

## Non Invasive Approach for Insulin Delivery: A Mini Review

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### Abstract

Present day major proportion of world population is affected by Diabetes mellitus. Insulin is a hormone secreted by pancreatic cells plays a key role in the management of diabetes mellitus. Diabetes mellitus if left untreated leads to further complications. So, Effective delivery of insulin can prevent or at least delay problems associated with diabetes mellitus. In spite of its drawbacks like needle phobia, skin rash, multiple doses a day till recent, parenteral route of administration remained the most commonly preferred way of insulin administration, so in order to bypass these complications various research is being carried out to develop alternate routes of insulin administration which can effectively manage diabetes mellitus. This article encompasses on various available techniques (approaches) applicable for non-invasive delivery of insulin into blood stream.

**Keywords:** Diabetes; Insulin; Non-InvasiveRoute; Patch

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### Introduction

Diabetes patients cannot produce sufficient insulin which is required to convert sugar, starches and other food source into energy. Insulin plays a major role in glycemic control. Various approaches that are currently available for the insulin delivery include insulin syringes, insulin infusion pumps, jet injectors and Pens. Most commonly preferred method is by subcutaneous injections. Major drawback of current forms of insulin therapy is their "Invasive nature". In case of diabetes mellitus Type I for an effective glycemic control patient requires about 3 or more insulin injections a day. In order to overcome the suffering and improve patient compliance, scientists have been looking for effective ways to deliver insulin into blood stream (exogenously). Several Non-Invasive approaches for insulin delivery have been explored which includes Transdermal, Buccal, Oral, Pulmonary, Nasal, Ocular, Rectal routes [1].

### Methods of Insulin Delivery

#### Insulin patches

It enables the delivery of insulin through skin. It is a beneficial route of administration because of low proteolytic activity of skin,

moreover shows a long lasting effect by maintaining steady blood insulin levels for prolonged period of time. Because of its large molecular size insulin can't effectively penetrate across stratum corneum. Various strategies have been developed which can improve the effectiveness of transdermal route which includes use of penetration enhancers in the formulation, iontophoresis, electroporation, ultrasound, magnetophoresis. Various formulations have been developed for this technique of delivery which are under clinical investigation for their effectiveness [2].

#### Ocular route

Enormous research studies reveal that ocular route can be utilized as a non-invasive means of delivering drugs systemically.

#### Oral route of insulin delivery

This route of administration is limited for insulin delivery because of its large molecular size, and enzymatic degradation in the GIT. Various researches have tried to overcome these barriers and promote the oral bioavailability of insulin, which includes entrapment of insulin in micro particles, simultaneous administration of protease inhibitors, coating of insulin with chitosan which stabilizes degradation thereby improves

permeability and absorption. Coating of insulin with PH independent Eudragit can improve bioavailability up to 13-14% when compared to intraperitoneally administered insulin.

### Nasal route

Due to its high epithelial permeability and patient compliance this route is well established for delivery of proteins and peptides. L-Penetratin which acts as a cell penetrating peptide improves the absorption of insulin with a bioavailability of 76% [3].

### Inhaled insulin

Pulmonary route is widely used for the treatment of respiratory disorders. Due to its large surface area lungs offer the best route for insulin delivery. Various pumps are available in the market and few formulations are still under clinical investigation for its approval.

### Buccal insulin delivery

This is another sophisticated route as an alternate for insulin injections. Few benefits by this route include high patient compliance, robustness of mucosal membrane [4]. Oral-lyn® is a unique oral formulation of insulin that is delivered via the RapidMist® device directly to the mouth, where it is rapidly absorbed into the bloodstream through the buccal mucosa.

### Self-regulated insulin

This is designed to release insulin in response to blood glucose level. Hydrogels loaded with glucose oxidase is an example,

in which glucose oxidase acts as a glucose sensor and pH sensitive hydrogel acts as insulin release controller. This is the best technique which improves patient quality by reducing the frequency of administration [5].

## Conclusion

Diabetes Mellitus is reaching potentially epidemic proportions in India. The quest to eliminate the needle from insulin delivery and to replace it with non-invasive route has begun serious pharmaceutical research which unfolded numerous methods. Though every method has its own pros and cons, few of them are under clinical investigation for their practical applicability. This review summarizes different effective ways of non-invasive routes of insulin delivery.

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