



A REVIEW ON MICRONEEDLE PATCH- AN INNOVATIVE APPROACH

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Article Received on 14/03/2018

Article Revised on 04/04/2018

Article Accepted on 24/04/2018

ABSTRACT

A microneedle patch developed to deliver the vaccine which could simplify the vaccination process and ensure that more people get vaccinated against this possibly fatal condition. The vaccine patch consists of 100 solid, water-soluble needles that are just long enough to penetrate the skin. The first patent on microneedles was filed in 1976 – the technology to make microneedles the trans follicular absorption of melanin. As a drug delivery tool, microneedle patches can deliver bioactive molecular of different physical size. Additionally, microneedle patches can be coated or encapsulate with DNA vaccine, subunit antigen, inactivated or live virus vaccine. A microneedle patch that delivers the vaccine could revolutionize the administration of the influenza vaccine, as well as of other vaccines. Compared to conventional intramuscular injection, microneedle vaccination resulted in more efficient lung virus clearance and enhanced cellular recall responses after challenge. These results suggest that dissolving microneedle patches can provide a new technology for simpler and safer vaccination with improved immunogenicity that could facilitate increased vaccination coverage. Because of their advantages in dose sparing, safety and treatment compliance, microneedle patches are expected to be widely applied in clinical treatment and vaccine administration in near future.

KEYWORDS: Microneedle patch, DNA vaccine, Conventional Intramuscular injection, Immunogenicity.

1. INTRODUCTION^[1]

Microneedle patches are increasing expanding consideration as an elective approach for the conveyance of immunizations. In this examination, an authorized regular flu immunization from 2007 to 2008 was created into dissolvable microneedles utilizing Thera Ject's microneedle innovation (VaxMat). The tips of the microneedles were made of antigens blended with trehalose and sodium carboxymethyl cellulose. The patches containing 15 µg for every strain of the flu antigen were portrayed widely to affirm the solidness of the antigen following creation into microneedles. The nearness of excipients and low groupings of the antibody on the microneedle patches made it trying to describe utilizing the ordinary single spiral immunodiffusion examination. Novel systems, for example, catch compound connected immunosorbent test and protein processing took after by mass spectroscopy were utilized to describe the antigens on the microneedle patches.

'A microneedle fix created to convey the flu immunization which could streamline the inoculation procedure and guarantee that more individuals get inoculated against this perhaps lethal condition.'

Use of A Band-Aid Like Patch To Deliver The Vaccine

On its internal side, the fix has minuscule needles. At the point when the fix is pushed on the skin, the needles enter the skin and break down, discharging the immunization into the body. The fix does not require refrigeration and can be securely arranged after use since it doesn't hold any of the needles.

Trial of Vaccines

The antibody was gone for in a little clinical trial that included 100 grown-ups between the ages of 18 and 49 years, partitioned into four gatherings. While one gathering got the injectable type of the immunization, the other three got the microneedle patches. Among these, one gathering managed the fix individually, the second were controlled the fix by their medicinal services suppliers, while the third gathering got a fake treatment as fix connected by a social insurance supplier.

Highlights^[3]

- The flu antibody must be taken every year by people of all age gatherings
- The bothers related with taking the injectable immunization could be one reason for dismissing inoculation

- A microneedle fix that conveys the immunization could change the organization of the flu antibody, and also of different antibodies
- A Band-Aid like fix could soon trade an infusion for the organization of seasonal influenza immunization.

The in vivo contemplates in mice upon microneedle organization indicate immunogenicity against monovalent H1N1 at measurements 0.1 and 1 μ g and trivalent antibody at a dosage of 1 μ g. The underlying information from the mouse considers is promising and shows the potential utilization of microneedle innovation for the conveyance of flu immunization.^[1]

The primary patent on microneedles was recorded in 1976 – yet the innovation to make microneedles the trans follicular retention of melanin.

Microneedle Patch In Developing Countries^[2]

- A huge number of individuals bite the dust of irresistible maladies every year, for the most part in creating nations, which could to a great extent be averted by the utilization of immunizations.
- As a conceivable arrangement, microneedle patches containing a variety of micron-sized needles on a glue backing have been created to be utilized for immunization conveyance to the skin. The microneedle patches offer an intense new innovation that can empower more viable inoculation in creating nations.
- Micro needling is a moderately new insignificantly obtrusive methodology including shallow and controlled puncturing of the skin by moving with smaller than normal fine needles. Over a brief timeframe, it has increased mass ubiquity and acknowledgment as it is a straightforward, shabby, safe, and viable strategy requiring insignificant preparing.
- Traditionally utilized as a collagen acceptance treatment for facial scars and skin restoration, it is additionally broadly utilized now as a transdermal conveyance framework for helpful medications and immunizations. feature the continually advancing examination and advancements in small scale needling systems, instruments.^[2]

3. Types of Microneedles^{[5][6]}

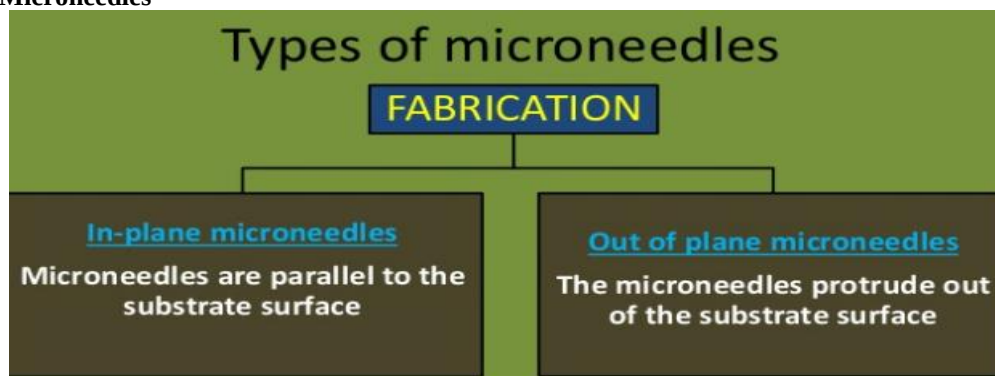


Fig. 2: Fabrication Based Microneedles.

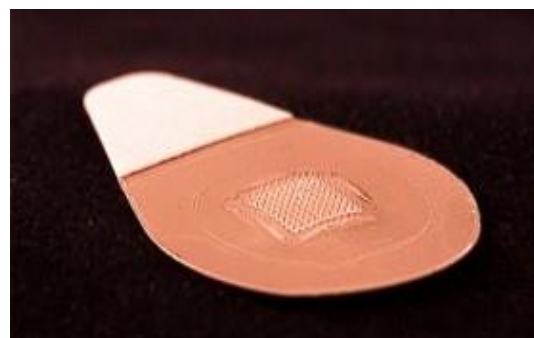


Fig. 1: Microneedle patch for vaccination.

2. Microneedle Patch Over Injections^{[4] [14]}

- ❖ The outcomes additionally demonstrated that counter acting agent reactions produced by the immunization, as estimated through examination of blood tests, were comparative in the gatherings inoculated utilizing patches and those getting intramuscular infusion, and these safe reactions were as yet display following a half year. More than 70 percent of fix beneficiaries announced they would lean toward fix immunization over infusion or intranasal inoculation for future vaccinations. No huge contrast was seen between the dosages of antibody conveyed by the social insurance laborers and the volunteers who self-controlled the patches, demonstrating that members could effectively self-direct the fix. After immunization, imaging of the utilized patches found that the microneedles had broken down in the skin, recommending that the utilized patches could be securely disposed of as non-sharps squander. The antibodies stayed strong in the patches without refrigeration for no less than one year.
- ❖ The assembling cost for the fix is relied upon to be focused with prefilled syringe costs. The fix, in any case, can drastically decrease the cost of inoculation, since self-organization can dispose of the need wellbeing specialists supervise the procedure. It can be effectively bundled for Transcutaneous inoculation (TCI) is an alluring immunization strategy contrasted and customary injectable antibodies since it is less demanding to control without torment

In-Plane or Out-of-Plane Microneedles

- **In-plane microneedles** are created with the pole being parallel to substrate surface. The benefit of this plan is that the length of the needle can be precisely controlled. An inconvenience is that it is hard to create two dimensional clusters.
- **Out-of-plane microneedles** then again, project from the substrate and are straight forward to create in exhibits. Rather, the length and high angle proportions wind up plainly noteworthy difficulties in the manufacture of these sorts of needles.

A. Hollow microneedles: Hollow microneedles (HM) can be created from an economically accessible 30 check hypodermic needles^[18] Pressure, and along these lines stream rate, can be changed in HM for a fast bolus infusion, a moderate mixture or a differed conveyance rate.^[17] HM can likewise be utilized to oversee a bigger dosage of medication arrangement^[19] fabricated long thin gaps with a high viewpoint proportion of 100 (distance across: 10 μm , profundity: 1 mm) in biodegradable polymer material utilizing an UV excimer laser.^[20]

Types of Hollow Microneedle: Empty microneedle cut skin finished by imbue needle exhausts

- a. Metal hollow microneedles
- b. Silicon hollow microneedles
- c. Glass hollow microneedles

B. Solid Microneedles

Strong MN convey drugs by means of aloof dissemination by making microchannels to build skin penetrability took after by the use of a medication stacked fix on the channels. From a security point of view, it is alluring for the microchannels to close not long after needle evacuation to forestall pervasion of undesired harmful substances or contamination by pathogenic microorganisms.^[21] Henry et al. utilized a profound receptive particle drawing procedure to manufacture silicon MN. A chromium concealing material was first stored onto silicon wafers and designed into specks which had a breadth around equivalent to the base of the coveted microneedles. The wafers were then stacked into a responsive particle etcher and subjected to plasma scratching. The locales ensured by the metal veil stayed to frame the microneedles.^[22]

These microneedles have the potential for lessened medication spillage bringing about change of medication conveyance proficiency and the likelihood of presenting various medications.

C. Other Types of Microneedles

Dissolving Microneedles

- Enthusiasm for dissolving microneedles is high a direct result of various focal points. These incorporate the one-advance application process which is advantageous for patients. Dissolving MN are created based on the "jab and discharge" standard. They are produced using polysaccharides

or different polymers. These MN discharge exemplified sedate into the skin following application and disintegration.

- A fascinating and valuable approach is the utilization of close infrared (NIR) light-responsive polymer-nanostructure composite microneedles utilized for on-request transdermal medication conveyance. Silica-covered lanthanum hexaboride (LaB6@SiO2) nanostructures were consolidated into polycaprolactone microneedles, filling in as a close infrared beam safeguard.
- At the point when the microneedles were illuminated with NIR light, light-to-warm transduction interceded by the LaB6@SiO2 nanostructures caused the microneedle to dissolve at 50 °C. The favorable position of this approach is that the arrival of dynamic pharmaceutical fixings can be activated remotely utilizing close infrared beams.

Dimensions of Microneedles

- The strong tip microneedles and empty microneedles have distinctive measurement. Strong microneedles are created in 750-1000 μm long, 15°-20° decreased tips edge and 190-300 μm bases territory. The veils of microneedles are intended to 400-600 μm triangles length, 70-100 μm channels distance across and 25-60EA/5 mm2 exhibits thickness.
- The empty microneedles exhibits are created with lumen distance across of 30 μm and tallness of 250 μm . The middle to focus the separation of the empty microneedles exhibit is 150 μm . The pivot of lumen is manufactured with the separation of 10 μm to the hub of outside section

4. Advantages^[6]

A portion of the significant favorable circumstances that the fix can offer are:

- ✓ Microneedle patches expanded purpose to immunize from 44% to half; 64% of members expecting immunization are liking to self inoculate.
- ✓ First-in people investigation of microneedle fix ease of use and acceptability; a snap based gadget giving power input to clients enhanced convenience.
- ✓ The fix goes to work consequently while the client carries on with a typical life, regardless of whether they travel a great deal, works distinctive movements, dozes late or is occupied night and day raising a family.
- ✓ The client never needs to recall when he took a pill, wafer, confection or mixture.
- ✓ The fixings are discharged into the skin over a coordinated discharge through retention.
- ✓ It offers custom definitions utilizing exclusive mixes and fixings

Economic and Manufacturing Advantages

The forthcoming immunization innovation could offer financial and assembling focal points.

- ✓ The fabricating cost for the fix is required to be aggressive with prefilled syringe costs. The fix,

notwithstanding, can significantly diminish the cost of immunization, since self-organization can take out the need wellbeing laborers direct the procedure.

- ✓ It can be effectively bundled for transportation, requires no refrigeration, and is steady. MN offers a moderately ease and negligibly obtrusive device for the treatment of numerous restorative and dermatologic conditions.^[3]

5. Disadvantages^[6]

This framework conveys a few weaknesses as well.

- ✓ The needle made of silicon and if the silicon left under the skin subsequent to evacuating the fix, it might make issues.
- ✓ The needles are little and considerably more slender than the width of hair so the microneedle tips can be severed and left under the skin. therefore, issues might be produced.
- ✓ Can cause Active acne, Herpes labials or some other nearby contamination, for example, warts
- ✓ Moderate to serious endless skin illness, for example, dermatitis and psoriasis and so forth.
- ✓ Blood dyscrasias, patients on anticoagulant treatment
- ✓ Extreme keloidal tendency, Patient on chemo/radiotherapy.
- ✓ self-organization isn't simple.
- ✓ Some members created neighborhood skin responses to the patches, described as swoon redness

6. Principle and Mechanism of Action^{[1][8]}

- These microinjuries prompt insignificant shallow draining and set up an injury recuperating course with arrival of different development factors, for example, platelet determined development factor (PGF), changing development factor alpha and beta (TGF- α and TGF- β), connective tissue actuating protein, connective tissue development factor, and fibroblast development factor (FGF).
- The needles likewise breakdown the old solidified scar strands and enable it to revascularize Neovascularization and neocollagenesis is started by

relocation and expansion of fibroblasts and setting down of intercellular network

- A fibronectin network frames following 5 days of damage that decides the affidavit of collagen bringing about skin fixing persevering for 5– 7 years as collagen III.
- The profundity of neocollagenesis has been observed to be 5– 600 μm with a 1.5 mm length needle. Histological examination of the skin treated with 4 microneedling sessions 1 month separated shows upto 400% expansion in collagen and elastin statement at a half year postoperatively, with a thickened stratum spinosum and typical rete edges at 1 year postoperatively
- Collagen fiber groups seem to have a typical grid design as opposed to parallel packages as in scar tissue
- Liebl et al. have proposed another theory to clarify how microneedling functions. Resting electrical layer capability of cells is around -70 mV , and when needles draw close to the film, the internal electrical potential builds rapidly to -100 mV .
- This trigger expanded cell movement and the arrival of different proteins, potassium, and development factors from the cells into the outside prompting the relocation of fibroblasts to the site of damage, and henceforth, collagen enlistment.
- Thus, the needles don't make an injury in a genuine sense, yet rather body cells are tricked into trusting that the damage has happened
- Microneedling improves the conveyance of different medications over the skin boundary as it sidesteps the stratum corneum and stores the medication specifically up to the vascularized dermis.
- It has additionally been appeared to cause huge augmenting of the follicular infundibulum by 47%, which may halfway clarify the expanded entrance of the pharmaceutical over the skin hindrance. Likewise, it expels the scales and sebum buildups in the area of the infundibulum

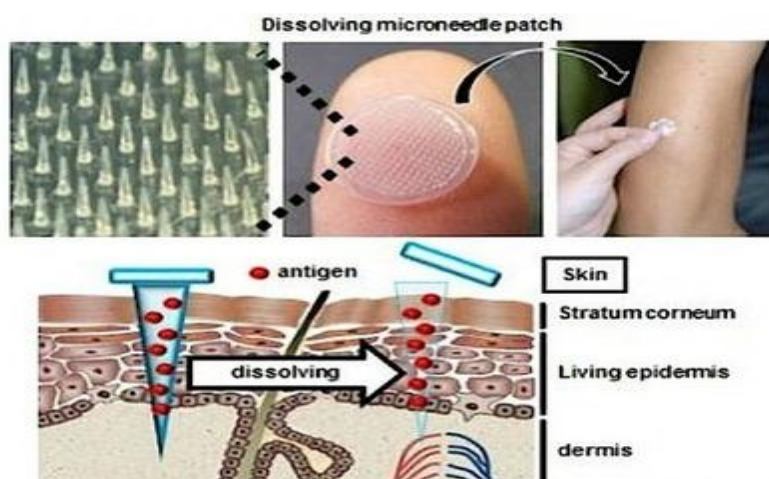


Fig. 3: Dissolving of Microneedle Patch.

7. Procedure^{[1][15]}

- ❖ Microneedling is a straightforward office-based strategy enduring 10 to 20 minutes contingent upon the territory to be dealt with.
- ❖ The patients must be guided preceding the methodology clarifying the normal results, postponed reaction, and requirement for different sittings
- ❖ The method is performed under topical anesthesia containing eutectic blend of lignocaine and prilocaine/tetracaine for 45 minutes to 60 minutes.
- ❖ After arrangement of the territory with sterile and saline, the skin is extended with one hand, and oppositely, rolling is completed 5 times each in the level, vertical, and slanted bearings with the other hand. The treatment endpoint is recognized as uniform stick point draining which is effectively controllable.
- ❖ Post-method, the zone is made wet with saline, or ice packs can be utilized for encouraging the patient. From that point, the patient is encouraged to utilize sunscreen consistently and take after sun-defensive measures.
- ❖ The system is all around endured by the patients and there are normally no post-treatment sequelae aside from slight erythema and edema going on for 2–3 days.
- ❖ There is no downtime and the patient can continue day by day work the exact following day.

- ❖ Treatments are performed at 3–8 week interims and various sittings are expected to accomplish the coveted impact on the skin.
- ❖ The last outcomes can't be seen instantly in light of the fact that new collagen keeps on being set down for roughly 3–6 months after treatment has stopped.

8. Formulations^[7]

- ✓ Phosphate cradle saline
- ✓ Brisbane (focus 360 microgms per ml)
- ✓ Vivaspin 500 or vivaspin 20
- ✓ KOH and HCL
- ✓ Excipients and surfactants
- ✓ Solution of polyvinyl chloride, sucrose and water

Vaccine stock arrangements were gotten in phosphate-cradled saline (PBS).

Monovalent load of B/Brisbane/60/2008 got at a grouping of 360 µg/mL was cushion traded utilizing Vivaspin 500, 100 kDa MWCO or Vivaspin 20, 10 kDa MWCO axis channels (Sartorius AG, Göttingen, Germany).

Vaccine was aggregated no less than 10-overlap utilizing the channels, at that point weakened with the coveted cushion. This procedure was rehashed a few times.

Finally, a similar support was utilized to change the antibody to the fitting focus for tests, which was 60 µg/mL, as dictated by ELISA.

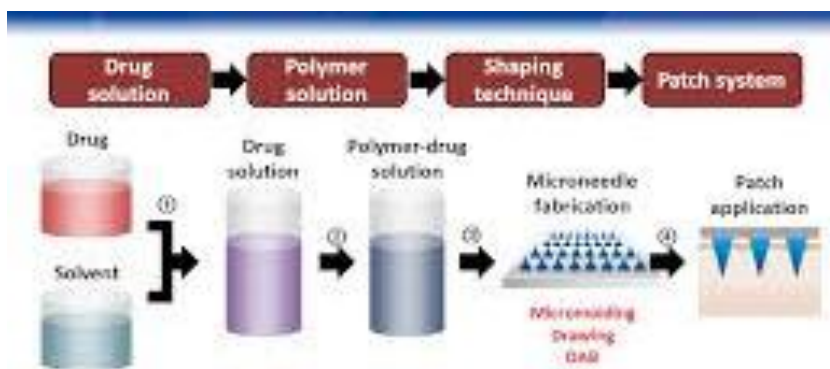


Fig. 4: Microneedle Developing Process.

Surfactants

- Surfactants are frequently incorporated into definitions used to coat microneedles. The impacts of incorporating surfactants in the immunization arrangement plan were in this manner inspected by picking agent surfactants from a few classifications, including cationic, anionic, zwitterionic and nonionic.
- The grouping of every surfactant was been half higher than its basic micelle fixation).
- First, the impact of getting ready fluid immunization arrangements containing surfactants was evaluated, which demonstrated that the expansion of surfactant to the fluid definitions lessened HA movement in all

cases by up to roughly half. Then, the impact of drying these plans was surveyed.

Vaccines and Reagents

- All investigations aside from those including trivalent patches were directed utilizing a monovalent load of B/Brisbane/60/2008 flu antigen. Trivalent patches included B/Brisbane/60/2008 and A/Brisbane/59/2007 (H1N1) and A/Victoria/210/2009 (H3N2) flu antigens.
- All excipients were gotten from Sigma–Aldrich aside from sodium heparin salt and ox-like serum egg whites (EMD).

9. Microneedle Patch Preparation^[7]

Dissolving microneedle patches were readied utilizing two separate arrangements.

Solution. 1. The antibody arrangement comprised of flu immunization, 1% (w/v) NaCMC, and 10% (w/v) of stabilizer in 150 mM ammonium acetic acid derivation cushion.

Solution. 2. The sponsorship arrangement comprised of polyvinyl liquor, sucrose, and water in a mass proportion of 8:6:15.

The creation technique comprised of the accompanying

- (1) 25 μ L of immunization arrangement was thrown onto a polydimethylsiloxane (PDMS) microneedle form, though vacuum was connected to help maneuver the antibody arrangement into the microneedle pits;
- (2) Abundance antibody arrangement was expelled from the shape with a level sharp edge;
- (3) The immunization arrangement was permitted to dry into the tips of the microneedle form depressions;
- (4) Roughly 200 μ L of support arrangement was thrown onto the microneedle shape under vacuum, in this way framing a total microneedle patch. Each fix was then put away in a desiccator at room temperature for 2 days before demolding with Scotch tape. Demolded patches were put away up to a half year at 25°C out of an ecological solidness chamber

10. Evaluation^{[7][8][10]}

Vaccine Stability Screening Experiments

- To increment the throughput of detailing screening, drops of immunization arrangement were dried on surfaces illustrative of covered metal microneedles or dissolving polymer microneedles. To mimic a metal microneedle drying surface, 6-mm-width round "chips" were cut from sheets of (Type 301 stainless steel).
- To reenact the drying surface of dissolving microneedle molds, a thin film of Sylgard 184 (Dow Corning, Midland, Michigan) was cured, from which 6-mm-breadth roundabout chips were evacuated with a sledge punch. Onto these surfaces were put roughly 2 μ L beads of defined antibody arrangement at a grouping of around 100 μ g/mL.

Enzyme-Linked Immunosorbent Assay

- Antibodies were conjugated to horseradish peroxidase with a Lightning Link conjugation kit. Unformulated antibody stock was serially weakened in PBS with 0.5% Tween-20 (PBST) and utilized as a source of perspective standard bend.
- After the recommended stockpiling time, chips and microneedle patches were put into PBS with the goal that the dried antibody and excipients were redissolved. This arrangement was run parallel to the reference standard bend on an Immulon 2HB 96-well microplate. The microplate was washed three times between each progression with PBST with 3% (w/v) cow-like serum egg whites.

- The HRP substrate response included Sure Blue Reserve TMB arrangement which was ceased with TMB Stop Solution (KPL). The microplate absorbance at 620 nm was perused utilizing an iMark plate per user
- The standard bend was fit to a four-parameter work utilizing the Microplate Manager 6 programming. HA action is introduced as the percent of HA movement staying for dried chip tests contrasted and fluid control arrangements and as the aggregate mass of dynamic HA staying in microneedle patches.

Drying Time/Temperature and Buffer Salts^[7]

- Amid microneedle fix producing, an immunization arrangement is normally dried on a microneedle surface or in a microneedle form.
- To survey immunization HA movement misfortune amid this drying procedure, we dried arrangements of B/Brisbane/60/2008 flu antibody on stainless steel chips to reproduce assembling of metal microneedles covered with antibody and on PDMS chips to recreate assembling of dissolving polymer microneedles in molds.
- The antibody was detailed with NaCMC (to build thickness), trehalose (to help balance out the immunization amid drying, as appeared in past examinations and one of four diverse cushion salts. Drying was performed at 4°C, 25°C, and 40°C for 60, 20, and 7 min, individually.
- Each chip was permitted to dry at the assigned temperature until the point when the example was "dry," as controlled by no further loss of mass on account of water vanishing, that is, equilibration with the encompassing air with mugginess of 15%–25%. Upon drying, each example was reconstituted and measured for restricting action by ELISA.

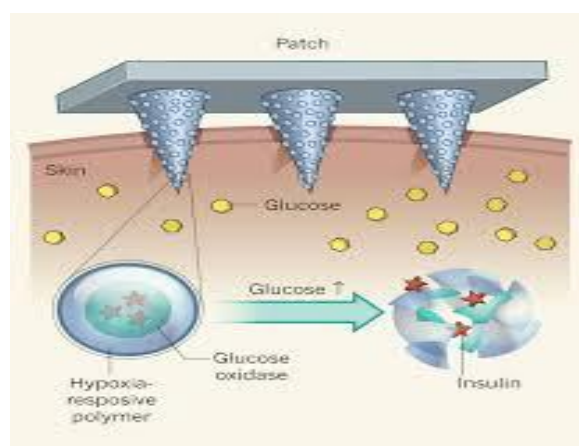


Fig. 5: Action of Patch Over Insulin.

Stabilizer Screening

- Planned antibody was dried on PDMS chips and put away for 24 h at room temperature with desiccant. IT HAS a wide scope of impacts, crossing from

relatively entire loss of movement to relatively total maintenance of action.

- To recognize details that settle HA amid drying, as well as amid consequent capacity, dried antibody tests were put away for 1 week at 40°C as a moment level of screening. Since there can be enhanced impacts when different stabilizers are utilized together, we chosen the best stabilizers from the underlying screen and evaluated their impact alone or in pairwise mix with each other.

Long-term stability of chips

- Utilizing the ideal immunization details distinguished in the 1-month screen, we did a 6-month screen utilizing those excipients in pairwise blend at plan proportions of 90:10, 50:50, and 10:90, and in addition mixes of three excipients and every one of the four excipients consolidated in break even with sums. All the definitions tried in this investigation were by and large stable for 3 months, yet at a half year, HA movement was lost in numerous details.
- At the half year time point, just definitions containing arginine and calcium heptagluconate among the twofold, triple, or fourfold excipient mixes, and in addition the trehalose/sucrose/arginine detailing, had no noteworthy misfortune in HA action in respect to day 0.

Packaging Humidity

To inspect the impact of dampness amid capacity, a few single-excipient details were dried on PDMS chips and put away 40°C for up to four months in aluminum pockets with either desiccant, to keep up a stickiness moving toward zero, or adapted silica gel pockets, to keep up a relative mugginess of 70%. dried up tests were by and large steady, though tests put away at hoisted mugginess quickly lost HA movement.

11. Delivery of Drugs^{[10][12]}

- The procedure of microneedling has been very much abused to build infiltration of medications over the skin obstruction.
- This has been demonstrated in-vitro skin models where upgraded assimilation of bigger particles, for example, calcein has been watched
- Microneedles cover a scope of movement between that of a transdermal fix and a hypodermic needle endeavoring to pick up the upsides of both and dispose of the hindrances of every single one of them.
- Micro needling has been utilized for the transdermal conveyance of different kinds of medications including macromolecular biopharmaceuticals, for example, insulin, development hormone, heparin, and egg whites; immunobiological, for example, hepatitis B, lockjaw toxoid, and flu antibodies; proteins, peptides and medications, for example, headache medicine, minoxidil, tretinoin, and L-ascorbic corrosive

- Microneedling has additionally been joined with other propelled strategies, for example, micropumps, sonophoresis, iontophoresis, and electroporation for better medication entrance regarding dermatology, microneedling is frequently joined with topical tretinoin and
- Vitamin C for the treatment of skin inflammation scarring and skin restoration, as depicted previously.
- Penetration improvement of minoxidil and platelet-rich plasma for androgenic alopecia is another application.
- Microneedling improves the impact of 5-aminolevulinic corrosive for more strong photodynamic treatment.
- They have been utilized as a part of mix for the treatment of actinic keratosis and photoaging
- This medication conveyance framework gives a few advantages over conventional techniques, including fundamental conveyance of the prescription to the patient. Specifically, microneedle patches and different items have extraordinary potential for immunization conveyance. This article will investigate the material parts that go into the make of microneedle-based conveyance frameworks, as they are essential for guaranteeing the most elevated quality and execution.

12. Marketed Product^[15]

Brand Names: U.S.

Afluria®; Active Ingredients: each 0.5ml dose of trivalent vaccine contains HA from three influenza strains:

- Influenza A/Brisbane /59/2007(H1N1)virus 15 µg
- Influenza A/Uruguay/716/2007(H3N2)virus 15 µg
- Influenza B/Brisbane/60/2008 virus 15 µg (total 45 µg HA antigen)

Fluarix®

- Influenza A virus A/Brisbane/59/2007(H1N1) hemagglutinin antigen(formaldehyde inactivated) 15 µg in 0.5 ml,
- Influenza A virus A/Uruguay/716/2007(H3N2) hemagglutinin antigen(formaldehyde inactivated) 15 µg in 0.5ml,
- influenza B virus B/Brisbane/60/2008 hemagglutinin antigen(formaldehyde inactivated) 15 µg in 0.5ml

Fluvirin®

- Influenza A virus A/California/7/2009x-181(H1N1) hemagglutinin antigen (propiolactone inactivated) 15 µg in 0.5ml,
- Influenza A virus A/ Victoria/210/2009x-187(H3n2)hemagglutinin antigen(propiolactone inactivated) 15 µg in 0.5ml

Dose: 45 µg influenza antigen(15 µg per strain)per 0.5ml. dose administered.

Pharmacologic Category: Vaccine, Inactivated (Viral)

- **Dosing: adult:** It is vital to take note of that flu seasons change in their planning and length from year to year. By and large, inoculation should start not long after the antibody ends up plainly accessible and preceding beginning of flu action in the group. Be that as it may, immunization should proceed all through the flu season as long as antibody is accessible.

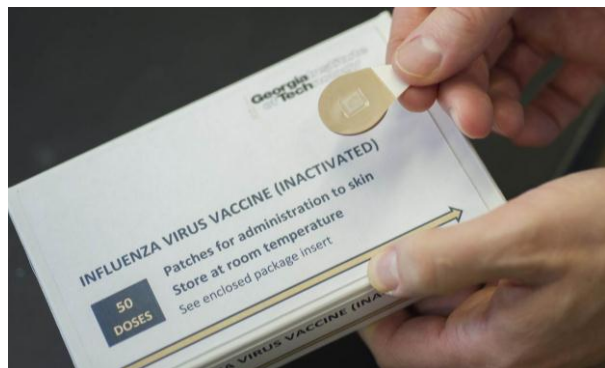


Fig. 6: Influenza Virus Vaccine Microneedle Patch (Marketed Product).

➤ **Dosing: Pediatric**

Note that flu seasons change in their planning and term from year to year. As a rule, immunization should start not long after the antibody winds up plainly accessible and preceding beginning of flu action in the group.

Immunization: I.M.:

Afluria®: Although affirmed for use in youngsters ≥ 5 years old, the ACIP does not suggest utilization of Afluria® in kids < 8 years because of an expanded rate of fever and febrile seizures noted amid the 2010-2011 flu season. In any case, if other age-proper immunizations are not accessible, youngsters 5-8 years old who are additionally considered in danger for flu intricacies might be given Afluria®. The advantages and dangers of this antibody ought to be examined with guardians or parental figures before organization.

Children 5-8 years: 0.5 mL/dose (1 or 2 doses per season;)

Children ≥ 9 years: Refer to adult dosing.

Fluarix®:

Children 3-8 years: 0.5 mL/dose (1 or 2 doses per season;)

Children ≥ 9 years: Refer to adult dosing.

Fluvirin®:

Children 4-8 years: 0.5 mL/dose (1 or 2 doses per season;)

Children ≥ 9 years: Refer to adult dosing.

Note: CDC recommendations: Children < 9 years who received no doses of flu vaccine during the 2010-2011 season, or were not previously vaccinated (ie, this is their first season of vaccination) or for whom vaccination status cannot be determined should receive 2 doses separated by ≥ 4 weeks, in order to achieve satisfactory antibody response. Children < 9 years that received at

least 1 dose of the 2010-2011 seasonal influenza vaccine require only 1 dose of the 2011-2012 seasonal influenza vaccine (CDC, 2011).

- **Dosing: Geriatric:** It is important to note that influenza seasons vary in their timing and duration from year to year. In general, vaccination should begin soon after the vaccine becomes available and prior to onset of influenza activity in the community. However, vaccination should continue throughout the influenza season as long as vaccine is available.

Immunization: I.M.: Adults ≥ 65 years: *Afluria®*, *Fluarix®*, *FluLaval®*, *Fluvirin®*, *Fluzone®*, *Fluzone® High-Dose*: 0.5 mL/dose (1 dose per season) The ACIP considers *Fluzone® High-Dose* an alternative vaccine for this age group

Dosage Forms: U.S.

Excipient information presented when available (limited, particularly for generics); consult specific product labeling.

Afluria®: Hemagglutinin 45 mcg/0.5 mL (5 mL) [contains chicken egg protein, neomycin (may have trace amounts), polymyxin B (may have trace amounts), thimerosal].

Fluarix®: Hemagglutinin 45 mcg/0.5 mL (0.5 mL) [contains chicken egg protein, gentamicin (may have trace amounts), hydrocortisone (may have trace amounts), may contain natural rubber/natural latex in prefilled syringe, polysorbate 80].

Fluvirin®: Hemagglutinin 45 mcg/0.5 mL (0.5 mL) [contains chicken egg protein, may contain natural rubber/natural latex in prefilled syringe, neomycin (may have trace amounts), polymyxin B (may have trace amounts)].

13. CONCLUSION^{[6][13]}

Following were a portion of the finishes of the examination:.

- ✓ Vaccination is an upsetting occasion for most youngsters, while the use of a Band-Aid is substantially more interesting. Fortunately endeavors are on to grow such an immunization conveyance framework for measles, rubella or German measles, and polio too.
- ✓ Current and future utilization of microneedle fixes as conveyance vehicle for medications and immunizations. Contrasted and conventional conveyance devices, microneedle patches have many points of interest, for example, giving torment free, non-obtrusive, advantageous course for reagent organization and conveyance, with no frosty chain required for capacity and transportation and also diminishing sharp medicinal waste, needle-caused damage and transmission of blood-borne irresistible sickness in country region.

- ✓ With the quick advancement of nanotechnology, microneedle patches have been enhanced by changing from undissolving to dissolving microneedles and their wellbeing has additionally enhanced significantly. As a medication conveyance device, microneedle patches can convey bioactive sub-atomic of various physical size. Also, microneedle patches can be covered or epitomize with DNA antibody, subunit antigen, inactivated or live infection immunization. Consolidating clinical outcomes with the consequences of patient meeting, microneedle patches are observed to be attainable and are predicated to soon be adequate for the therapeutic administration.
- ✓ Overall, MN offers a straightforward yet practical remedial methodology with negligible unfriendly occasions and a promising wellbeing profile.

14. ACKNOWLEDGEMENT

Most importantly I am thankful to the almighty, who is the creator and director of all that initial and final modes to destiny.

Finally, I consider this opportunity to express a deep sense of gratitude to my Parents who has always believed in my thoughts and supported me all through.

I take the opportunity to express my deep sense of gratitude and respect, **Assistant Prof. Sana Ahmed, M.Pharm** (Department of pharmaceuticals) Deccan School Of Pharmacy for her guidance support and immense encouragement given during the course of seminar work.

I am grateful to Prof. Dr.Syed Abdul Azeez, M.Pharm, PGDPMIR, PCCRM, PH.D honorable Principal of Deccan School Of Pharmacy, providing facilities to do this work and for his constant support and encouragement.

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