Beards and facial hair are part of male characters and fascination. Topical therapy for beard enhancement may be desired by some men to improve beard growth and density. A review of all reports on topical treatments for beard enhancement is presented here. Searching the United States National Library of Medicine PubMed, exploring all titles containing beard, facial hair or mustache as of July 22, 2020. A total of 445 articles resulted from the initial search. After reviewing the publications three studies match the aim of the review, two of which were double-blind clinical trials, and one was a case report. Topical 3 % minoxidil, as studied by Ingprasert et al., showed a significant increase in hair count, photographic scoring and patient self-assessment. Saeedi et al. studied the use of 2.5 % testosterone gel for men with thalassemia major and found an increase in terminal hair. Vestita et al. published a case report demonstrating unexpected improvement of beard density for a patient using tretinoin 0.05 % cream. Limited evidence on topical treatments for beard enhancement. Topical minoxidil is an off-label treatment to enhance the beard. Other topical options such as testosterone, tretinoin, or bimatoprost could constitute potential treatment options. Further studies needed to recommend the best topical options for men who desire to enhance their beards.

Key words: Beard, facial hair, Minoxidil, Testosterone, Tretinoin, Camouflage, Hair Transplant, Laser

The results were filtered to find any topical treatment used for enhancing the beard. A total of 445 articles resulted from the initial search after reviewing the publications for potential relation to beard enhancement. Three studies matched the review’s aim regarding topical therapy for beard enhancement in men. Ingprasert et al. investigated topical 3 % minoxidil for stimulating hair in the beard area. It was a double masked, placebo control, randomized trial. They demonstrated a significant increase in hair count, photographic scoring and patient self-assessment. Saeedi et al. conducted a randomized, double blinded, and controlled studying using 2.5 % testosterone gel treatment for facial hair in men with thalassemia major. They have found an increase in terminal hair in the treatment group. Vestita et al. published a case report demonstrating unexpected improvement of beard density for a patient using Tretinoin 0.05 % cream. Table 1 summarizes the studies of topical therapies used for beard enhancement.

**Topical Therapies**

Facial hair characterize males and underdeveloped facial hair can be stressful for some men. Topical minoxidil treatment is commonly used to treat hair loss, such as androgenetic alopecia. Off label use of topical...
Minoxidil for facial hair enhancement is reported\[8\]. Minoxidil is known to induce hair growth as a side effect, even in other body sites\[9,10\].

Ingprasert et al. published a study showing beard enhancement from topical Minoxidil (Table 1)\[5\]. The significant results are promising; however, no other clinical studies were reported. Ingprasert et al. reported the treatment result after 16 w of therapy. The beard’s enhancement might be temporary while using topical minoxidil. Longer follow up is needed for long term effects. Other concentrations might be worth investigating for future studies for efficacy and safety.

S. Lee et al. studied Minoxidil 2 % lotion’s ability to enhance the eyebrows compared to placebo. They demonstrated significant improvement in the treatment group, including hair count and diameter\[11\]. Another study examined topical Minoxidil 3 % and topical bimatoprost 0.03 % to enhance the eyebrows. The results showed that both treatments were effective with no significant difference; however, contact dermatitis happened more frequently in the minoxidil group. However, the Author concluded that minoxidil is used as the first option for eyebrow enhancement and bimatoprost is the second\[12\]. Both topical treatments might help increase hair density in the beard area.

Minoxidil can induce hair growth through various suggested mechanisms. For example, minoxidil may work by prolonging the anagen phase, showing antiapoptotic markers in the skin\[13\]. Furthermore, minoxidil can augment dermal papilla’s vascular supply by increasing vascular endothelial growth factor\[14\]. It may also act by stimulating adipocyte stem cells to produce growth factors\[15\]. These suggested mechanisms might contribute collectively to the enhancement of hair growth.

M. Saeedi et al. clinical trial showed that topical testosterone increased the beard area’s terminal hair in young men who suffer from beta thalassemia major. Hypogonadism and low levels of testosterone are known complications among this population. Therefore, topical testosterone, as suggested by the authors, helps transform the vellus hair into terminal hair\[6\]. The Beard area possesses androgens receptors that influence hair growth\[15\]. In vitro experiment, adding testosterone on beard dermal papilla cells culture caused increased mitotic activities due to androgen dependence\[16\]. Transgender males grow facial hair after receiving testosterone therapy, while anti androgens reduced the beard hair for transgender females\[17\]. These findings are essential to consider when starting topical testosterone.

The topical therapy is Tretinoin, which helped enhance one patient’s beard by Vestita et al. This was an incidental finding as the 30 y old man received tretinoin cream for acne treatment\[7\]. Bazzano et al. studied tretinoin therapy for androgenetic alopecia. They reported an increase in terminal hair after using topical Tretinoin in 7 out of 12 individuals\[18\]. Hair growth cycle in animal studies demonstrated that retinoids might increase the anagen phase and decreased the telogen phase\[19\]. However, retinoids such as isotretinoin might induce telogen effluvium\[20,21\].

**TABLE 1: SUMMARY OF STUDIES REVIEWED FOR TOPICAL TREATMENTS USED FOR BEARD ENHANCEMENT**

<table>
<thead>
<tr>
<th>Article</th>
<th>Study type</th>
<th>Treatment used</th>
<th>Results</th>
<th>Side effects</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ingprasert et al. 2016[5]</td>
<td>It is a Randomized double-masked placebo-controlled study for 16 w.</td>
<td>Minoxidil 3 % 0.5 ml applied twice daily for 16 w.</td>
<td>The treatment group's significant results were increased hair count, self-assessment, and the global photographic score; however, there were no significant hair diameter changes.</td>
<td>No significant side effects reported</td>
<td>46 males completed the study out of 48.</td>
</tr>
<tr>
<td>M. Saeedi et al. 2007[6]</td>
<td>It is a Randomized, double-blind controlled trial for 6 mo.</td>
<td>Testosterone 2.5 % Gel. Applied 2 cm of gel twice daily for 6 mo.</td>
<td>It showed a significant increase in terminal hair in the treatment group.</td>
<td>Skin irritation happened in one patient</td>
<td>Total of 32 males. The study aims to improve the facial hair in men with thalassemia major who frequently have hypogonadism.</td>
</tr>
<tr>
<td>Vestita et al. 2016[7]</td>
<td>Case report of acne treatment for 3 mo.</td>
<td>0.05 % tretinoin cream</td>
<td>New increase in density of the beard</td>
<td>Not mentioned</td>
<td>Two glycolic acid peel treatments were given during treatment.</td>
</tr>
</tbody>
</table>
Retinoid have a synergetic effect on minoxidil action on hair growth\cite{22,23}. This effect may be due to enhanced permeability of the skin, thereby improving drug absorption\cite{24}. Tretinoin also stimulates the sulfotransferase enzymes increasing the availability of minoxidil sulfate\cite{25}. This metabolite is more potent than the parent drug\cite{26}. Testing for sulfotransferase enzyme activity might predict minoxidil responders among androgenetic alopecia patients\cite{27}.

Topical treatment options can be combined together or used with other hair enhancement procedures like hair transplant; however, the therapies’ safety is essential. These treatments can come with side effects, such as erythema, irritation and contact dermatitis\cite{6,24}. Cardiovascular complications may happen after the use of topical minoxidil\cite{28}. Topical testosterone can be absorbed systemically and might even induce hirsutism in sexual partners\cite{6}.

**Camouflage techniques**

Men have used camouflage to cover up the gaps between hair follicles in the face (fig. 1A and 1B). Men are using different pigmented powders, sprays or lotions as concealers for skin between hairs for the scalp. Although used for androgenetic alopecia, it still a useful option for enhancing the beard\cite{29,30}. A drawback is that it is a temporary option and removed when exposed to shampoo\cite{29}. These quick methods can meet the need of men for special occasions.

**Hair Transplant**

Hair transplantation can restore or reshape the beard or mustaches. Follicular unit grafts collected from the scalp donor site similar to treatment of androgenetic alopecia. Hair transplantation can enhance facial hair efficiently and satisfy the patient’s needs. Patients with a patchy beard can have a full beard if hair grafts are enough\cite{31}. However, it is an invasive procedure and requires a skillful hair transplant surgeon. The challenge will be implanting the follicles in the right direction angle of the facial hair\cite{31,32}. Furthermore, the patient must be aware of the possibility of repeating the procedure to cover the large areas. Nonetheless, complications like infections, wrong angulation or formation of bumps may occur\cite{32-34}. Topical Minoxidil was reported as an adjunctive treatment to hair transplantation of the scalp\cite{35,36}. A suggestion could be using minoxidil with facial hair transplantation in future studies, however, existing data supporting minoxidil as a topical medication for beard enhancement\cite{5,8}. Platelet rich plasma injection has been used to enhance hair graft survival during hair transplantation\cite{37}. Furthermore, Platelet rich plasma injection showed some efficacy in promoting hair growth in androgenetic alopecia\cite{38}. Despite Platelet rich plasma’s benefit, the existing evidence is limited and further studies are needed for hair transplantation guidelines or hair-enhancing treatments\cite{39,40}. Compared to scalp hair, facial hair may differ in response to adjunct therapies like Minoxidil or Platelet rich plasma.

**Micropigmentation**

Micropigmentation is using a tattoo to cover the visible skin between the hairs of the scalp\cite{29}. Successful Micropigmentation results for androgenetic alopecia treatment reported by Park et al. Their study had 43 receiving this treatment and only one patient was not satisfied\cite{41}. Other publications showed Micropigmentation as a possible option for hiding the alopecia or scars\cite{42}. However, the tattoo has several
risks of allergy, infections or pigment change\cite{42,43}. Aggravation of skin diseases such as vitiligo can happen from the trauma induced by tattoo placement\cite{44,45}. Important aspect is that tattoo procedures are not controlled by health authorities directly. However, stats or governmental regulations are handling it. The latter is also related to non-health artists’ practice, affecting the procedure’s safety\cite{42}. Alopecia areata treated with tattoos for designing the eyebrows with good results; however, the designed eyebrow must be symmetrical and meet patient expectations\cite{46}.

**Micro Needling**

Kim *et al.* conducted a study on mice using microneedle application for stimulating hair growth. They have found that micro needling induced hair growth and upregulated the hair growth factors such as vascular endothelial growth factor, Beta Catanin\cite{47}. These growth factors play a role in hair growth\cite{47,48}. The injury induced by the micro needling initiate the wound healing pathway, favoring hair growth and anagen promotion\cite{49}. Clinical studies were done and showed that micro needling could cause hair growth\cite{50}. Starace *et al.* clinical study of micro needling for treating Androgenetic alopecia and telogen effluvium. All patients reported improvement of hair loss after receiving three sessions of micro needling. Side effects include erythema, minimal bleeding and pain, none of which lead to stopping the procedure\cite{50}. Micro needling also can have a synergistic impact on topical minoxidil in treating androgenetic alopecia\cite{51,52}. This procedure may help the poor responders to Finstride and topical minoxidil\cite{53}. The Beard enhancement requires similar studies to know the possible benefits of micro needling. Wound healing of the minimal injuries could be the reason for the hair growth in micro needling\cite{49}. One case report of a patient who had new hair in the beard near a wound scar. The authors suggested that the microenvironment of the healing wound may be the reason for the new hair\cite{54,55}. Further studies can clarify this theory.

**Laser Therapy**

Lasers can help for promoting hair growth in alopecia. Fractional \text{CO}_2 laser induce hair growth in Alopecia areata as monotherapy\cite{56}. The combination of fractional \text{CO}_2 laser and topical corticosteroids improved the hair growth in resistant cases of Alopecia Areata\cite{57}. Salah *et al.* used fractional \text{CO}_2 laser as monotherapy and in combination with topical Minoxidil for Androgenetic Alopecia with success\cite{58}. Cho, Sung Bin *et al.* have reported hair growth treating patients using fractional thulium laser 1927 nm. The topical growth factor solution gave better results post laser treatment\cite{59}. Ablative or non-ablative fractional lasers may help various alopecia. S. Cho *et al.* did a retrospective review of 17 patients with different alopecia. In their study, multiple causes include Alopecia Areata, scarring alopecias and autosomal recessive hypotrichosis. However, variable improvement was noticed; long standing Alopecia areata and surgical scar hair loss didn’t improve\cite{60}.

Low Level Laser Therapy (LLLT) is another treatment for androgenetic alopecia in literature\cite{61-63}. Various laser devices available for such treatment modality, including laser comb and laser helmet. Zarei, Mina *et al.* reviewed LLLT for hair growth in 2015. They found that most studies showed successful hair growth and improvement; however, Several studies did not significantly improve\cite{60}. The combination of topical Minoxidil and LLLT has better results for hair growth compared to topical minoxidil alone\cite{64}. The lasers may not be easily accessed for patient treatment. The cost effectiveness is significant when recommending such therapy.

Laser treatment for hair enhancement work through several mechanisms. Zhuo *et al.* studied fractional \text{CO}_2 laser in a murine model. They found wound healing after laser treatment resulted in hair growth. Growth factors such as Wnt Family Member (WNT) 10b, Vascular endothelial growth factor (VEGF) and Transforming growth factor beta 1 (TGF-β1) were observed after laser treatment\cite{65}. Bae *et al.* showed in their study similar observations\cite{66}. Kim *et al.* observed an increase in WNT10a after laser treatment using fractional erbium glass in humans. Their pilot study showed a rise in the anagen phase after receiving the laser therapy\cite{67}. LLLT therapy uses less energy for hair growth stimulation. Zhang *et al.* demonstrated that LLLT could stimulate the WNT-β catanin pathway. They concluded that LLLT leads to upregulation of WNT10b and Beta catanin, promoting Mice’s hair growth\cite{68}. LLLT received Food and Drug Administration (FDA) approval for safety and efficacy for treatment of Androgenetic alopecia\cite{63,69}.

Willey *et al.* reviewed 543 patients after laser hair removal of the face and neck areas. They found 57 cases of new hair growth. The authors suggest that a sub therapeutic energy for hair removal may stimulate the hair to grow\cite{70}. Future studies will provide evidence for the LLLT and Beard enhancement.
Conclusion
Studies on topical treatments for beard enhancement is limited in the literature. Minoxidil is an off label treatment option to enhance the beard. Other topical options such as testosterone, Tretinoin, bimatoprost may be a potential treatment. Camouflage can help in beard enhancement. Laser therapy and micro needling are utilized for Alopecia treatment; however, further studies will clarify facial hair enhancement benefits. Hair transplant can reshape and enhance beard density. Future studies are needed to recommend topical therapies for patients who desire to increase their beard density.

Conflict of interests:
The Author declared no conflict of interest.

REFERENCES


This article was originally published in a special issue, “Biomedical Research in Clinical and Preclinical Pharmaceutics” Indian J Pharm Sci 2020:82(3)Spl issue7;19-25