Efficacy of the Smartphone App for sending Text Reminders to reduce 'No Shows' in Speech Therapy Sessions at a Tertiary Care Centre in India

Md Noorain Alam[1]*, Sanjay Munjal[1], Naresh Panda[1], Manisha Garg[1], Mannat Kaur Shipra[1]

Post Graduate Institute of Medical Education & Research (PGIMER), Chandigarh

ABSTRACT

Purpose: *There is a need for intensive therapy following cochlear implantation, but many clients fail to show up for their scheduled appointments at the therapy centres. This study aimed to establish the efficacy of a Smartphone app in reducing the 'no shows' among the population with cochlear implants (CI). A secondary aim was to find the level of satisfaction with automated reminder SMS messages among parents of children with CI.*

Method: *The study participants were 24 children with CI who were attending the Auditory Verbal Therapy sessions at a tertiary care centre. Half of them formed the study group and the other half the control group. Parents in the study group, with access to working mobile phones, received SMS text reminders about therapy and mapping sessions; parents in the control group did not receive any reminders. Data was analysed after 3 months, using a z-test for proportions to find the difference in the mean percentage of 'shows' in the study and control groups. A questionnaire was administered to the parents in order to evaluate their satisfaction with the SMS reminders.*

Results: *The number of 'shows' in the study group was 209 out of the scheduled 233 appointments, while the number of 'shows' in the control group was 173 out of the scheduled 232 appointments. The reminder system was effective for parents of children with cochlear implants to maintain appointment schedules with greater regularity as compared to the parents who did not receive the reminders.*

Conclusion: *SMS text reminders via a Smartphone app are a low-cost and effective method of reducing the 'no shows' in the Auditory Verbal Therapy and*

* **Corresponding Author:** Md. Noorain Alam, Lecturer, ENT Department, Post Graduate Institute of Medical Education & Research, Chandigarh, Email: noorain.aslp@gmail.com

mapping sessions for children with cochlear implants. Parents of the children in the study expressed a high level of satisfaction with the SMS text reminders. Future studies with a larger number of subjects could consider controlling the variables like income, education level, distance from the therapy centres and motivation of the parents.

Key words: *cochlear implants, auditory verbal therapy, Smartphone app, 'no shows'*

INTRODUCTION

When a client does not attend his/her scheduled appointments, it is called a 'no show'. The consequences of non-attendance include increased appointment waiting times (Gucciardi, 2008), increased costs of care delivery (Murdock, Rodgers, Lindsay & Tham, 2002; Weinger, Lin, McMurrich & Rodriguez, 2005), under-utilisation of equipment and personnel (Murdock et al., 2002) reduced appointment availability (Martin, Perfect & Mantle, 2005; Weinger et al., 2005), reduced client satisfaction (Taylor, Ellis, & Gallagher,2002; Lloyd, Dillon & Hariharan, 2003), and negative relationships between clients and staff (Martin et al., 2005; Gucciardi, 2008). Although data on non-attendance varies, studies from around the world consistently report non-attendance rates between 15% and 30% in outpatient health clinics (Ulmer & Troxler, 2006; Taylor, Bottrell, Lawler & Benjamin, 2012).

Multiple studies that have investigated the reasons for non-attendance reported forgetfulness, competing work or family-related commitments, poor health, poor client-provider relationships, adverse clinical experiences, practice error, and client confusion over dates and times, as the most frequent causes of non-attendance (Martin et al., 2005; Neal, Hussain-Gambles, Allgar, Lawlor & Dempsey, 2005; Crosby et al., 2009). Some of these causes could potentially be averted - particularly practice error and client confusion over dates and times if a reminder service were implemented.

For children with severe to profound sensorineural hearing loss who will not benefit from hearing aids, cochlear implant surgery is a viable treatment option. Cochlear implant (CI) is a surgically implanted device that bypasses the outer and middle ear and directly stimulates the auditory neurons for the perception of sound. It has external (speech processor, transmitting coil, and cables) and internal (electrode array and receiving coil) components. After the CI surgery,

the external component (speech processor) is activated at an interval ranging between 3 - 5 weeks. This activation process is known as 'switch on'. The processor further needs to be programmed through a procedure called 'mapping'. During the mapping session, the stimulation levels of the CI's internal electrode array are adjusted so that the user can hear a wide range of sounds. Mapping needs to be done at regular intervals to enable the recipient to hear soft sounds as well as loud sounds at a comfortable level. For mapping sessions post 'switch on', the recipient is required to visit the clinician twice in the first month, then once a month for three months. Thereafter the visits should be once every three months, on two occasions, followed by visits after six months. However, the mapping schedule may vary depending upon the consistency of behavioural responses during mapping sessions. Recipients with consistent and reliable responses to the sound stimuli presented through CI have less frequent schedules for mapping sessions, whereas those with inconsistent responses during the sessions need to visit more frequently.

After 'switch on', the CI recipient undergoes regular speech and language therapy sessions known as Auditory Verbal Therapy (AVT). The intensity of rehabilitation and training in the auditory/oral method of communication are two critical variables associated with the successful use of CI (Buckler & Siebert, 1996). The frequency of therapy centre visits varies for each client, depending on the mapping schedule and frequency of speech therapy sessions. For an optimum outcome, at least two visits per week for AVT sessions (lasting 1 hour each) are desirable.

Benefits of Cochlear implants include improvement in auditory development, language growth, and improved speech intelligibility (Robbins, Koch, Osberger, Zimmerman-Phillips & Kishon-Rabin, 2004; Flipsen & Colvard, 2006; Kubo, Iwaki & Sasaki, 2008).).Apart from other factors such as the age at implantation, types of device used, communication mode, amount of time the device is worn, and chronological age (Geers & Moog, 1994), language acquisition of children with CI is also influenced by the nature and intensity of habilitation (Gates et al., 1995). A large number of children with hearing impairment from poor families receive a CI under the Assistance to Disabled Persons for Purchase/Fitting of Aids and Appliances (ADIP) scheme of the Ministry of Social Justice and Empowerment, Government of India. This scheme provides financial assistance for implants and surgery, as well as mapping and speech therapy post implant. Under this scheme, a therapy centre needs to provide mapping sessions in a fixed protocol, and speech therapy sessions thrice a week for two years after surgery.

As the 'no shows' cause the child to miss out on appropriate interventions and are a waste of time for therapists, it is imperative to employ an appointment reminder system. There are several client reminder systems including text messages on the mobile phone, postal communication, telephone call reminders, and email. However, postal communication is not feasible for the population with CI due to the frequency of visits required of them. Telephone call reminders are a good option; however, it may not be that easy to use in case of the clinician's busy schedule, lack of human resources to make phone calls to the clients, the inability of parents to accept a call at a particular time, etc. Email notifications do not seem to be an efficient way to remind parents about appointments as some of them may not make use of email services, may not check their email frequently, or may have internet connectivity issues.

The majority of the population worldwide has access to mobile phones. In January 2021, the total number of unique mobile users was estimated to be 5.22 billion, which is 66.6 % of the world population (Kemp, 2021). In India, mobile telephone penetration has been estimated to be the second-highest in the world, with 110.18 mobile connections per 100 citizens. By January 2021, about 85.53% of Indians had access to mobile phones (TRAI, 2021). One of the modes of communication through mobile phones is SMS text messaging. SMS text messages are a very helpful appointment reminder system. The efficacy of SMS text messaging in reducing 'no shows' is comparable to personal telephone calls (Car, Gurol-Urganci, de Jongh, Vodopivec-Jamsek & Atun, 2012). It is moreover a cheap method of sending information, is non-intrusive and more convenient than a traditional phone call. Nowadays, most mobile network companies provide free SMS services to their clients as part of their mobile plans, so text messages are virtually free in India. However, sending each client separate reminders can take up a lot of time for the clinician and can be very cumbersome to send several SMS messages manually. There are however a few android and iOS mobile apps available, which may be used to send SMS messages automatically.

Objective

As there is a need for intensive therapy following cochlear implantation, it seems a good idea to use an appointment reminder system to decrease the number of 'no shows'. Smartphone apps may be used to send SMS text reminders. This study aimed to find the efficacy of a Smartphone app that sends automated reminder SMS messages in reducing the 'no shows' among the population with cochlear

implants. It compared the attendance of the population with cochlear implants in a group that received text appointment reminders via a Smartphone app and in a group that did not receive any reminders.

A secondary aim was to find the level of satisfaction among parents of children with CI, with SMS text reminders for their appointments with the therapy centres.

METHOD

Study Participants

A total of 24 children with CI were enrolled in this study. The children were attending the AVT sessions at the Speech and Hearing Unit, ENT department of Post Graduate Institute of Medical Education and Research Chandigarh, a premier tertiary care centre in India. Two groups (study group and control group) were formed, with each group comprising 12 recipients of cochlear implants.

Inclusion criteria:

- Children with CI who were in the upper age range of 10 years and with no associated conditions like intellectual disability or cerebral palsy.
- Parents with access to a working mobile phone, who had at least five years of education and could read and understand simple Hindi sentences, and who consented to participate in this study.

Data Collection

In the study group, the phone number of each parent was entered in the SMS reminder message sending app and was synced with the Google calendar. A reminder SMS message was framed in Hindi, informing parents about their child's upcoming appointment, and prompting them to inform the clinician in case they were unable to visit on the scheduled day. The recurrent reminder schedule was set so that each parent received the reminder for therapy and mapping sessions 48 hours and again 24 hours before the scheduled session. The control group did not receive any reminders. Participants who rescheduled appointments ahead of time or arrived too late to be seen were coded as absent. Sessions that were cancelled by therapists were excluded from the analyses. At the end of three months, the data was analysed and 'no shows' were compared between the two groups.

Analysis

To find out the difference in the mean percentage of 'shows' in the study and control groups a *z-test* for *proportions was used.* The normality of data was tested using the *Kolmogorov-Smirnov normality* test. As the data was found to be normally distributed (p>.05), a 2-samples t-test was administered to find the mean difference in percentage of 'shows' between study and control groups, based on gender, age, implant age, and implant usage duration.

The parents who received the SMS reminders were asked to answer seven questions to evaluate the efficacy of the appointment reminder system from their perspective.

RESULTS

The attendance of both groups was analysed against the number of scheduled appointments. Characteristics of the study group and control group are shown in Table 1.1 and Table 1.2. The study group comprised 6 male and 6 female recipients, with a mean age of 6.01(±2) years, mean age at implant surgery of 4.51(±1.39) years and mean implant usage duration of 1.5(±.73) years. The control group comprised 4 male and 8 female recipients, with a mean age of 5.63(±1.53) years, mean age at implant surgery of 4.45(±1.52) years, and mean implant usage duration of 1.18(±.7) years.

The number of 'shows' and 'no shows' against the scheduled appointments of the study group and the control group are shown in Table 2. The number of 'shows' was 209 out of the scheduled 233 appointments in the study group, while the number of 'shows' in the control group was 173 out of the scheduled 232 appointments. The mean percentage of 'shows' was 90.47% (15.94) for the study group and 73.30% (13.38) for the control group.

Table 1.1: Characteristics of the Study Group

S. N	Gender	Age	Age at implant	Duration of CI usage
1	F	7.6	5.5	2.1
2	F	7	5	2
3	M	7.83	5.83	2
4	F	6.5	4.42	2.1

Table 1.2: Characteristics of the Control Group

S. N	Gender	Age	Age at implant	Duration of CI usage
1	F	6.41	5	1.41
2	M	7	5.67	1.33
3	F	6	5.25	0.75
4	F	3.25	2.91	0.34

5	F	7.1	5.58	1.5
6	M	6.1	4.58	1.5
7	F	7	5.75	1.3
8	M	4	3.08	0.9
9	F	9	6.2	2.8
10	M	3	2.5	0.5
11	M	3	2.1	0.9
12	M	4	3.6	0.4
Mean (SD)		6.01 (2)	4.51 (1.39)	1.5 (.73)

5	F	5	2.25	2.75
6	F	5.92	3.9	2.02
7	M	8	7.3	0.7
8	F	3.5	2.84	0.66
9	M	5.5	3.92	1.58
10	M	3.75	3.16	0.59
11	F	5.83	5.16	0.67
12	F	7.4	6	1.4
Mean (SD)		5.63 (1.53)	4.45 (1.52)	1.18 (.7)

Table 2: Number of 'Shows' and 'No Shows' against the Scheduled Appointments of the Study Group and the Control Group

S. N.	Study Group				Control Group			
	Scheduled Appointments	Shows	No shows	Shows (%)	Scheduled Appointments	Shows	No shows	Shows (%)
1	18	18	0	100	18	12	6	66.67
2	15	12	3	80	21	13	8	61.9
3	24	21	3	87.5	15	9	6	60
4	21	21	0	100	20	20	0	100
5	21	21	0	100	12	9	3	75
6	31	30	1	96.7	22	16	6	72.72
7	21	21	0	100	18	12	6	66.67
8	12	12	0	100	20	14	6	70
9	28	20	8	71.42	16	10	6	62.5
10	15	15	0	100	22	22	0	100
11	18	9	9	50	22	18	4	75
12	9	9	0	100	26	18	8	69.23
	Total -233	Total -209	24	Mean- 90.47 (15.94)	Total -232	Total -173	Total - 59	Mean- 73.30 (13.38)

The comparison of the percentage of 'shows' in both the groups on the *z-test* for *proportions* as shown in Table 3 was statistically significant ($p<.05$). The percentage of 'shows' in the study group was significantly higher than that of the control group.

Table 3: Comparison of the Percentage of 'Shows' between the Study Group and the Control Group on the *z-* score *Test* for *Proportions*

S. N.	Group	Mean % of 'shows' (SD)	z-value	p-value
1	Study group	90.47(15.94)	4.34	**.001***
2	Control group	73.30(13.38)		

*** - Significant difference**

As shown in Table 4, a 2-samples t-test was administered to find out the mean difference in the percentage of 'shows' between the study and the control groups, based on gender, age, implant age, and implant usage duration of the CI recipient children. When compared with the control group, the mean percentage of 'shows' was significantly higher ($p<.05$) in the study group for female recipients, recipients who were more than 5 years of age, recipients who were implanted after 5 years of age, and recipients who were using the implant for more than 1 year.

Table 4: Comparison of the Percentage of 'Shows' between the Study Group and the Control Group based on Gender, Age, Implant Age, and Implant Usage Duration, using

2-samples t-test

Characteristics of Participants		Mean (SD) percentage of 'shows' in the Study Group	Mean (SD) percentage of 'shows' in the Control Group	t-value	p-value
Gender	Male	89.03(19.72)	72.77(18.28)	1.31	.22
	Female	91.90(12.83)	73.57(11.75)	2.78	**.02***
Age	<5 years	87.5(25)	86.25(16)	0.08	.93
	>5 years	91.95(11.12)	66.83(5.30)	5.76	**.00005****
Implant Age	<5 years	89.53(18.9)	78.13(15.48)	1.23	.24
	>5 years	91.78(12.6)	66.56(5.98)	4.04	**.004***
Implant Usage	<1 year	87.5(25)	78.61(17.27)	0.67	.52
	>1 year	91.96(11.12)	68(5.33)	4.84	**.0004****

***- Significant; **- Highly significant**

Parental Perception of Text Reminder System

At the end of the study a questionnaire was administered to the parents of children with CI, in order to evaluate their satisfaction with the SMS reminders. It had seven questions devised to know: whether they received the SMS message

reminders before every appointment; whether they found it helpful to get such an SMS text message and to indicate the level of helpfulness on a 10-point scale; whether they needed any additional form of reminder system; and, whether they informed the clinician in case they had to cancel an appointment. They were asked to compare the SMS service with other possible reminder systems. They were also asked to suggest improvements and to explain any difficulties faced with the SMS reminder system. The questions and the responses of parents of the subject group are given below.

Q1: Did you receive the SMS before every appointment?

All the parents reported that they received text messages before the scheduled appointments.

Q2: Do you think that getting text messages are beneficial to improve attendance? Rate your satisfaction on a 10-point scale

All the parents reported that it was beneficial to receive the text messages before the scheduled appointments. On a scale from 1 - 10, eight parents (66.7%) reported the highest level of satisfaction (10 points) with text messages service, while 3 parents (25%) gave it 9 points and 1 parent (8.3%) gave it 8 points. Overall, parents reported a very high level of satisfaction with the SMS text reminders.

Q3: What other services are required to improve attendance, like phone calls, emails and postcards?

Ten parents (83%) reported only 'phone call' as an additional method, while only 2parents (17%) reported both phone calls and emails to be used as additional methods to improve attendance.

Q4: How do you compare SMS texting with phone calls, emails, and postcards?

All the parents (100%) reported SMS texting as the best method for receiving reminders.

Q5. Did you inform the clinician about the cancellation of the appointment after receiving the SMS messages?

All the parents (100%) replied in the affirmative that they reported to the clinician about the cancellation once they received the SMS and could not attend the session.

Q6. How can we improve this service?

Nine parents (75%) reported that there was no need to use any other reminder method, while 3(25%) reported that telephone calls along with text messages may improve the text system.

Q7. What difficulties did you face with this service? (Did not see the SMS messages, message not received, got disturbed by the SMS messages)

None of the parents reported any difficulties with the text reminder system.

DISCUSSION

The present study was conducted to find the efficacy of the SMS reminder system in reducing the 'no shows' in the CI population attending therapy at a tertiary care centre. Two groups, comprising 12 CI recipients in each group, were enrolled in the study. The study group was enrolled for receiving the reminder SMS texts on their phones from the clinician's mobile Smartphone app. The parents received the reminders twice, i.e., 48 hours and 24 hours before the scheduled appointment for the AVT/mapping sessions. The control group did not receive any reminders. At the end of three months of therapy sessions, the number of 'shows' and 'no shows' were calculated for both the groups and compared. The study group had a significantly higher percentage of 'shows' than the control group. The reminder system targets the parents and the actual participants, i.e., children with cochlear implants who are dependent upon their parents for keeping the appointments. Hence the reminder system was effective for parents of children with cochlear implants to maintain appointment schedules with greater regularity as compared to the parents who did not receive the reminders.

In a review of seven studies with 5841 participants, it was found that mobile text message reminders improved the rate of attendance at healthcare appointments (Akhu-Zaheya & Wa'ed, 2017). In another study, the automated text message appointment reminders resulted in improved attendance at scheduled post-Emergency department discharge outpatient follow-up visits (Arora, Burner, Terp, Nok Lam, Nercisian, Bhatt & Menchine, 2015). In a study on the papillomavirus vaccination programme for low-income postpartum women, it was found that missed appointments for injections were less likely among those who received text message reminders (Berenson, Rahman, Hirth, Rupp & Sarpong, 2016).

However, there were many authors who could not find any significant difference in the number of 'shows' after using the reminder system. In a study on a dental outpatients' clinic, it was found that even with an increased number of SMS texts, higher attendance could not be ensured (Bellucci, Dharmasena, Nguyen & Calache, 2017). In a study directed at people in need of orthodontic treatment, reminder systems like telephone, mail, and SMS could not reduce the number of failed appointments (Bos, Hoogstraten & Prahl-Andersen, 2005). In a study with clients at higher risk of Sexually Transmitted Infections and HIV, the testing efficacy of SMS text reminders was evaluated for re-attending the clinic and was found to be not significantly different from not giving a reminder (Burton, Brook, McSorley & Murphy, 2014).

A few studies could not establish any significant relationship between the 'no shows' and the reminder system, although the reminders still had additional benefits including increasing medical knowledge (Richman, Maddy, Torres & Goldberg, 2016), increasing self-efficacy in disease self-management (Gatwood et al, 2016), and increasing the rate of taking medication on consecutive days (Stoner, Arenella & Hendershot, 2015).

The current study also tried to analyse the effect of age, gender, age at the surgery, and usage duration in children of both groups. Mothers, parents of children more than five years of age, and age at surgery, as well as those with more than one year of implant usage in the study group showed a significantly higher percentage of 'shows' when compared with the control group ($p<.05$). Parents of girls in the study and control groups seemed to be less motivated to attend AVT sessions, probably due to the prevailing social milieu in which girls get less preference than boys. Similarly, in both the study and control groups, parents of CI recipients who were more than five years of age seemed to be less motivated to attend AVT sessions. This could be due to the ceiling effect on language development in their wards and the parents 'confidence that they could carry out therapy activities at home. The text reminders might have encouraged these less motivated parents in the study group to attend therapy sessions; their attendance increased significantly in comparison to the less motivated parents of the control group who did not receive any reminder. Given the small number of parents participating in this study, one needs to be careful in associating the above variables with adherence to appointments.

This study of the reminder system in the AVT group is the first of its kind. Considering the important requirement of intensive speech therapy for children

with cochlear implants, this study may be useful for many clinics to decrease the number of 'no shows'.

The questionnaire used in this study to measure the parents' perception of, and satisfaction with, the reminder system revealed that most parents are satisfied with this text reminder system and do not want any other reminder system. In another study, client satisfaction with text messaging ranged from 77% to 96% (Fischer et al, 2017). In a different study, subjects showed a clear preference for mailed reminders over telephone calls or SMS messages (Bos et al, 2005).

Limitations

There are a few limitations to the study. The number of 'no shows' in therapy sessions may be affected not only by parents forgetting the scheduled appointments but also by the level of motivation and awareness of the parents, the economic condition of the family, distance from the therapy centre, and the general health status of the child. These variables were not controlled in the study. It is a preliminary study and needs longitudinal data with a higher number of subjects to generalise the findings.

CONCLUSION

SMS text reminders via a Smartphone app is effective in facilitating a reduction in the 'no shows' for the speech therapy sessions and mapping sessions for persons with cochlear implants. Parents of children with CI showed a high level of satisfaction with SMS reminders. There is a need to conduct a similar study with a larger number of subjects and in different settings so that the results may be generalised. Such a study should consider controlling the variables like income, education level, distance from the therapy centres and motivation of the parents.

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