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One Month Trial of HOCl: An Observational Pilot Study

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One-Month Trial of HOCl: An Observational Pilot Study

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ABSTRACT

The search for a clearly superior aid to wound healing that meets the unique needs of the hair transplant surgeon has been fraught with frustration and littered with failed attempts.[1,2] Hydrogen peroxide, chlorhexidine, isopropyl alcohol, and betadine have been used for their antibacterial properties.[2,3] Copper peptide, silicone, hydrocolloid, and others have been used for their accelerative healing properties with mixed results. As of 2007 hypochlorous acid (HOCl), which has both antibacterial and wound healing properties, had never been used as a pharmaceutical drug, and as of 2021, it has not been described in the literature specific to hair transplant procedures. We investigated the use of medical grade HOCl as a routine component of both intra-operative hair transplant procedures (both linear excision and follicular unit excision) and as a post-operative wound healing aid.

Keyword: hypochlorous acid (HOCl)

INTRODUCTION

Hypochlorous acid (HOCl) is a molecule that is produced by our bodies as part of our immune response to pathogens.[4] HOCl is bactericidal, fungicidal, and viricidal, and it increases the oxygenation of tissues as part of the natural wound healing process. As a component of our immune response, HOCl possesses innate anti-inflammatory properties and is non-toxic, non-irritating and non-sensitizing.[5,6,8,9,12] Recent global desire for increasing its use in medical settings has come as a result of its effectiveness against biofilms, and—with the COVID-19 pandemic—its unique safety profile when compared to other common antimicrobials such as Dakin's® solution (NaOCl), chlorhexidine, isopropyl alcohol, hydrogen peroxide, or bleach.[2,3]

In the past, HOCl usefulness was limited by its instability, even though it is fairly simple to make.[11] If the solution is too acidic (pH < 3.5), chlorine gas and trichloride (Cl-3) will form. If it is too basic (pH > 5.0), sodium hypochlorite (NaOCl) will precipitate. For reference, concentrated OCl- (hypochlorite) with a pH > 9.5 is bleach. In order to maintain the desirable form and maximize effectiveness while decreasing toxicity, a stable form in the pH range of 3.5-5.0 had to be created.

In 2007, Wang et al. published a pharmaceutical formulation of HOCl that would have the potential to be commercially viable while maintaining the optimal pH range.[11] Unlike "homemade" HOCl, medical grade formulations would have to meet manufacturing standards for sterile production and long-term storage. In 2016, Bongiovanni investigated its use in preventing complications in the healing of soft tissues with a study of 1,249 venous leg ulcers (VLUs). Commercially available solutions started to become available shortly thereafter but without widespread use. According to Bongiovanni, "There are three factors that contribute to failure of wounds to heal in a timely manner: compromised perfusion resulting in diminished tissue oxygen levels; invading flora and host immunological impairment. We have found that the use of hypochlorous in our VLU care regimen successfully addresses the first two factors and can favorably influence the third.[9] "By 2019, a panel of key opinion leaders in dermatology and plastic surgery published a literature review touting HOCl as the "future gold standard for wound care and scar management in dermatologic and plastic surgery procedures" noting in particular the decreased incidence of both hypertrophic scarring and keloids with its use.[10,13]

OBJECTIVES

Since this molecule was novel to our practice, we chose to perform a pilot study to determine its efficacy and ease of use for both FUE and linear excision (FUT) hair transplant surgery. We purchased the stabilized, medical grade surgical HOCl spray, **SurgiHEAL PRO™**, which was recently introduced to the hair transplant surgical market to aid in the treatment and healing of intra- and post-operative wounds for both donor and recipient areas.

METHODS

In June 2021, we recruited 16 patients (6 FUE surgeries, 10 linear excision surgeries), documenting their progress with photos and recording/tabulating their unscripted impressions with the standard question, "What did you think of the spray?" at post-operative day 1 and post-operative day 10. We evaluated the efficacy in the donor area for both FUE and linear excision patients using a split-head treatment approach. Petroleum jelly was used post-operatively on the donor area left-hand side (Figure 1). All 16 patients were given the HOCl sprays to use on the right side of the donor area and the full recipient area post-operatively starting on day 1.

FIGURE 1. FUE *(left)* and linear excision *(right)* donor areas on the day of surgery showing split-head treatment with petroleum jelly applied on the left side and HOCl gel spray on the right side.

We used HOCl intra-operatively for both donor area harvesting (both linear excision and FUE) and during graft placement alongside saline. All staff including the surgeon and the physician assistant was free to use either saline spray or HOCl spray as they chose at all times. This included intra-operatively, during graft harvesting, site making, and graft placement. HOCl intra-operative spray was not used on any patient outside of the day of surgery.

Our endpoints included photographic evidence and the single question, open-ended patient survey (as above) with the chief metric being any change relative to our current standard treatment. Our current standard treatment includes petroleum jelly to the donor area (both FUE and linear FUT procedures), and saline or plain water sprays to the recipient areas with TID gentle washing using zinc pyrithione shampoo the first 72 hours.

For this pilot study, we provided each patient with one bottle of stabilized HOCl hydrogel spray to apply to the right side of the donor area (both linear excision and FUE surgeries) post-operatively. We also provided another bottle of stabilized HOCl liquid spray to patients for use in the recipient areas. Instructions for each area were to "spray liberally about every 1-3 hours while awake." Additional petroleum jelly was also provided to apply to the left side of the donor area as often as needed (suggested with every hair wash TID in the first 72 hours post-operatively).

A staff meeting was also held to solicit open-ended observations at the end of the pilot study.

RESULTS

No adverse events were reported at any time during the pilot study or to date.

Intra-Operative

Intra-operative observations included reduced bleeding in both the recipient and donor areas. The hemostasis was temporary, but sufficient lag was created that both linear wound closure and site-making were more efficient when the HOCl spray was used.

Post-Operative Day 1 (Donor and Recipient)

Post-operative donor area observations at day 1 showed mild improvement over baseline. Most notably, 10 (62.5%) patients reported that the sensation of stinging or burning was absent on the right side of the donor area (HOCl hydrogel spray site) during post-operative day 1 hair wash when the zinc shampoo lather was applied; however, stinging was reported on left side (petroleum jelly site). The remaining 6 (37.5%) patients did not note any discomfort during the post-operative day 1 hair wash.

No changes from baseline, and in particular no stinging sensation, were reported in the recipient areas (HOCl liquid spray site) during the post-operative day 1 hair wash.

Post-Operative Day 10 (Donor and Recipient)

Post-operative donor area observations at day 10 included slightly decreased crusting on the right side for our linear excision patients (at the suture removal) (Figures 2 and 3 [left/vaseline side and right/HOCL side]). FUE patient photos did not show a definitive difference in either crusting or erythema between the petroleum jelly treated side (left) or the HOCl treated side (right) (Figures 4, 5, and 6).

At the 10-day post-operative visit, 2 (12.5%) patients who were using the HOCl post-operative spray continued to have crusting in the recipient areas. Some patients continued to report slight pinkness to the recipient area as well, but this was not quantified.

SURVEY RESULTS

All patients responded positively to the standard question, "What did you think of the spray?" Patients found the sprays simple to use, and all patients ran out of product for both the donor and recipient areas within the first week post-operatively.

FIGURE 2. Linear excision donor area on post-operative day 10 showing both treatment areas: petroleum jelly *(left photo)* and HOCl gel spray *(right photo)*.

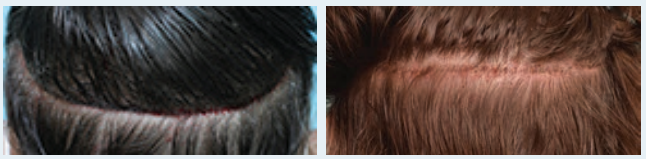


FIGURE 3. Linear excision donor area on post-operative day 10. The photo on the left shows the petroleum jelly treated side with slightly more crusting. The photo on the right shows the HOCl gel spray treated side with comparatively less crusting.

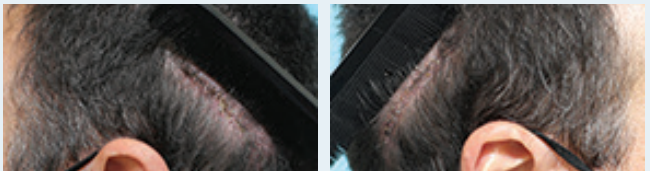


FIGURE 4. FUE donor area on post-operative day 1 *(left)* and post-operative day 10 *(right)* showing results of split-head treatment with petroleum jelly applied on left and HOCl gel spray on right.

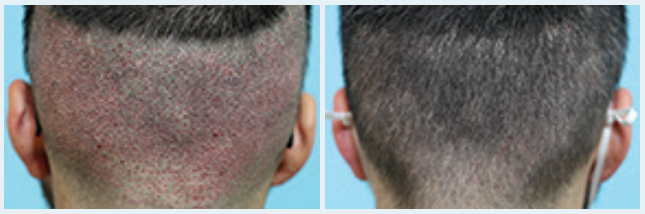


FIGURE 5. FUE donor area on post-operative day 1 *(left)* and post-operative day 10 *(right)* showing results of split-head treatment with petroleum jelly applied on left and HOCl gel spray on right

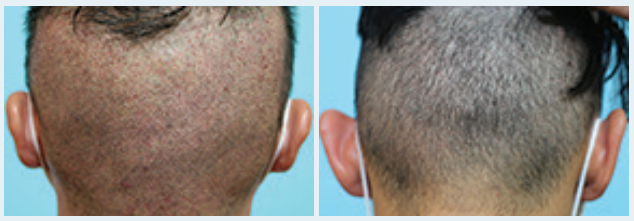


FIGURE 6. FUE donor area on post-operative day 1 *(left)* and post-operative day 10 *(right)* showing results of split-head treatment with petroleum jelly applied on left and HOCl gel spray on right.

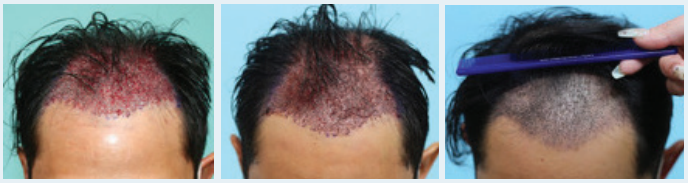
Three patients returned with requests to purchase more (one each on post-operative days 3, 4, and 5). One patient requested to use it on an ongoing basis with the claim that it helped to resolve his chronic seborrheic dermatitis.

At our staff meeting to evaluate the results of our pilot trial, all staff were unanimous in their opinion that the surgical field was significantly clearer during FUE graft harvest when using HOCl spray than with saline alone. Staff was also pleased with ability to break up clots the way H_2O_2 used without the cytotoxic risks to grafts that hydrogen peroxide had the potential to elicit (this office no longer uses dilute hydrogen peroxide as part of our intra-operative procedures, but experienced staff had experience with H_2O_2 in the past). The initial smell of the product surprised many; "It smells like a pool/laundry/clean house" was the prevailing staff opinion. Without objective evidence, several staff noted a slight hemostatic effect during the graft placement portion of each surgery (dull implanters into pre-made sites) that would need to be investigated further to quantify.

DISCUSSION

Our brief experience with HOCl spray showed noticeable improvement in intra-operative hemostasis and several post-operative patient outcomes (Figure 7). Based on these experiences and a review of the characteristics from the scientific data, stabilized HOCl can be considered an emerging treatment with potential applications in wound care, hair transplant surgeries, and various dermatological conditions involving hair.

FIGURE 7. FUE recipient area at day of surgery *(left)*, at post-operative day 1 *(middle)*, and at post-operative day 10 *(right)* showing typical results.



Despite our significant efforts to get patients to gently remove recipient area crusts with frequent washing and gentle rubbing, our practice has a baseline rate of residual crusting of between 50%-60%. Resistance to touching the grafted areas for fear of dislodging grafts seems to be the most potent patient concern. Post-operative sprays have helped in the past (copper peptide, plain saline, and even misting with water), but patients rarely used them consistently past post-operative day 3. As noted above, our 10-day post-operative visits with post-operative HOCl spray use demonstrated that 12.5% of patients continued to have crusting in the recipient areas. This was an improvement over our practice's baseline and likely results at least partially from these patients' comfort with and willingness to consistently use the HOCl product.

While it is too early to compare the quality of scarring in these pilot study patients to those who did not receive HOCl treatment for their procedure, previous evidence clearly indicates that the scarring may be improved through reduction of peri-operative inflammation.[4] Furthermore, the sooner inflammation is reduced post-operatively, the more likely optimized scars will result.[7] Therefore, it is conceivable that intra-operative use of stabilized hypochlorous solutions in hair transplant procedures will reduce the severity and potential of post-surgical scarring. We will continue to monitor these 16 patients to see what the full 12-month course of healing reveals.

Initial concerns of this author regarding the use of a "bleach-like" product on grafts prompted cytotoxicity concerns that this pilot study was unable to address. Two additional sources provided some helpful information on this topic. It has been found that there were zero issues with graft growth using HOCl solution intra- and post-operatively in over 400 surgeries with mean follow-up time 7 months, and graft survival has not been affected (personal communication with Dr. Daniel McGrath, August 13, 2021). Second, in an application for inclusion into the WHO Essential Medicines List, the World Health Organization reviewed the literature for safety, biocompatibility, wound healing enhancement, environmental disinfection, and antisepsis.[3] This review concluded that it was not only safe to use, but that it also enhanced wound healing and was non-toxic to tissues (including directly on mucous membranes and open wounds). Given that methicillin-resistant Staphylococcus aureus (MRSA) continues to be an ongoing risk for post-operative infection for hair transplant surgeons, the concept of using HOCl sprays to both prevent and treat has obvious and beneficial implications.[14,15]

Anecdotally, there is at least one surgeon who was brave enough to spray some HOCl spray in his eyes and in his mouth to test the assertions in the WHO report. He reported no irritation, stinging, or adverse events. (Personal communication, June 15, 2021.)

There are some obvious limitations of this pilot study. There was no control group outside of the left donor area (petroleum jelly treated). Results were observational, subjective, and performed at a single surgical location where bias could be introduced. It is also likely that insufficient product was provided to enable optimal results (staff consensus was that two 3oz bottles of each spray formulation would likely have been an adequate amount). It would also be valuable to assess whether post-operative folliculitis is reduced in patients using HOCl spray as compared with baseline incidence in our practice, but the follow-up time for this pilot study was too brief to provide meaningful data.

CONCLUSION

Stabilized HOCl holds significant promise in advancing the standard of care for the treatment and healing of intra-operative and post-operative wounds in hair restoration surgical procedures. Patient satisfaction was overall superior to traditional regimens. With the insights and knowledge gained from this initial pilot study, we plan to perform a multi-centered trial to further evaluate the initial observations using intra- and post-operative stabilized HOCl solutions on both the donor and recipient areas for all follicular unit transplantation surgeries regardless of donor harvest technique. ■

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