG DELIVERY

The specialized lining of the oral cavity, known as the oral mucosa, is essential for drug absorption, especially in buccal and sublingual delivery. It is composed of four primary layers: Epithelium, basement membrane, lamina propria, and submucosa. The surface area of oral cavity is 200 cm^2. A squamous epithelial layer covers its mucosa, and depending on the region, this layer may have a keratinized or non-keratinized surface. The soft palate, ventral surface of the tongue, floor of the mouth, inner lips, and cheeks are lined with non-keratinized epithelium, whereas the hard palate and gingiva are covered by keratinized epithelium, whereas the keratinized layer covers the hard palate and other hard areas of the oral cavity. The sublingual region is covered by the non-keratinized layer which makes it highly permeable to drugs.[6,7]

- The lamina propria is a layer of connective tissue that is rich in collagen, elastin, nerve, and a dense circulatory network, located underneath the epithelium[8]
- The submucosa contains loose connective tissue, fat cells, and salivary glands that help maintain constant moisture for drug dissolution[8,9]
- The rich blood supply in this region directly drains

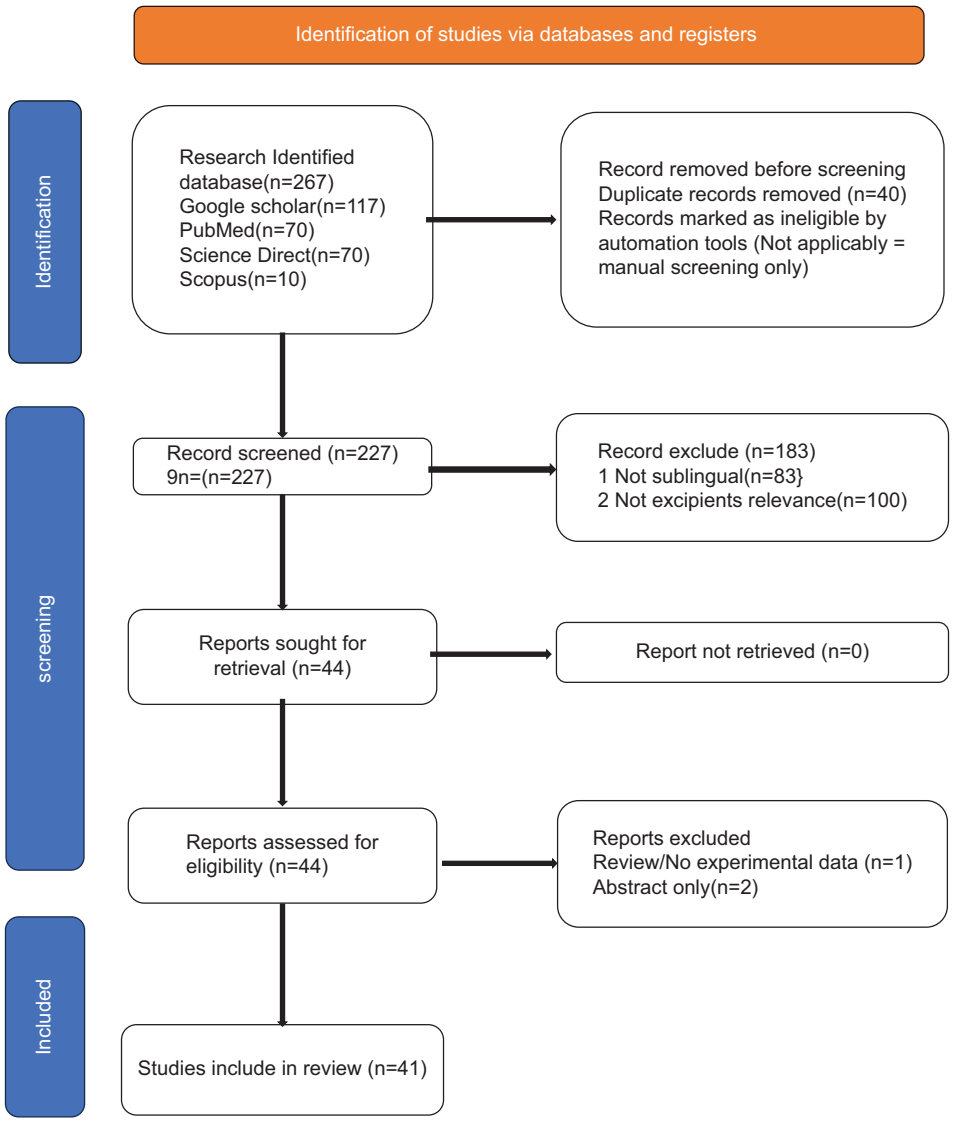


Figure 1: Literature screening process

Table 1: Advantages of sublingual drug delivery systems with examples

Advantages	Explanation	Examples
Rapid onset of action	Fast absorption through highly vascular sublingual mucosa	Nitroglycerin (angina pectoris); sumatriptan (migraine)
Avoidance of first-pass metabolism	Direct entry into systemic circulation through venous drainage	Loratadine; prazosin
Improved patient compliance	Easy to administer, no water needed, helpful for pediatrics/geriatrics	Vitamin B12 supplements; folic acid
Non-invasive and convenient	No needle, painless, self-administration	Hormonal therapies
Emergency use suitability	Provide immediate drug action in acute conditions	Hypertensive crisis (nifedipine); acute pain (morphine); asthma (salbutamol)
Reduced dose and side effects	Enhanced bioavailability reduces dose requirement	Opioid dependence therapies (buprenorphine)
Improved patient acceptability	Pleasant taste and ease of administration without water increases patient comfort and acceptability.	Sublingual vitamin supplements; antiemetic formulations

Table 2: Physicochemical properties of drug candidates suitable for sublingual delivery[16]

Properties	Ideal requirement
Solubility	High aqueous solubility for rapid dissolution in saliva
Permeability	Good permeability through the mucosal membrane, log P 1-3
pKa/Ionization	>2 for acidic drugs; <10 for basic drugs
Molecular weight	Preferably <500 Da for easy diffusion
Dissolution rate	Rapid dissolution
Stability	Chemically and physically stable in saliva and during storage
Dose requirement	20–40 mg
Disintegration time	30–60 s
Lipophilicity	Lipophilic

Table 3: Some marketed sublingual tablets[20]

Brand name	Drug	Category	Strength
Abstral	Fentanyl citrate	Opioid analgesic	0.05 mg, 0.8 mg
Subutex	Buprenorphine	Opioid analgesic	2 mg, 8 mg
Avitan	Lorazepam	Antianxiety	1 mg, 2 mg
Edular	Zolpidem tartrate	Sedative/hypnotic	5 mg, 10 mg
Isordil	Isosorbide dinitrate	Vasodilator	2.5 mg, 5 mg
Suboxone	Buprenorphine hydrochloride	Narcotic/opioid antagonist	2/0.5 mg, 8/2 mg
Nitrostat	Nitroglycerin	Antianginal	0.3 mg, 0.4 mg

into the systemic circulation through the sublingual and facial veins, bypassing hepatic first-pass metabolism[10,11]

- These unique anatomical and physiological characteristics of the oral mucosa, especially in the sublingual region, make it an ideal route for rapid and efficient systemic drug delivery. The anatomical structure of the sublingual region is illustrated in Figure 2.

PHARMACOLOGICAL BASIS AND MECHANISM OF SUBLINGUAL ABSORPTION

Absorption

In sublingual drug delivery, the drug is placed under the tongue, where it enters the bloodstream directly through the mucosal membrane.

Table 4: Types of superdisintegrants[32-35]

Type	Example	Mechanism	Feature	Source
Synthetic	Sodium starch glycolate, CCS, crospovidone	Swelling, wicking	Consistent, effective at low %	Nanzhao *et al.*, 2005
Semi-synthetic	modified cellulose, starch	Swelling, capillary action	Derived from natural and chemical modification	Mehta *et al.*, 2024
Natural	Alginate, gums, chitin	Swelling, hydration	Eco – friendly, variable performance.	Ansari *et al.*, 2020
Co-processed	Synergistic combinations	Multiple mechanisms	Enhanced, tailored functionally	Mehta *et al.*, 2024

Table 5: Natural superdisintegrants for sublingual tablet[39-43]

Natural material	Botanical name	Part of plant	Key properties	Use in research
Locust bean gum	*Ceratonia siliqua*	Seeds	Swelling polymer, eco-friendly, binder/disintegrants	Mehta *et al.*, 2024
Plantago ovata husk	Psyllium husk	Outer seed coat	Very high swelling index, forms mucilage that rapidly breaks tablets	Darksiene *et al.*, 2019
Banana powder	*Musa acuminata*	Pulp of ripe banana	Starch+mucilage content helps in swelling and disintegration	Singh *et al.*, 2024
Fenugreek seed	*Trigonella foenum-graecum*	Single pods	Hydrophilic mucilage, excellent swelling, also acts as a binder	Kunal *et al.*, 2014
Lepidium sativum	Garden cress	Seed, root, and above part of the plant	High swelling, gel forming	Patel *et al.*, 2022

Table 6: Synthetic superdisintegrants for sublingual tablets[47-49]

Excipients	Properties	Mechanism of action	Used in research
Crospovidone	Cross-linked Polyvinylpyrrolidone, high swelling capacity	Wicking+swelling	Patel *et al.*, 2014
CCS	Cross-linked cellulose derivative, fibrous structure	Wicking, swelling	Ali *et al.*, 2020
Sodium starch glycolate	Modified potato starch, high water uptake	Rapid swelling	Gupta *et al.*, 2019

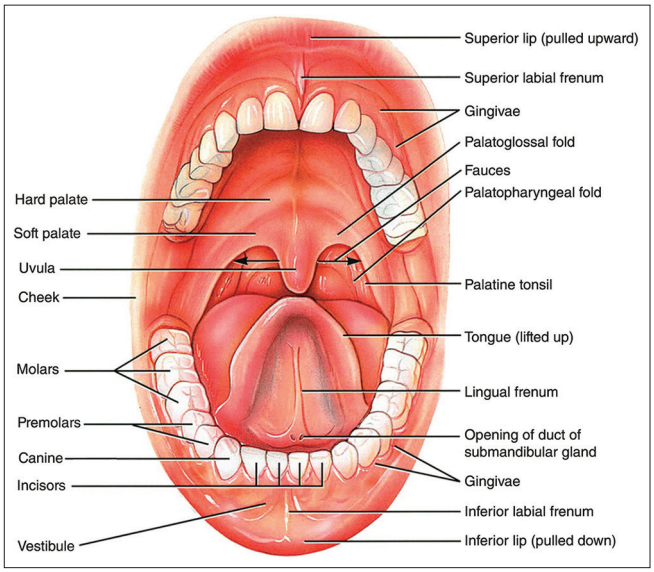


Figure 2: Anatomy of sublingual mucosa

The mechanism underlying this absorption process is as follows:[4,12]

Dissolution and penetration

The sublingual glands are located beneath the tongue on the floor of the mouth. Saliva is produced there by mucin as soon as drug is placed under the tongue, it starts to dissolve in the saliva. The mucosal membrane is then penetrated by the drug molecules that have dissolved. Drug can diffuse into the capillary network more readily because the sublingual mucosa has a comparatively high permeability when compared to the stomach mucosa.[4,13]

Direct entry into systemic circulation

The medication avoids the digestive tract and the liver's first pass metabolism by entering the venous circulation after being absorbed through the mucosal membrane. Moreover, the liver's front circulation after being absorbed

Table 7: Comparison between natural and synthetic superdisintegrants

Aspect	Synthetic	Natural
Sustainability	Petrochemical or synthetic manufacturing	Plant-derived, renewable, biodegradable, eco-friendly
Disintegration efficacy	Very fast, reproducible, predictable (<30–60 s for sublingual tablet)	Variable; some perform dose to synthetic, but others may take longer or require higher concentration
Concentration needed	Effective at low concentration (2–5%w/w)	Often needed higher concentration (4–8% or more) to match synthetic performance.
Batch-to-batch uniformity	Highly consistent (industrially manufactured)	Can vary due to natural sources, climate, harvest, and processing
Patient safety	Generally safe, but some may cause minor irritation if not processed well	Natural sources are biocompatible, biodegradable, low toxicity, and eco-friendly
Cost	Usually more expensive due to industrial processing	Usually cheaper and locally available
Application	Preferred for poorly soluble active pharmaceutical ingredients	Preferred for natural, eco-friendly, and pediatric/ geriatric formulation
Source	Chemically synthesized	Plant or natural sources
Regulatory acceptance	Already well-established in pharmacopeias (less eco-friendly)	Plant-derived, eco-sustainable
Taste mouthfeel	Mostly neutral, but some like sodium starch glycolate can give a chalky feel	Natural powders sometimes impart taste, color, or odor (e.g., fenugreek mucilage)

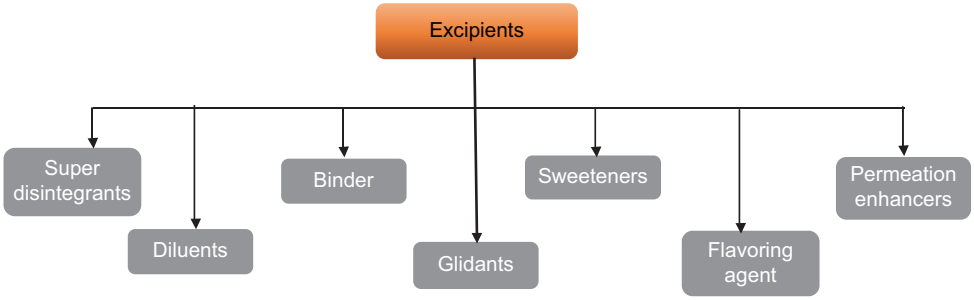


Figure 3: Excipients used in sublingual tablets

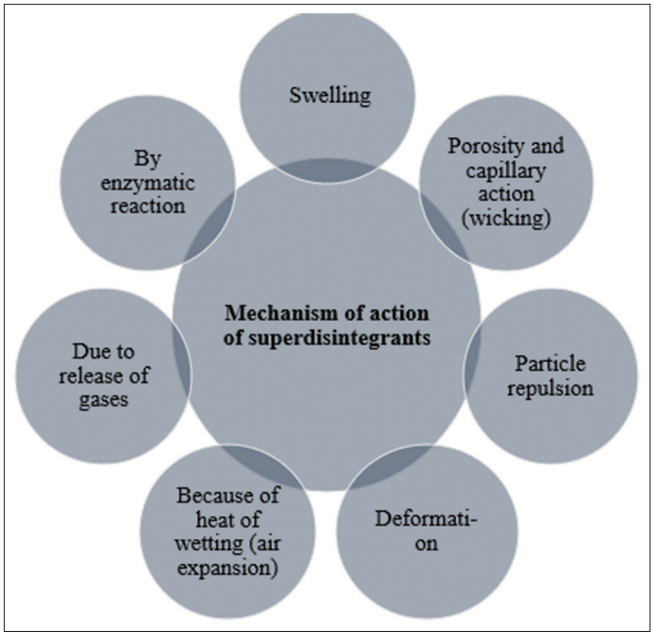


Figure 4: Mechanism of superdisintegrants

through the mucosal membrane. The drug can reach its target site more effectively through this direct entry into the systemic circulation. This rapid systemic availability makes sublingual delivery particularly useful in emergency conditions.[4,14]

ADVANTAGES OF SUBLINGUAL DRUG DELIVERY[1,15,16]

The major advantages of sublingual drug delivery systems are summarized in Table 1. The ideal physicochemical characteristics required for sublingual drug delivery are presented in Table 2.

LIMITATIONS

While the sublingual route offers many benefits, it also comes with some important limitations that need to be considered. Only small doses of drugs can be given under the tongue because the space available for absorption is very limited. Medicines that taste bitter or unpleasant may be difficult for patients to keep under the tongue, which can reduce acceptance and compliance. Drugs with large molecular size or poor

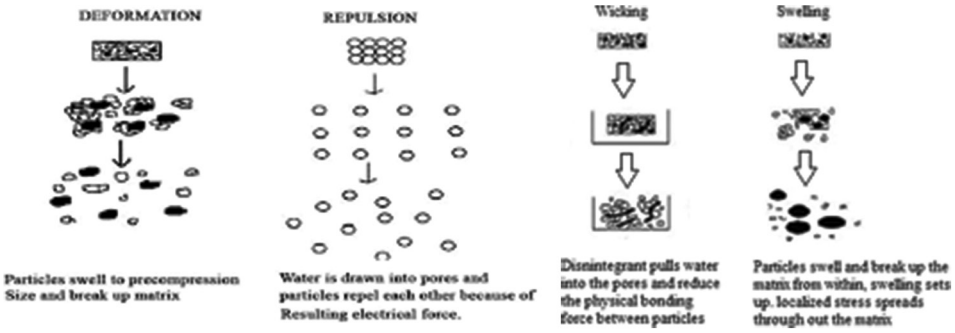
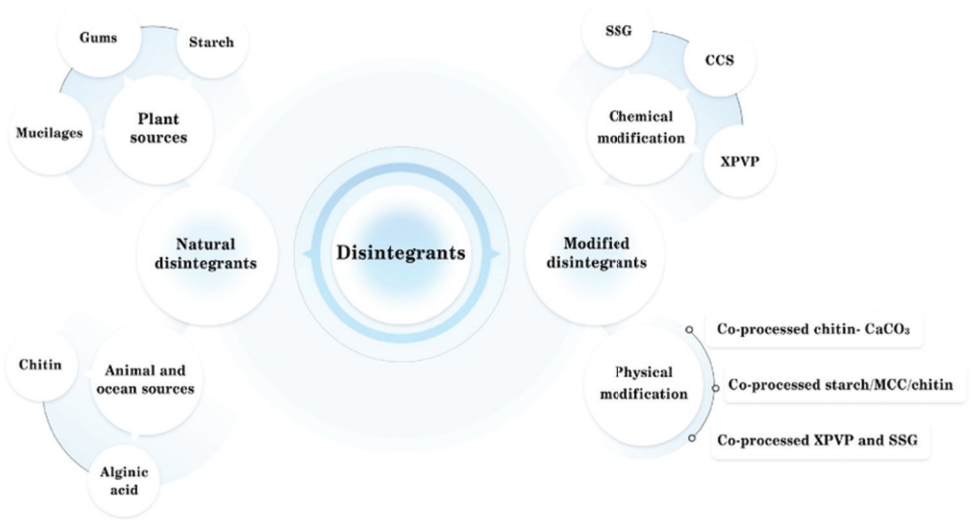


Figure 5: Deformation and repulsion, swelling, and wicking



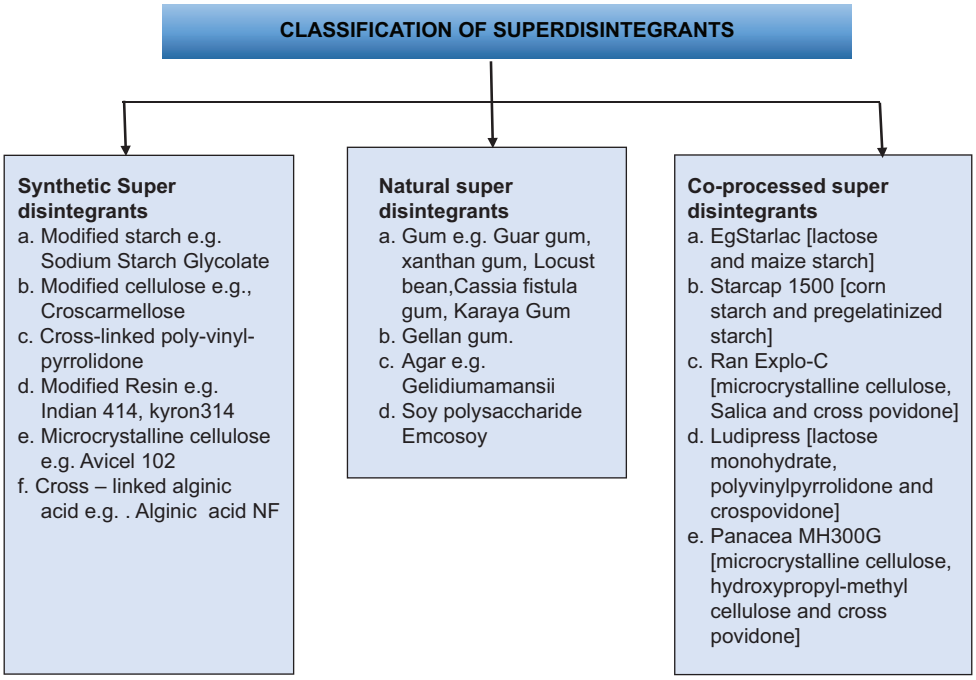


Figure 6: Classification of disintegrants

permeability cannot easily pass through the mucosal lining, making sublingual delivery unsuitable for them. Absorption also depends on saliva, so people with a dry mouth may not get the expected effect. In some cases, medicines may cause irritation or a burning sensation under the tongue. Another limitation is that the drug does not stay in the sublingual area for long and can be washed away quickly, making it unsuitable for sustained release formulations. Because of

these challenges, sublingual delivery must be carefully chosen depending on the drug's properties and patient needs.[17]

FACTORS AFFECTING SUBLINGUAL ABSORPTION[15,16,18,19]

Lipophilicity of drug

The lipophilic nature of a drug helps it cross the lipid-rich sublingual membrane into the blood. Moderately lipophilic drugs show better sublingual absorption because they balance solubility in saliva with membrane permeation. If lipophilicity is too low or too high, absorption efficiency usually decreases.

Solubility in salivary secretions

The drug must first dissolve in saliva to create a sufficient concentration gradient for diffusion across the sublingual mucosa. Poor salivary solubility leads to slower dissolution, lower available drug at the membrane surface, and thereby reduces sublingual absorption.

Salivary pH and pKa

The mean pH of saliva in the sublingual area is slightly acidic, usually around 6.0. This pH favors the absorption of drugs that remain unionized. Furthermore, drug absorption through the oral mucosa occurs if the pKa is greater than 2 for acid and less than 10 for base.

Thickness of oral epithelium

The thickness of the buccal epithelium is greater than that of the sublingual epithelium (100–200 μm), resulting in more rapid drug absorption across the thinner sublingual mucosa. Because of the thinner epithelium and the medication's immersion in a similar volume of saliva, drug absorption is accelerated.

Partition coefficient

The partition coefficient shows how much a drug prefers "oil" versus "water," so it directly affects how easily the drug leaves saliva and enters the lipid-rich sublingual membrane. If the value is in optimum range. The drug can both dissolve in saliva and partition into the mucosa, leading to faster and higher sublingual absorption. Too low or too high values usually reduce absorption efficiency.

Surface area and blood supply of sublingual mucosa

The extensive vascularization and relatively large surface area of the sublingual mucosa enhance drug uptake by providing a rich capillary network for rapid absorption. Drugs placed under the tongue reach the circulation faster because of this high perfusion, which minimizes diffusional resistance and accelerates systemic entry. The continuous blood flow also helps maintain a strong concentration gradient, supporting sustained and efficient absorption.

EXCIPIENTS USE IN SUBLINGUAL DOSAGE FORM

When it comes to sublingual tablets, the kind that dissolve under the tongue, excipients are the unsung heroes in the formula. Excipients are ingredients other than the active drug that helps shape how a tablet performs and feels. Their main jobs include making sure the tablet breaks apart quickly in the mouth, improving how the medicine tastes, and helping the whole process feel pleasant for patients. A few of the most important excipients in sublingual tablets are called superdisintegrants, such as crospovidone, croscarmellose sodium (CCS), and sodium starch glycolate (SSG). These make the tablet crumble fast in the small amount of saliva under the tongue, so the medicine is released and absorbed rapidly into the bloodstream just where it is needed for quick action. Other helpful excipients include diluents such as lactose, mannitol, dextrose, and sucrose. These not only add bulk to the tablet, making it easier to handle but they also improve sweetness and mouthfeel. Hence, the tablet is comfortable to take and dissolve smoothly. In many sublingual formulations, small amounts of lubricants like magnesium stearate are added so the powder does not stick during tablet making and everything compresses smoothly. To help the tablet wet and dissolve even faster, ingredients such as citric acid are sometimes used because they gently stimulate saliva. Sublingual tablets also include permeation enhancer, flavoring agent, cooling substance, etc. Overall, every excipient works together to make sure that the tablet is easy to take, dissolves quickly, and delivers the drug in the most effective way possible.[21,22] The major categories of excipients used in sublingual tablet formulations are shown in Figure 3.

Diluent/Fillers

These provide bulk and improve the compressibility. Ideal diluents are water-soluble and inert. Example – mannitol, lactose, dextrose, sorbitol, super disintegrants.

They ensure fast tablet disintegration in the limited saliva volume under the tongue, enhancing drug release. Example – CCS, SSG, crosspovidone, hydroxypropyl cellulose.

Binder

Binder improves the mechanical strength of tablets while allowing rapid disintegration. Example

– polyvinylpyrrolidone, hydroxypropyl methylcellulose, starch paste, gelatin

Lubricants and glidants

Lubricants reduce friction during tablet compression; glidants improve powder flow. Hydrophilic lubricant is preferred to prevent delayed disintegration. Example – Magnesium stearyl fumarate, colloidal silicon dioxide, talc.

Sweeteners

These improve taste and patients' compliance, as sublingual tablets dissolve directly in the mouth. Example – Aspartame, Sucralose, Xylitol, Mannitol, Saccharin sodium.

Flavoring agent

These agents are used to mask unpleasant drug taste and enhance sensory acceptability. Example – peppermint oil, menthol, citrus or fruit flavors, Vanillin Permeation enhancers facilitate.

Drug transport across the sublingual mucosa by modifying membrane permeability. Example – sodium lauryl sulfate, bile salt, surfactants, fatty acids.[23]

SUPERDISINTEGRANTS

Superdisintegrants play an important role in making sublingual dosage forms fast-acting, patient-friendly, and effective. When a tablet is placed under the tongue, only a very small amount of saliva is available, so the tablet must break apart quickly for the drug to be absorbed efficiently. To achieve this, superdisintegrants are included in the formulation to trigger rapid tablet breakup. These special excipients draw water into the tablet and either swell or cause the tablet to fall apart into tiny particles almost instantly. As a result, the active drug is released very quickly in the mouth and becomes ready for absorption through the sublingual mucosa, which contains abundant blood vessels. This allows the drug to bypass the liver's first-pass metabolism.[24]

Formulators choose superdisintegrants such as crospovidone, CCS, and natural polymers for sublingual tablets because these agents need only a very small amount of saliva to break the tablet apart rapidly. This feature is especially valuable for pediatric and geriatric patients, as well as for individuals who have difficulty swallowing. They help provide a faster therapeutic response, improve drug bioavailability, and make the overall dosage form more convenient and acceptable for patients.[25]

SUPERDISINTEGRANTS SELECTION CRITERIA[26]

- It should have a pleasant mouthfeel
- It should have a greater capacity for hydration but should not form a strong gel
- It should not cause any formation of complexes with the drug
- It should offer favorable flow characteristics
- It should act quickly on contact with saliva so that the tablet breaks apart without requiring much pressure.

MECHANISM OF ACTION OF SUPERDISINTEGRANTS

Various mechanisms are used in superdisintegrants. The following mechanisms describe how the tablets are broken into small particles.

Swelling action

Disintegrants demonstrate this process. The disintegrants begin to expand and break the tablets as they come into contact with the medium. There will be enough swelling force generated if the tablet has little porosity.[27]

Wicking (porosity and capillary action)

Some disintegrants work by means of capillary action and porosity. The aqueous medium will seep into the tablet upon exposure to the medium, replacing the absorbed air within the particles. It will lead to the weakening of the intermolecular bonds present in the tablet and break the dosage form into particles. The rapid increase in volume generates internal stress within the tablet matrix, leading to its rupture and facilitating faster disintegration.[28]

Heat of wetting

Disintegrants with exothermic characteristics will cause disintegration action, and when they get wet, capillary air expansion will create localized stress. A small number of disintegrants exhibit this mechanism. This localized rise in temperature further accelerates moisture penetration, thereby enhancing the overall rate of tablet disintegration.[26]

Chemical reaction

The release of CO_2 gas may occasionally be the cause of the disintegration activity. It happens when bicarbonates or alkali metal carbonates (base) react with tartaric acid or citric acid (acid) in the presence of water. As a result, another name for these interactions is acid-base reaction. The tablet will

experience internal pressure production, which results in the tablet disintegrating.[28]

Deformation

The shape of the disintegrant particles will change during compression, and during the wetting process, it will return to its pre-compression shape. It will result in the tablet shattering since the size of the distorted particle will increase.[29]

Particle repulsive force

The tablets containing non-swellable disintegrants will demonstrate this process. A network of starch will form when the tablet is exposed to the medium because the medium will pass through the hydrophilic pores. Hydrogen bonds will break as a result. The disintegration process will be caused by electric repulsive interactions between the particles.[29] The principal mechanisms by which superdisintegrants facilitate tablet breakup are presented in Figure 4

Enzymatic reaction

The body's naturally occurring enzyme also functions as a disintegrant. These will result in disintegration because the binder in the tablet would not be able to bind.[30] The processes of deformation, particle repulsion, swelling, and wicking are illustrated in Figure 5.

TYPES OF SUPERDISINTEGRANTS

Superdisintegrants are specialized excipients that promote the rapid disintegration of tablets, ensuring quick drug release. They can be broadly classified based on their origin and structure into synthetic, semi-synthetic, natural, and co-processed types, each with unique characteristics and mechanisms of action.[31] The major categories of superdisintegrants are summarized in Table 4. A classification of superdisintegrants into synthetic, natural, and co-processed categories is shown in Figure 6.

Natural versus synthetic superdisintegrants

Natural superdisintegrants

Natural superdisintegrants are plant-derived polymers and mucilages that rapidly break apart sublingual tablets in the mouth, offering a safe and patient-friendly alternative drug delivery in the context of sublingual dosage forms. These natural agents, such as *Plantago ovata* husk, gum Karaya, gellan gum, and locust bean gum, are gaining popularity for their ability to accelerate tablet disintegration without the disadvantages sometimes associated with synthetic excipients.[36,37]

For example, the mucilage from *P. ovata* husk swells many times its size in the presence of moisture, breaking up the tablet swiftly and enabling immediate action. These plant-based excipients are not just effective – they are biodegradable, safe, and less likely to cause adverse reactions. This makes natural super disintegrants ideal for vulnerable groups, such as children, the elderly, or individuals sensitive to synthetic chemicals. Gum karaya and gellan gum have also proven their worth, showing that with meticulous formulation, natural substances can rival or even surpass their synthetic counterpart in providing rapid disintegration and drug release.[38] Representative natural superdisintegrants and their characteristics are presented in Table 5

Synthetic superdisintegrants

Synthetic superdisintegrants such as CCS, SSG, and crospovidone play an essential, often unsung role in the creation of sublingual tablets. These excipients deliver medication rapidly and reliably. In the context of sublingual dosage forms, these engineered excipients are designed to quickly break apart the tablet beneath the tongue, harnessing advanced swelling and wicking mechanisms that ensure the drug becomes available almost instantly for absorption into the bloodstream.[44,45]

These substances are engineered to work in tiny amounts, often only 1–10% of the total tablet weight, enabling precision in manufacturing and consistent results from batch to batch. Synthetic superdisintegrants like CCS can swell four to eight times their original size in under ten seconds. This creates channels for saliva to penetrate and accelerate the breakdown of the tablet. For vulnerable patients – children, the elderly, or anyone unable to swallow this reliability transforms their treatment journey, making difficult moments less daunting.[46] Common synthetic superdisintegrants used in sublingual tablet formulations are listed in Table 6.

DISCUSSION

This review points out how important it is for manufacturers to select an appropriate superdisintegrant. A superdisintegrant greatly affects the way sublingual tablets work in that it will impact how well the drug dissolves and when it will take effect. Superdisintegrants that are made from synthetic materials (such as Crospovidone, CCS, and SSG) will give fast, reliable, and consistent disintegration, which will make them suitable for products that need fast therapeutic activity.

Natural superdisintegrants, although more variable, offer advantages such as safety, biodegradability, and lower cost. Materials such as *P. ovata* husk, gum karaya, and gellan gum show good potential when used at optimized levels, but their performance may be affected by batch variations and the need for higher concentrations.

Overall, synthetic agents ensure consistent mechanical strength and regulatory acceptance, while natural polymers provide eco-friendly and patient-friendly alternatives. More standardized evaluation studies are still needed to clearly define selection criteria for superdisintegrants in sublingual formulations. Future advancements should focus on hybrid and co-processed systems that combine the strengths of both natural and synthetic categories.

CONCLUSION

The delivery of drugs through the sublingual mucosa is a key method in the modern treatment of illness that requires rapid access to an effective amount of medication by the body. When people take a medication sublingually, the body directly absorbs it from beneath the tongue into the bloodstream. This process avoids the first-pass metabolism of the liver and helps provide an initial dose of the medication to the body much sooner than with a standard oral tablet. The rate at which the drug dissolves in a small amount of saliva and is absorbed by the body is the primary factor that dictates the effectiveness of sublingual tablets. For this reason, the role of superdisintegrants in the formulation of sublingual tablets is very important.

Super disintegrants, both natural and synthetic, were discussed throughout this paper. The paper covered the types of super disintegrants, how they work, their characteristics (some are more soluble than others), their benefits/downsides, their influence on product performance, and how they mutually interact with each other as well as with other types of preformulation/excipients. Synthetic super disintegrants such as CCS, crospovidone, and SSG provide ultra-rapid, consistent, and reproducible disintegration of a dosage form/substance, even under emergency situations; they can retain their efficiency even at lower concentrations than with the typical synthetic disintegrants. Natural super disintegrants, including gum karaya, gum arabic, gellan, and *P. ovata* husk, are gaining popularity because of their ability to biodegrade, their relatively low toxicity and price compared to synthetics, and ultimately because of the way in which they can provide sustainable and patient-friendly alternatives for many of today's pharmaceutical products.

Natural and synthetic superdisintegrants are equally important to products, as they each provide strengths that will be beneficial based on the final formulation's goal. Accordingly, the decision on the selection of the type of superdisintegrant will depend on several factors, including the need for rapid disintegration; how the drug will behave in a sublingual environment; the type of product and patient; manufacturing cost; and environmental concerns. As the industry has evolved, the combination of scientific efficiency and sustainability has been the focal point of sublingual tablet development for the foreseeable future.

FUTURE SCOPE

Future research should aim to create hybrid co-processed super disintegrants, which incorporate the effectiveness of synthetic sources while also having the safety of natural materials. With continued progress in polymer science, nanotechnology, and standard evaluation methods, there is an opportunity to greatly enhance the performance, stability, and patient acceptance of sublingual drug delivery systems, opening the possibility for the next generation of such systems.

DISCLAIMER

The authors are solely responsible for the content and writing of this manuscript.

REFERENCES

1. Ramon Roma J, Castro Rebollo P, Bastida C. Sublingual and buccal drug administration in medical emergencies. Med Clin (Barc) 2024;163:619-25.
2. Madhav NV, Shakya AK, Shakya P, Singh K. Orotransmucosal drug delivery systems: A review. J Control Release 2009;140:2-11.
3. Bahraminejad S, Leuner C, Buckley S, Beeton C. Sublingual and buccal delivery: A historical and scientific review. Front Pharmacol 2019;10:1328.
4. Joshi D, Choudhary NK. A review on sublingual drug delivery: Enhancing bioavailability and therapeutic outcomes. Int J Newgen Res Pharm Healthc 2024;2:243-50.
5. El-Setouhy DA, Basalious EB, Abdelmalak NS. Bioenhanced sublingual tablet of drug with limited permeability using novel surfactant binder and microencapsulated polysorbate: *In vitro*/*in vivo* evaluation. Eur J Pharm Biopharm 2015;94:386-92.
6. Shojaei AH. Buccal mucosa as a route for systemic drug delivery: A review. J Pharm Pharm Sci. 1998;1(1):15-30.
7. Khan AB, Kingsley T, Caroline P. Sublingual tablets and the benefits of the sublingual route of administration. Int J Pharm Res Dev 2017;16:257-67.
8. Shaikh S, Manjunatha BS. Histology, oral mucosa. In: StatPearls. Treasure Island, FL: StatPearls Publishing; 2023.
9. Garg T, Rath G, Goyal AK. Buccal drug delivery: A comprehensive review. J Pharm Bioallied Sci 2015;7:281-7.
10. Dixit RP, Puthli SP. Oral strip technology: Overview and future potential. J Control Release 2009;139:94-107.
11. Kumar A, Sharma P, Aggarwal G, Gupta M, Goswami S. A review on sublingual drug delivery system for enhanced bioavailability. Int J Pharm Sci Res 2011;2:1500-10.
12. Hua S. Advances in nanoparticulate drug delivery

approaches for sublingual and buccal administration. Front Pharmacol 2019;10:1328.
13. Bartlett JA, van der Voort Maarschalk K. Understanding the oral mucosal absorption and resulting clinical pharmacokinetics of asenapine. AAPS PharmSciTech. 2012;13:1110-1115.
14. Goswami T, Jasti B, Li X. Sublingual drug delivery. Crit Rev Ther Drug Carrier Syst 2008;25:449-84.
15. Labhade S, Malode C, Rawal V, Rupvate S. Review on sublingual drug delivery system. J Drug Deliv Ther 2019;9:864-8.
16. Malpure M, Gudur A, Punathil R, Dharashivkar S. A review on sublingual tablets: An efficient alternative for drug administration. Int J Pharm Sci 2025;3:1408-18.
17. Santosh Kumar R, Sartha Chandra T. Sublingual drug delivery systems-faster therapeutic action dosage forms. J Drug Deliv Ther 2019;9:838-44.
18. Swetha M, Unnamalai B, Pawar U, Manasa T, Keerthi V. An overview on sublingual drug delivery system. Int J Pharm Pharm Sci 2025;7:125-9.
19. Reddy DR, Sukanya P, Abdul Malik SK, Shareef SK, Said K, Janardhan T, *et al*. Sublingual drug delivery system. Int J Pharm Res Appl 2024;9:114-9.
20. Sarkhejiya N, Patel VP, Pandya DJ. Sublingual delivery: A promising approach to improve bioavailability. Pharma Sci Monit 2013;4:3870-89.
21. Kumar RS, Kumari A. Superdisintegrant: Crucial elements for mouth dissolving tablets. J Drug Deliv Ther 2019;9:461-8.
22. Amaliyar PR, Patel H, Chaudhary SA, Shah H, Patel A, Suva M. A brief review on natural and synthetic superdisintegrants. Inventi Rapid: Novel Excipients. 2014;2014:1-8.
23. Pandey P, Dahiya M. Oral disintegrating tablets: A review. Int J Pharma Res Rev 2016;5:50-62.
24. Baphale S, Patil R. Natural polymers: Use as superdisintegrants. Int J Pharm Sci Rev Res 2024;84:82-7.
25. Taj DR, Jaiswal NR, Chavan GC, Acharya PN, Sonawane MM. A review on utilization of natural superdisintegrant in the advancement of orally dispersible tablet. World J Pharm Res 2022;11:129-38.
26. Amaliyar PR, Patel H, Chaudhary SA, Shah H, Patel A, Suva M. A brief review on natural and synthetic superdisintegrants. Inventi Rapid Novel Excipients 2014;2014:1-8
27. Mangal M, Thakral S, Goswami M, Ghai P. Superdisintegrants: An Updated Review. Int J Pharm Res 2012;2:26-35.
28. Chandrashekhara S, Deshmkh H, Nagesh C, Murade A, Usgaunkar S. Superdisintegrants: A recent investigation and current approach. Asian J Pharm Tech 2012;2:19-25.
29. Kumar VD, Sharma I, Sharma V. A comprehensive review on fast dissolving tablet technology. J Appl Pharm Sci 2011;1:50-8.
30. Pahwa R, Gupta N. Superdisintegrants in the development of orally disintegrating tablets: A review. Int J Pharm Sci Res 2011;2:2767-80.
31. Liu Z, Shi C, Fang Y, Shen L, Zhao H, Mu Y, Zhao L. A comprehensive understanding of disintegrants and disintegration quantification techniques: From the perspective of tablet microstructure. J Drug Deliv Sci Technol 2025;88:104891.
32. Nanzhao Y, Liu X, Chen H, Wang J. Evaluation of synthetic superdisintegrants for fast disintegration of tablets. J Pharm Sci 2005;94:512-8.
33. Mehta S, Rao P, Kulkarni R. Development and characterization of natural polysaccharide-based superdisintegrants for tablet formulations. Int J Pharm Pharm Sci Res 2024;15:45-53.
34. Ansari N, Shaikh S, Khan M. Eco-friendly superdisintegrants: A comparative study of natural polymers for rapid tablet disintegration. J Adv Pharm Technol Res 2020;11:210-6.
35. Mehta S, Joseph A, Patel R. Functionally tailored co-processed superdisintegrants: Optimization and performance evaluation. Pharm Dev Technol 2024;29:134-42.
36. Shukla A, Gautam A. FDA-approved natural superdisintegrants and their comparision in formulation of mouth dissolving tablet. Int J Sci Dev Res 2023;8:339-44.
37. Maheshwari S, Singh A, Varshney A, Sharma A. Advancing oral drug delivery: The science of fast dissolving tablets (FDTs). Intell Pharm 2024;2:580-97.
38. Metta S, Sahoo SK. Green alternatives in drug delivery: Harnessing the potential of natural superdisintegrants for enhanced pharmaceutical performance. Afr J Pharm Sci 2024;4:120.
39. Mehta S, Rao P, Kulkarni R. Development and evaluation of eco-friendly natural polymers as swelling superdisintegrants in tablet formulations. Int J Pharm Sci Res 2024;15:110-8.
40. Darksiene R, Petrauskas V, Urbonavicius A. Evaluation of high-swelling natural mucilage for rapid tablet disintegration. J Nat Prod Res 2019;33:520-7.
41. Singh A, Yadav N, Kumar S. Formulation and characterization of tablets using starch-mucilage blends as natural superdisintegrants. J Pharm Investig 2024;54:72-9.
42. Kunal MU, Reddy BP, Rao VJ. Extraction and characterization of hydrophilic plant mucilage as a multifunctional excipient for tablet formulations. Int J Pharm Pharm Sci 2014;6:180-5.
43. Patel R, Shah D, Panchal P. Investigation of gel-forming natural excipients as superdisintegrants in fast-disintegrating tablets. J Drug Deliv Ther 2022;12:65-72.
44. Kumar A, Saharan VA. A comparative study of different proportions of superdisintegrants: Formulation and evaluation of orally disintegrating tablets of salbutamol sulphate. Turk J Pharm Sci 2017;14:40-8.
45. Kumar RS, Annu K. Superdisintegrant: Crucial elements for mouth dissolving tablets. J Drug Deliv Ther 2019;9:461-8.
46. Ansari N, Madhavi BL. A review on fast dissolving

tablet by using superdisintegrants. Int J Pharm Pharm Res 2020;18:689-712.
47. Patel DM, Patel NM, Patel VF. Formulation and evaluation of fast dissolving tablets containing superdisintegrants. Int J Pharm Sci Rev Res 2014;25:124-30.
48. Ali J, Arora S, Ahuja A, Khar RK. Fast dissolving tablets: A review. Int J Pharm Sci Nanotechnol 2020;13:4510-20.
49. Gupta MM, Bansal P, Chauhan H. Superdisintegrants: An updated review. Int J Pharm Pharm Sci 2019;11:1-5.

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