Randomized and controlled pilot study of the pragmatic use of mobile phone based follow up of actinic keratoses treated with topical 5-fluorouracil

Suzana S Bosanac MAS[1]; Victoria Nguyen[2], Donna Bui BS[1], Daniel B Eisen[3] MD, Raja K Sivamani[3,4] MD MS CAT

Affiliations: [1]School of Medicine, University of California, Davis, Sacramento, California, USA, [2]University of California, Davis, Sacramento, California, USA, [3]Department of Dermatology, University of California, Davis, Sacramento, California, USA, [4]Department of Biological Sciences, California State University, Sacramento, California, USA

Corresponding Author: Raja Sivamani MD, MS, CAT, Department of Dermatology, University of California, Davis, 3301 C Street, Suite 1400, Sacramento, CA 95816, Tel: 916-703-5145, Fax: 916-734-7183, Email: raja.sivamani.md@gmail.com

Abstract

Store-and-forward teledermatology involves transmission of a patient's images to a healthcare provider and subsequent response from the provider about the diagnosis or management. Furthermore, teledermatology in which mobile phones (e.g. smartphones) are utilized for communication between the patient and their provider is referred to as mobile-teledermatology. In this study, we investigate the use of mobile-teledermatology in the management of actinic keratoses. We demonstrate that mobile-teledermatology may enhance communication between the patient and their provider when managing cutaneous disease and that even individuals in older age groups are highly satisfied with this type of follow up.

Keywords: dermatology, telemedicine, teledermatology, mobile phone, actinic keratosis, skin cancer, prevention, fluorouracil

Introduction

Topical 5-fluorouracil (5-FU), [1] is typically used as field therapy for actinic keratosis [2], but patients report treatment fear and misunderstanding with using 5-FU [3]. Typical follow up has included telephone-based grading and in-person follow up [2]. However, mobile phone photography and communication offers simplified interaction [4, 5], but has not been explored in research contexts. The purpose of this study was to assess whether mobile teledermatology (TD) reduced the total number of 5-FU doses applied and the number of clinic contacts by patients on 5-FU field therapy.

Case Synopsis

Patients initiating topical 5-FU for actinic keratoses (AK) at the University of California Davis Dermatology Clinic were recruited between September 2016 and May 2017. This was a parallel group, two-arm, controlled pilot study with 1:1 allocation ratio using a priori binary randomization in

Table 1. *Subject baseline demographics and clinical characteristics. Comparison of subject characteristics in control and teledermatology group.*

	Control group	Teledermatology group	p-value
N	13	13	
Sex (M/W)	13/0	12/1	
Age range	58 to 84	54 to 83	
Age*	67.7 ± 6.9 (63.5-71.9)	67.3 ± 7.6 (62.7-71.9)	0.9
Baseline AK*	16.1 ± 9.2 (10.5-21.7)	18.5 ± 10.8 (12-25)	0.5
End AK*	1.7 ± 1.8 (0.6-2.8)	1.8 ± 3.4 (-0.2-3.9)	0.9
Treatment doses*	29.7 ± 14.9 (20.7-38.7)	25.6 ± 9.2 (20.1-31.1)	0.4
Clinic contacts*	1.2 ± 1.7 (0.2-2.3)	0.2 ± 0.4 (-0.1-0.4)	0.03**

sequentially numbered and sealed envelopes to assign subjects to control (telephone only) or TD group (telephone plus mobile phone photography). Actinic keratoses were counted at baseline and week 8. Both groups received phone calls at weeks 1, 2, 3, 4 (or until treatment discontinuation) to assess medication adherence.

Case Discussion

The control group followed standard-of-care instructions regarding treatment discontinuation. The TD group was given access to a secure HIPPA-compliant cloud-based communication platform (Klara Technologies Inc, New York, NY) to capture and upload photos weekly (using personal smartphones) and answer questions regarding redness, swelling, stinging/burning, pain, and presence of open sores. A board-certified dermatologist assessed photos and reviewed answers. Participant ranking of a "severe" side effect or presence of erosions on photographic examination was an indication to stop treatment. The dermatologists' feedback to continue or stop treatment were provided to TD participants. Outcome measures were assessed weekly and included the number of treatment doses, clinic contacts (phone call, electronic messages, and in-person follow up), and satisfaction with TD communication.

The sample size of 13 resulted in 80% power to detect a one-day difference in clinic contacts with an alpha set to 0.05. Statistical analyses were performed with PROC TTEST procedure in SAS v9.4 (SAS Institute Inc., Cary, NC, USA) and $p<0.05$ was considered statistically significant. Patient satisfaction survey responses were reported as percentages.

Of n=26 subjects recruited, n=13 were randomized to each group and included in analysis. Nearly all the subjects were men (96%) aged 54 to 84 years (**Table 1**). Although there were no significant differences in AK counts or 5-FU treatment doses, the control group had a significantly greater number of clinic contacts compared to the TD group (1.2±1.7 versus 0.2±0.4, p=0.03). All subjects were satisfied with mobile phone technology for AK follow up (**Table 2**).

Conclusion

This is a pilot study and future larger studies are needed to expand on findings here for more generalizable results. Nevertheless, our results suggest that mobile phone and cloud based secure

Table 2. *Patient Satisfaction Survey results. Results demonstrating responses for survey evaluating patient satisfaction with teledermatology (mobile phone photography) follow up.*

		Week 4 (N=10)	Week 8 (N=13)
I think that the dermatologist was able to get as good an idea about my skin problem by using mobile phone technology as he/she would have in person.	Agree	50%	92%
	Disagree	10%	0%
	Not sure	40%	8%
2. I would be happy to use this system again.	Agree	70%	92%
	Disagree	10%	0%
	Not sure	20%	8%
3. Please rate your satisfaction with this type of consultation.	Very satisfied	50%	69%
	Satisfied	30%	31%
	Somewhat satisfied	10%	0%
	Not satisfied	10%	0%
	No opinion	0%	0%
4. How satisfied were you with the use of this mobile phone based platform for communication?	Not satisfied	0%	0%
	Mildly satisfied	30%	8%
	Moderately satisfied	20%	31%
	Very satisfied	50%	61%
5. Would you have preferred an in-person visit or a mobile phone based visit for following your treatment?	In person follow up	40%	23%
	Mobile phone based follow up	30%	38%
	No preference	30%	38%

communication platforms enhance patient communication and reduce the number of clinic contacts. Furthermore, our older demographic population suggests that the benefits of mobile healthcare communication technology are not exclusive to younger age groups and that satisfaction with their use can be high.

References

1. Stockfleth E, Peris K, Guillen C, Cerio R, Basset-Seguin N, Foley P, Sanches J, Culshaw A, Erntoft S, Lebwohl M. A consensus approach to improving patient adherence and persistence with topical treatment for actinic keratosis. International Journal of Dermatology. 2015;54(5):509-15
2. Pomerantz H, Hogan D, Eilers D, Swetter SM, Chen SC, Jacob SE, Warshaw EM, Stricklin G, Dellavalle RP, Sidhu-Malik N, Konnikov N, Werth VP, Keri J, Lew R, Weinstock MA, Veterans Affairs Keratinocyte Carcinoma Chemoprevention Trial G. Long-term Efficacy of Topical Fluorouracil Cream, 5%, for Treating Actinic Keratosis: A Randomized Clinical Trial. JAMA dermatology. 2015;151(9):952-60. Epub 2015/05/08. [PMID: 25950503].
3. Esmann S, Jemec GB. Patients' perceptions of topical treatments of actinic keratosis. The Journal of dermatological treatment. 2014;25(5):375-9. Epub 2012/12/12. [PMID: 23215635].
4. Zuo KJ, Guo D, Rao J. Mobile teledermatology: a promising future in clinical practice. J Cutan Med Surg. 2013;17(6):387-91. [PMID: 24138974].
5. Foolad N, Ornelas JN, Clark AK, Ali I, Sharon VR, Al Mubarak L, Lopez A, Alikhan A, Al Dabagh B, Firooz A, Awasthi S, Liu Y, Li CS, Sivamani RK. International inter-rater agreement in scoring acne severity utilizing cloud-based image sharing of mobile phone photographs. Int J Dermatol. 2017;56(9):920-5. [PMID: 28436531].