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Research Article

Clinical and Radiographic Evaluation after Two Years of Implants with Mandibular Overdentures and Submitted to Immediate Loading

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Abstract

Objective: To evaluate the survival, the level of peri implant bone loss, the behavior of tissue peri implant, the prosthetic behavior and satisfaction level of patients treated with 2 unsplinted implants loaded immediately and rehabilitated overdenture on O 'ring attachments in the lower mandible after two years of follow.

Materials and Methods: 27 lower edentulous patients who received each one two implants in interforaminal area (BioHorizons INTERNAL IMPLANT SYSTEM 3.8 x 15 or 3.8 x 12 mm) and were rehabilitated immediately with an overdenture connected through two O 'ring attachments. Two years after, periapical radiographs were taken and were compared with baseline radiographs. By Albrektsson, Mombelli, Silness-Löe criteria and analog scale were evaluated different aspects.

Results: During the two observation years, the loss of an implant was appeared, the survival rate of implant was 98.2%. On average, the loss of bone level was 0,72 mm. A probing depth was shown < 2 mm. There was an adequate prosthetic overdenture behavior, and the satisfaction was between 89 and 96%.

Conclusion and Clinic Relevance: After 2-year follow, it is arguable that overdenture mandibular on two unsplinted implants and loaded immediately on O 'ring attachments, it is a reliable technique in which prosthodontic rehabilitation time is reduced with a high survival rate without commitment at peri-implant tissues and satisfied patients.

Keywords: *Immediate Loading; Mandibular Overdentures; Unsplinted Implants; O 'Ring Attachments*

Introduction

For many years the total mucosa-supported prostheses were the best available treatment for edentulous patients, but many of them expressed their dissatisfaction and had troubles performing oral functions due to the lack of adequate retention and stability [1,2].

Some studies began to show that restorations with overdentures supported by a minimal number of implants provide an effective therapy with a high probability of success [3,4]. The attachment mechanism of the overdenture implant provides increased retention and stability compared to conventional prostheses [5,6].

Experts have proposed in 2003 [7] and 2009 [8], the use of an overdenture on two implants should be the minimum treatment should receive a patient suffering from lower total edentulism.

There is scientific evidence [9] that the effect of two mandibular implants rehabilited with overdentures is stable over an observation period of two years and shows statistically significant differences compared to the use of mucosa-supported when quality of life is compared among these patients.

Late or conventional load has been well researched in edentulous mandibular overdenture rehabilitated patients, with very good radiographic, clinical and satisfaction level results [10-12]. The concern arises whether similar results can be obtained by immediate loading.

For some years now, they have been conducting research on the immediate loading of implants with overdentures as a clinic alternative with predictable results and a high survival rate [13-15].

The efficacy of immediate loading restorations in the edentulous mandible within the first week was also reported in the literature [16-18] that provides several advantages of over conventional loading since immediate restoration of function is performed, the number of visits for patient treatment is decreased and morbidity of a second surgical intervention is reduced [19].

For retaining the overdenture different attachments are used as the system "O 'ring", "Locator" and "magnets". The 'O' ring system can be less expensive and sensitive technique, but it seems less retentive than the Locator system and needs more maintenance especially the first year [20,21]. Recent researches [22] confirm that there were not significant differences in the retention force between the Locator and O 'ring system.

This work is the result of two years of follow clinical and radiographic behavior, 54 unsplinted implants with O 'ring attachments immediately loaded placed in 27 patients and rehabilitated with overdenture in lower edentulous patients.

Materials and Methods

The selected sample by convenience, was 60 implants placed in 30 lower edentulous patients (two implants each), and who met the inclusion criteria of research: having bone availability to allow the placement of two interforaminal implants of the size of 3.8 x 15 or 3.8 x 12 mm from BioHorizons RMR® trading house (BioHorizons INTERNAL IMPLANT SYSTEM). Patients who received mandibular bone regeneration, strong bruxers, irradiated patients, patients with mental disorders, patients with severe systemic disease that prevented surgery, and heavy smokers (more than 10 cigarettes per day) were excluded. This work was approved by the Bioethics Committee of the University Institution (Enactment 09 de 2010) where the research was conducted and all patients signed an informed consent.

At two years the survival of the implants was observed, the percentage of peri-implant bone loss, probing depth, plaque, the prosthetic behavior on dentures and patient satisfaction.

Throughout the follow, an implant that was placed and rehabilitated was lost; This patient was considered for the survival rate in the observation two years, but he was not included for the evaluation of other variables. Two patients changed their residence: one traveled abroad and the other to a rural area, and it was not possible to attend for follow appointment. Both reported that they had their overdenture with a good performance, but could not be evaluated directly, were not taken into account for observation.

Given the above, the sample for monitoring two years survival rate were 28 patients with 56 implants and for evaluating the remaining variables were 27 patients with a total of 54 implants.

Patients received all controls by a periodontist and a prosthodontist previously calibrated.

Implant survival

In implant survival success criteria mentioned were taken into account in the work of Ahlqvist., *et al* [23]. The implant should be performing and clinically stable, there should be no pain, peri-implants tissues must be clinically healthy or show signs of inflammation mild; X-rays should not show radiolucency or other pathological conditions adjacent to the implant.

Changes in bone level

Changes in bone level were measured by peri-apical radiographs. Two examiners calibrated (periodontist) one internal and one external, performed the measurement of bone height through software Image Analysis (SoproImagin), whereby the distance between the implant platform was measured to the bone level more apical contact the implant body. To perform distortion measures each radiograph was calculated, taking into account the length of the implant in position. The amount of bone loss was determined by the difference between the bone level periapical radiographs taken at baseline and at 3 weeks of implants placed compared to the bone level on taken x-rays after two years of follow**.**

Assessment of conditions peri-implant

It included assessment of probing depth in millimeters, as well as plaque index, bleeding index, and presence of dental tartar. Plaque and bleeding were evaluated according to indexes Mombelli., *et al* [24]. To assess inflammation peri-implant, the modified index Silness and Löe was used [25]. Probing depth was defined as an average value of measurements of 4 site (mesial, distal, buccal and lingual) using a calibrated periodontal probe (Hu-Fryde) the presence (score 1) or absence (score 2) of dental calculus was also measured.

Prosthetic evaluation of overdenture

1) The retention was judged acceptable if there was evidence of active retention time of application of force.
2) The stability was considered acceptable only if less motion is observed when the over-denture rotated and heightened. It was also assessed by asking the patient: does the talking?
3) The static and dynamic occlusion was evaluated with articular paper, it was considered acceptable when there was bilateral stability during intercuspal occlusal position and it was no interference during normal occlusion. It was also assessed by the question does chewing?
4) The fissures and fractures were assessed by direct observation of overdentures.
5) Retentive elements, it was assessed that were intact and fulfill their retentive function.

Patient satisfaction

Patient satisfaction was assessed using the validated survey Bergendal by a visual analog scale comparing the overall prosthetic function before and after treatment with implants; and the appreciation of the patient (subjective evaluation) therapy over-denture.

Data collection and analysis

The population data of patients and implants were recorded in SPSS version 21, were analyzed with descriptive statistics, absolute and relative frequencies of each variable, averages, percentage distribution between the sample and analyzed. A comparison of the initial bone loss at one and two years was also performed.

Results

The sample observation at two years were 27 patients in total 54 interforaminal implants. During the two years of observation one implant in the first year, the implant was placed again and is performing. This patient was included in the evaluation of only survival but not taken into account for data other observations.

The survival rate of the function implants after 2 years was 98.2% (Table 1).

Time	Patients		Successful Implants		Implants Failed	Survival Rate
	n	%	n	%	n	
0 month	30	100	60	100	0	100 %
12 months	29	100	57	98	1	98,2%
24 months	28	100	55	98	1	98,2 %

Table 1: *Survival rate of implants a week (0 months), 12 and 24 months.*

On average, two-year observation shows us a bone loss of 0.72 mm. Also, bone loss of the right and left implants in the last year was 0.34 mm (Table 2).

Implant	Time	Average	Confidence range	Deviation	Bone loss after 24 months compare to loss after 12 months
Right Mesial	Initial	0.3548	0.5465 - 0.1632	0.4844	0.243
	Two years	0.5978	0.0826 - 0.3689	0.5785	
Right Distal	Initial	0.4630	0.6587 - 0.2673	0.4947	0.3703
	Two years	0.8333	0.1124 - 0.5543	0.7054	
Left Mesial	Initial	0.3211	0.4896 - 0.1526	0.4259	0.4389
	Two years	0.76	1.03 - 0.48	0.694	
Left Distal	Initial	0.3333	0.4990 - 0.1677	0.4187	0.326
	Two years	0.6593	0.8939 - 0.4246	0.5930	
Average		0.72			0.34

Table 2: *Difference between the average initial bone loss and two years in mm, in the mesial and distal surface of the right and left implants.*

The range of less 0.5mm bone loss frequency higher percentage recorded in all groups (Table 3).

	Right Implant				Left Implant			
	Mesial		Distal		Mesial		Distal	
	N	%	N	%	n	%	n	%
< 0.5	22	81.5	13	48.1	13	48.1	11	40.7
0.5 - 1	3	11.1	5	18.5	5	18.5	11	40.7
1 - 1.5	1	3.7	3	11.1	4	14.8	2	7.4
1.5 - 2	1	3.7	5	18,5	5	18.5	2	7.4
> 2	0	0	1	3.7	0	0	1	3.7
Total	27	100	27	100	27	100	27	100

Table 3: *Ranges peri-implant bone loss two years, according to different ranges.*

The higher frequency level index plate according to Silness and Löe was between 0 and 1.0 is equivalent to a level of 33.33% plate (Table 4).

	Right Implant		Left Implant	
	N	%	N	%
0	0	0	11	40.74
1 - 1.5	13	48.14	10	37.3
2 - 2.5	10	37.03	2	7.4
2.5 - 3	4	14.81	4	14
Total	27	100	27	100

Table 4*: Absolute and relative frequency of bacterial according to Silness and Löe, plaque index per implant.*

Only one implant recorded positive probing (3.7%) (Figure 1).

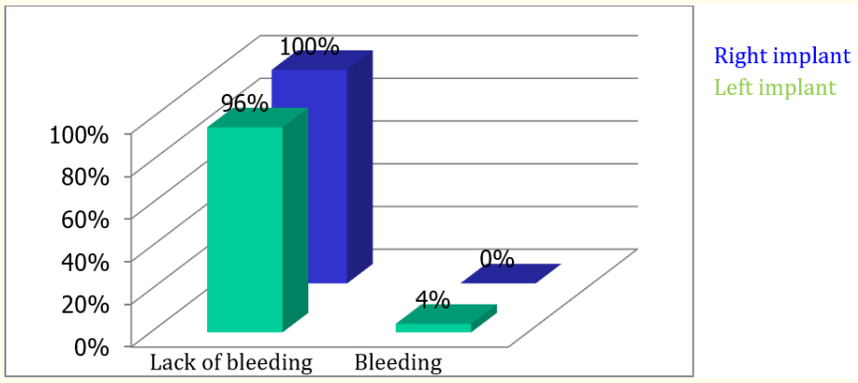

Figure 1: *Absolute and relative -Frequency Bleeding Index according to implant.*

No depth to increased probing (all < 2 mm) in any of the surfaces in implants examined was found (Table 5 and 6).

Implant	Area	Average	CI 95%	Deviation
Right	Mesial	1.86	2.13 - 1.56	0.718
	Distal	2,000	0,700 - 3,299	0,816
	Buccal	1,500	0,582 - 2,418	0,577
	Lingual	1,250	0,454 - 2,045	0,500
	Right probing average	1,687	1,186 - 2,188	0,3145
Left	Mesial	1,750	0,226 - 3,273	0,957
	Distal	1,750	0,954 - 2,545	0,500
	Buccal	1,750	0,954 - 2,545	0,500
	Lingual	1,500	0,581 - 2,418	0,577
	Left probing average	1,687	1,090 - 2,284	0,375

Table 5: *Average implant probing depth and examined area (mesial, distal, buccal and lingual).*

Implant	Area	Average	IC 95%	Deviation
Right	Mesial	1.86	2.13 - 1.56	0.718
	Distal	2,000	0,700 - 3,299	0,816
	Vestibular	1,500	0,582 - 2,418	0,577
	Lingual	1,250	0,454 - 2,045	0,500
	Average right probing	1,687	1,186 - 2,188	0,3145
Left	Mesial	1,750	0,226 - 3,273	0,957
	Distal	1,750	0,954 - 2,545	0,500
	Vestibular	1,750	0,954 - 2,545	0,500
	Lingual	1,500	0,581 - 2,418	0,577
	Average left probing	1,687	1,090 - 2,284	0,375

Table 6: *Average depth to catheterization by implant and by examined area (mesial, distal, Vestibular and lingual).*

The satisfaction of all patients was high, it was between 89 and 96% (Table 7). The main difficulties reported by patients were related to the permanence of the prosthesis in place and function in speech.

		Yes	No		Total	
Variable	**n**	**%**	**n**	**%**	**N**	**%**
Satisfaction	24	88,89	3	11,11	27	100
Remains in place	24	88,89	3	11,11	27	100
Works when chewing	25	92,59	2	7,41	27	100
It Works when you talk	24	88,89	3	11,11	27	100
Your prosthesis is pretty	26	96,30	1	3,70	27	100

Table 7: *Patient's satisfaction with the use of the envelope-denture.*

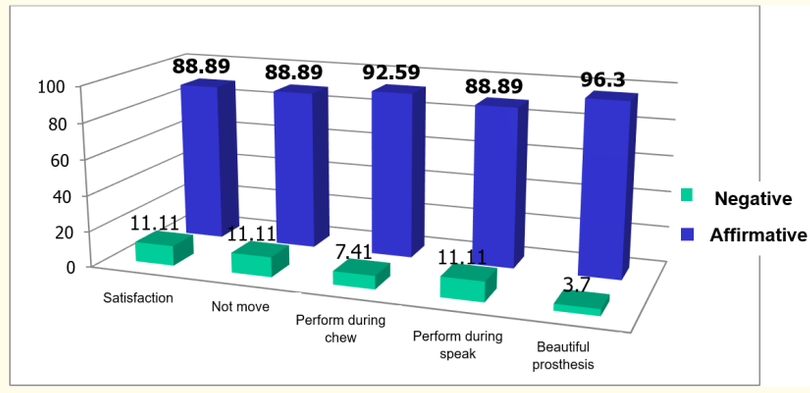

Figure 2: *Absolute and relative -Frequency Bleeding Index according to implant.*

There more frequent maintenance and complications were changing retention elements and relining, followed by the fracture of the prosthesis (Table 8).

Complications	n	Percentage
Changing retentive elements	13	48,14
Override	4	14,81
Loosening of the abutment	2	7,40
Metal Housing Fracture	1	3,70
Uncomfortable eating	2	7,40
Fracture of the prosthesis	3	11,11

Table 8: *Complications of implants assessed at 24 months.*

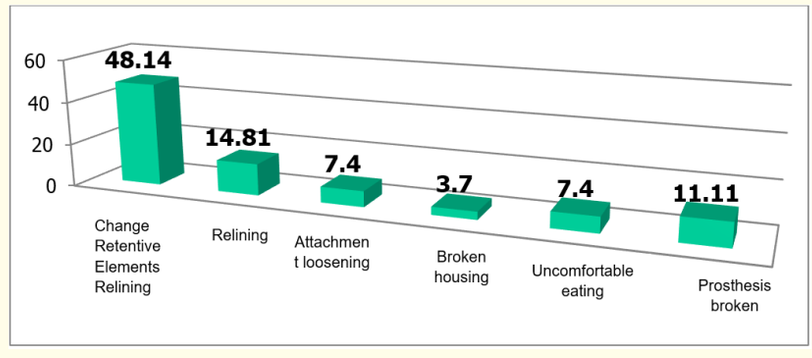

Figure 3: *Maintenance and complications of implant overdentures assessed after 24 months.*

Discussion

In this study the survival rate of the implants was 98.2%, and could be the result of careful patient selection, an insertion torque achieved in all implants placed above 40 Nw with what is He achieved an adequate primary stability of the implant. Surgical and prosthetic treatment execution were carried out by a surgeon and a highly qualified prosthodontic.

Furthermore, it has been reported that the survival rate of the implants of the interforaminal area used to support overdentures is over 90%, and that the appearance of early failures is rare and represent a small percentage [27,28].

Similar to this work in the survival rate results were reported by Arora., *et al.* in 2014 [29], who evaluated overdentures on implants immediately loaded and placed in the interforaminal area of the mandible and obtained two years of observation a survival rate of 96,6% and similar to Ormianer., *et al.* study in 2006 [30] with a 96.4% success rate.

Stephan., *et al.* [31] performed a comparative evaluation two years, between immediate derating late conventional loading in three endosseous implants connected with a gold bar that retained mandible overdenture, concluding the procedure reduced the processing time for the insertion of prostheses and showed comparable to conventional loading protocols results in turn obtained an implant survival of 100% compared with the present work was 98.2%.

The results of this work in terms of survival rate two years are comparable to investigations where a greater number of implants or research using a different immediate loading (early or late) was used. The study by Gatti., *et al.* in 2000 [32], about four implants splinted with bar obtained a 90% success rate. Stephan., *et al.* in 2007 [31], their evaluation of 3 splinted implants with bar obtained a survival rate of 100%. Tawse-Smith., *et al.* in 2002 [33], obtained an early loading implant survival of 100%. Eccellente., *et al.* [34] in their study of four implants unsplinted and immediately loaded found a survival rate of 98.7%, Stricker., *et al.* 2004 [35], reported on their research into 10 fully edentulous patients rehabilitated with overdenture on two implants in the interforaminal area, splinted with bar and immediately loaded, where they obtained a survival rate of 100%.

EL-Sheikh in 2012 [36] conducted a study with 2 and 3 reduced diameter implants (3.3 mm), he observed for 6, 12 and 24 months found a survival rate of 98%.

Ismail H in 2015 [37] published the results at 6, 12 and 24 months in a study using a single implant of 13 mm in length and with late charge, rehabilitated with mandibular overdenture. He found a survival rate of 100%, this percentage was maintained during the follow period.

Regarding the performance of implants immediately loaded and rehabilitated overdentures, prospective research published by Turkyilmaz and Turner, in 2007 [38], refers to the assessment of this protocol after two years, and concludes that early load does not adversely affect the clinical behavior of these implants and that although, as in the present work, it required some maintenance procedures in the overdentures and some prosthodontic complications occurred, these tended to decrease over time.

The study of systematic review and meta-analysis conducted in 2010 by Alsabeeha., *et al.* [39] on comparative studies of immediate loading protocols and/or early and standard protocols for rehabilitation mandibular overdentures, reviewed 10 studies that met the inclusion criteria, including they have at least 2 years of evolution. This systematic review published the conclusion that considering this time of evolution, protocols immediate and early loading were similar to conventional protocol success and that did not exist until that evidence moment in the long term to support or refute protocols immediate or early loading rehabilitated with mandibular overdentures. These results are consistent with the findings in this study regarding the success recorded in the immediately loaded implants.

Malmstrom., *et al*. in 2015 [40], showed the results of monitoring 48 patients with 2 unsplinted implants and rehabilitated with overdentures and conventional loading. He observed a survival implant 97.7% at 24 months of observation. It is noteworthy that in the study of Malmstrom implants were placed by residents inexperienced graduate.

It is interesting to note that literature is presenting studies [36,37] where mandibular overdentures supported for 1 implant standard size or 2 or 3 reduced diameter unsplinted implants, with late loading after 2 years of observation, show comparable success rates in this study which was immediately loaded.

Considering the success of implants is very important to emphasize primary and secondary stability. Primary stability is believed to play an important role in the successful osseointegration [41]. Primary stability is a function of the quality and quantity of the local bone, geometry implant and technique used in implant placement [42]. Secondary stability is the result of the formation of secondary bone and lamellar and cancelled bone. In the present investigation, it was required for immediate loading force greater insertion torque to 45 Nw implant and placement technique favoring primary stability of all implants.

A simple mean difference was used for comparison of mean bone loss. The marginal bone loss should be < 1 mm in the first year and each year thereafter < 0.2 mm. All implants met this proposed Albrektsson parameter [43].

In the present study, the average bone loss in the marginal bone level after 2 years was 0.72 mm. In a similar work, Arora., *et al.* study, in 2014 [29], they observed two years, a marginal bone loss around implants of 1.08 mm. Marzola., *et al.* in 2007 [44], found a change in marginal bone level of 0.71 mm, immediately after loading two mandibular overdenture unsplinted implants. Stricker., *et al.* in 2004 [35], when evaluating two years, 10 patients with two dental implants each, placed in the interforaminal area, which were immediately loaded with a buss bar and an overdenture, and recorded bone loss at 24 months of 0, 79 mm, very similar to this study.

In a systematic review by Kawai., *et al.* published in 2007 [17], bone loss in implants with immediate load was the first 0,59 mm during 12 months and 0,72 mm after two years, similar to those obtained in this study data.

Malmstron 2015 [40] in his study with conventional load showed average bone loss of 0.33 +/- 0.48 mm to two years of observation.

These findings suggest that immediate loading of splinted undischarged mandibular overdenture implants not be influencing change the pattern of marginal peri-implant bone.

In this evaluation study two years most of the implants showed less than 33% of plaque. For many years, studies like Wie [45] have failed to establish any level between the plaque and soft tissue complications with early loss of implants relationship. Buser [46] in his study of implants, registered after three years, an index plate next to zero ("0") in approximately 88% of the implants. Lekholm instead of recorded a 45% free of plaque implants [47]. For Pontoriero., *et al.* in 1994 [48] and Kaptein., *et al.* in 1999 [49]; bleeding effect on peri-implant pathology is probably due to its association with dental plaque, thus the accumulation of dental plaque, followed by bleeding results from the gingival inflammation and the formation of peri-implant pockets. According to Rocha dos Santos., *et al.* in 1992 [50], after conducting an extensive literature review, hygiene is a key factor in maintaining the implants.

Only one implant index recorded positive bleeding in this study (3.7%). According to Ferreira., *et al.* in 2006 [19], it has not been clearly defined if the rate of peri-implant bleeding could represent a reliable parameter to identify the presence of peri-implant disease. Some studies suggest that peri-implant mucosa may be more sensitive probing forces, causing bleeding index positive [51,52]. The clinical and the radiographic appearance must always be used as a diagnostic factor of peri-implant disease even if there is no presence of bleeding.

In the present study, patient satisfaction was between 89% and 96%. Similar results obtained Pocztaruk R., *et al.* [53] where the level of satisfaction of the patients was 95.83%. Awad., *et al.* [54], reported that patients using mandibular overdentures supported by two implants had a significantly high percentage of satisfaction with various functional aspects of the prosthesis (stability, comfort and ability to chew).

Other studies such as Krennmair., *et al.* in 2012 [55], reported high satisfaction of patients with mandibular overdenture and emphasize that comfort, better pronunciation, greater ability to chew and stability of the denture is presented; results that are similar to this work.

Previous studies show that subjects who receive mandibular overdenture on two implants experience significantly less difficulty chewing hard foods (meat, raw carrot and apple) compared to those receiving conventional prostheses [56-58].

As for the prosthetic behavior of overdentures in this work after two years it was observed that major maintenance is required in changing retention elements; most repairs and adjustments are required during the first year of use. Turkyilmaz., *et al*. in 2007 [38], suggest that complications tend to decrease over time. The percentage of maintenance including both adjustments and repairs overdentures in all patients was 77% the first year and 23% the second year.

The findings of this research was two unsplinted implants, as the prosthetic behavior is similar to other studies such as Payne and Solomons, published in 2000 [59], which conducted a prospective study using overdentures 2, 3 or 4 splinted implants with different systems, in 59 edentulous patients and demonstrated that maintenance and prosthodontic complications were higher in the first year than in subsequent years.

Conclusion

In clinical and radiographic to two years observation, It is arguable that that patients edentulous mandible, treated with two implants with O 'ring attachments placed in the mandibular area, immediately loaded and restored with overdenture recorded a high success rate, without commitment peri-implant level and with high satisfaction for patients.

Despite the short time of clinical and radiographic observation reported by this study, it can be said that the procedure reduces the time of prosthetic rehabilitation without compromising the result of two years of implants.

Immediate loading gives many advantages, most of the studies reviewed demonstrate the equality of the procedure compared to conventional load, with regard to implant survival and peri-implant bone loss.

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Ethical Approval

All the procedures develop in human beans were with the ethics institutional community and Helsinki declaration 1964 and its postarious modifications.

Conflict of Interests

The authors have no conflict of interest.

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Volume 18 Issue 5 May 2019