Surgical management of acute retrograde peri-implantitis: a review of current literature

Bianca Di Murro DDS
Piero Papi DDS
Giorgio Pompa MD, DDS

Oral Surgery Unit, Department of Oral and Maxillo-Facial Sciences, "Sapienza" University of Rome, Rome, Italy

Corresponding Author:
Bianca Di Murro
Oral Surgery Unit
Department of Oral and Maxillo-Facial Sciences
"Sapienza" University of Rome
Via Caserta 6
00161 Rome, Italy
E-mail: biancadimurro@hotmail.it

Summary

***Aims*: Periapical implant lesions, also named apical peri-implantitis or retrograde peri-implantitis, were described since 1992, and are characterized by progressive bone loss at the periapex of the implant. Several case reports have suggested these lesions are possible causes for early implant failure. The aim of this article was to review the Literature to identify current knowledge on surgical management of acute retrograde peri-implantitis.**
***Methods*: The Authors conducted an independent search of the literature, for reports published from 1st January 2008 up to 1st December 2018 in English in several databases: Pubmed, Web of Science, SciVerse, MEDLINE and through The Cochrane Database of Systematic Reviews. Only articles reporting data on the surgical treatment of dental implants affected by retrograde peri-implantitis were included. Articles with unclear or unavailable data or with less than 6 months of follow-up were excluded.**
***Results*: A total of 47 records was identified through database searching. After removal of duplicates, twenty-three studies were selected for title and abstract analysis, with 14 articles considered for detailed screening. Eight studies were included in the present review: four case series and four case reports. A total of 36 dental implants was treated, with follow-up ranging from 6 months to 6 years. Successful resolution of the peri-apical lesion was observed in 34/36 implants (94.5%), with complete radiographic bone fill and absence of further symptomatology.**
***Conclusions*: Several surgical techniques have been reported for lesions, with proper endodontic evaluation of adjacent teeth. Surgical and chemical debridement of the implant associated with GBR considered the preferred treatment option.**

Key Words: retrograde peri-implantitis, apical peri-implantitis, surgical treatment, surgical management, review.

Introduction

In recent years, implant placement has become widespread in clinical practice (1), with long-term success and survival rates reported in literature (2). Its massive use, however, has resulted in different types of complications, divided in mechanical (3,4) and biological (5-7). When, after implant placement, localized pain develops in the apical area, with or without radiographic changes, a periapical implant lesion should be suspected (8). Periapical implant lesions, also named apical peri-implantitis or retrograde peri-implantitis, were described, for the first time, by McAllister et al. (9) in 1992. These lesions are characterized by progressive bone loss at the periapex of the implant and several case reports have suggested they are the possible cause of early implant failure (10-12).
The retrograde peri-implantitis (RPI) has a prevalence (13) of 0.26%, significantly lower than marginal peri-implantitis; although its incidence may increase up to 7.8% when teeth adjacent to the implant exhibit an endodontic infection (14).
It seems positively correlated with the presence of a small distance between an implant and its adjacent tooth and a shorter time elapsing from the endodontic treatment of the adjacent tooth to the implant placement (13). The aetiology of this lesion is still unclear. According to several Authors, the most likely cause is the endodontic pathology of the tooth replaced by the implant or of the adjacent tooth (15,16). Among other factors hypothesized, contamination of the implant surface (17), bone overheating, pre-existing bone disease, presence of root fragments or foreign bodies were reported in literature (10,18-20). The diagnosis of RPI is both clinical and radiological, with lesions classified into two groups: inactive and active forms (17). The inactive lesions show no symptomatology and are radiologically represented as a radiolucency

around the apex of the implant. These lesions do not need further treatment, although these patients should be inserted in a proper follow-up program: standardized periapical X-rays every 6 months. If an expansion of radiolucency occurs, it may indicate activation and needs surgical intervention. On the contrary, active lesions usually showed symptoms (17) such as: persisting pain at the mucosa correspondent to the implant (19), inflammation, suppuration by fistula discharge, mobility and dull percussion (21, 22). According to Pennarrocha- Diago et al. (23), the evolution stage of the periapical lesion should be divided in three parts, promptly individuated and included in the diagnosis to determine the best suitable treatment strategy.

Acute periapical lesion staging can be divided into three parts:

1. Non-suppurated: there are no radiographically detectable changes in bone density around the apex of the implant, but a spontaneous and localized pain at the implant mucosa is present.
2. Suppurated: an appreciable radiolucency is present as a result of purulent collection around the apex of the implant, with an active process of bone reabsorption.
3. Suppurated-fistulized: there is a visible radiolucency, a fistulous tract from the apex of the implant is detectable in the buccal plate or in coronal direction. Diagnosis of retrograde peri-implantitis, and therefore its prevalence, may also be influenced by the limits of two-dimensional radiographic imaging systems, with an underestimation that can be solved by the use of three-dimensional cone beam.

The aim of this article was to review the Literature to identify current knowledge on surgical management of acute retrograde peri-implantitis.

Materials and methods

To address the research purpose, the Authors (BDM, PP) conducted an independent electronic search of the literature for reports published from 1st January 2008 up to 1st December 2018 in English in several databases: Pubmed library, Web of Science (Thomson Reuters), SciVerse (Elsevier), MEDLINE (OVID) and through The Cochrane Database of Systematic Reviews (CDSR). In addition, a manual search was performed in the databases of the following journals: Implant Dentistry; Clinical Oral Implants Research; Clinical Implant Dentistry and Related Research; European Journal of Oral Implantology; International Journal of Oral & Maxillofacial Implants; Journal of Oral Implantology; International Journal of Oral and Maxillofacial Surgery; International Journal of Oral and Maxillofacial Surgery; Journal of Periodontology; Journal of Clinical Periodontology; International Journal of Periodontics and Restorative Dentistry; Journal of Prosthetic Dentistry; International Journal of Endodontics; Journal of Endodontics.

Search strategy

The following search strategy was performed: "retrograde peri-implantitis" OR "periapical peri-implantitis" OR "periapical implant lesion" OR "apical peri-implantitis" AND "treatment" OR "surgical treatment" OR "surgical management".

Study selection

Only articles in English and reporting data on the surgical treatment of at least one dental implant affected by retrograde peri-implantitis were included. Randomized clinical trial, prospective or retrospective cohort studies, case-control studies, case series or case reports were included. Articles with unclear or unavailable data or with less than 6 months of follow-up were excluded.

Quality and risk of bias assessment

To evaluate methodological quality of case reports and case series included, a recently modified version of the Newcastle-Ottawa Scale was used (24). This tool is divided into four sections: selection (1 item), ascertainment (2 items), causality (4 items) and reporting (1 item). As suggested by the Authors (24), results of the items are not summarised to obtain an aggregate score to evaluate methodological quality: on the contrary, an overall judgment is expressed for each article (low-medium-high). The Cochrane Collaboration's two-part tool for assessing risk of bias was used. Bias is assessed as a judgment (high, low, or unclear) from five domains (selection, performance, attrition, reporting, and other).

Results

Study selection

Two reviewers (BDM, PP), independently from each other, extracted pertinent data (year; study design; number of implants; surgical technique; outcome and follow-up time) from selected studies. A total of 47 records was identified through database searching. After removal of duplicates, twenty-three studies were selected for title and abstract analysis, with 14 articles considered for detailed screening (Fig. 1). The kappa agreement between reviewers was 0.9.

Population

A total of 36 dental implants was treated, with follow-up ranging from 6 months to 6 years. Successful resolution of the peri-apical lesion was observed in 34/36 implants (94.5%), with complete radiographic bone fill and absence of further symptomatology.

Quality assessment

Eight studies were included in the present review: four case series and four case reports. All articles were classified as low-quality studies, in accordance with the adapted version of the Newcastle-Ottawa Scale.

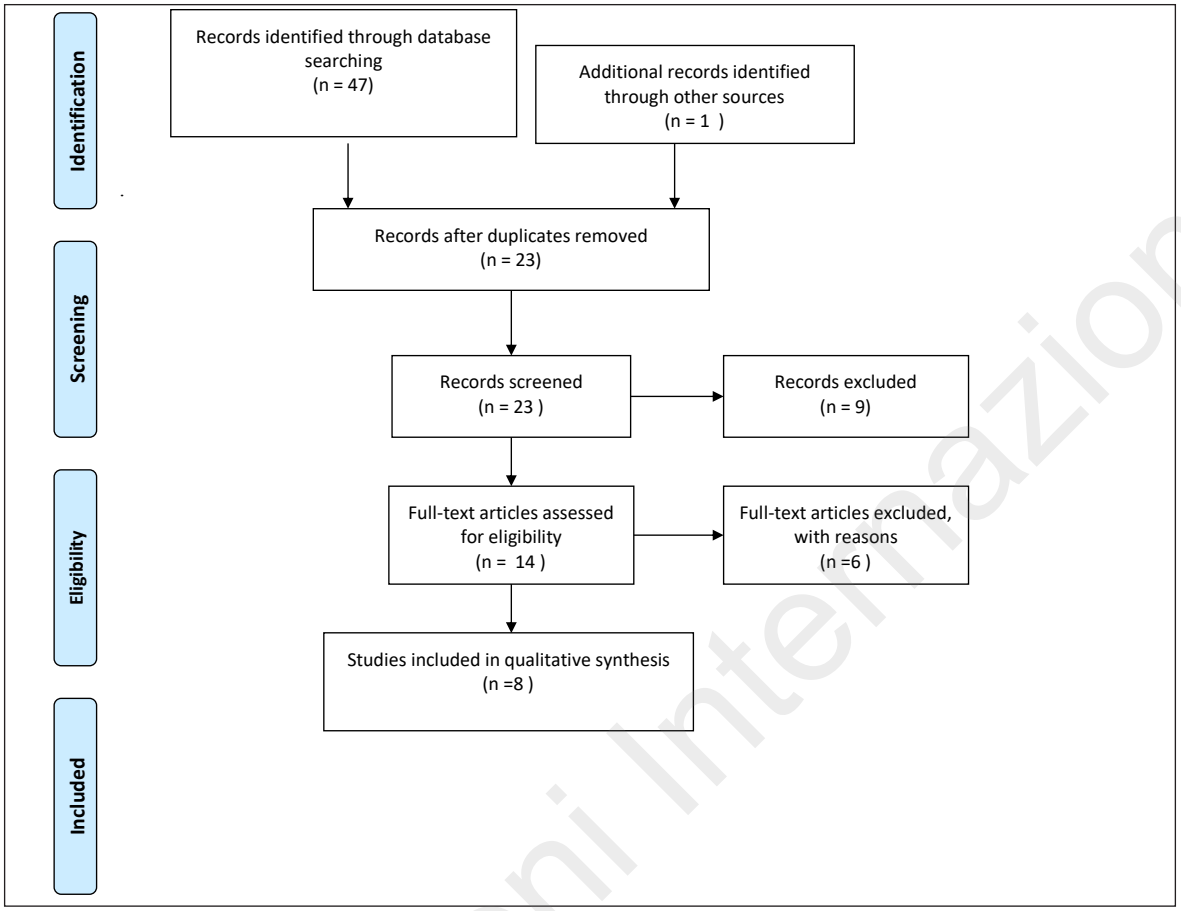

Figure 1. PRISMA Flow-chart of study selection.

Surgical treatment options:

-Surgical and mechanical debridement of the apical part of the implant.

-Surgical and mechanical debridement of implant with Guided Bone Regeneration (GBR) of the defect.

-Implant apex resection.

Risk of bias

All 8 studies included were classified as having a high-risk of bias (Tab. 1).

Study results

Based on the analysis of studies included, the following surgical options are presented in detail:

- Dahlin et al. (25) (2009, case series): Implant apex resection was performed on 2 implants. Resulted in complete healing without further symptomatology and complete radiographic bone fill into the resected area. Follow-up period ranged from 1 to 3 years.
- Zhou et al. (26) (2012, case series): Surgical and mechanical debridement of periapical lesion was performed on 6 implants, trepanation and curettage of the apical part of the implant within irrigation by natural saline and chlorhexidine, further application of tetracycline paste. Uneventful healing resulted for all patients treated, with complete disappearance of the apical radiolucency. Follow-up time ranged from 12 to 36 months.
- Quaranta et al. (27) (2014, case report): Surgical and mechanical debridement was performed on 1 implant with application of tetracycline paste. Then, placement of a bioabsorbable pericardium membrane over the defect. Resulted in complete radiographic bone fill and absence of clinical symptoms. Five years follow-up.
- Mohamed et al. (28) (2012, case report): Surgical and mechanical debridement was performed on 1 dental implant, then Guided Bone Regeneration (GBR) with a xenograft and Platelet Rich Fibrin (PRF). Furthermore, endodontic retreatment of adjacent teeth. Resulted in complete radiographic bone fill and absence of clinical symptoms. One year follow-up.
- Penarrocha-Diago et al. (29) (2013, case series): Surgical and mechanical debridement was performed on 22 dental implants, with an implant survival rate of 91% with no radiologic or clinical alterations. Follow-up period from 1 to 6 years.
- Chan et al. (30) (2011, case series): Surgical and mechanical debridement was performed on 2 implants. Furthermore, irrigation with 0.12% chlorhexidine gluconate and GBR using an allograft mixed with 250 mg tetracycline powder and

Table 1. Risk of bias of studies included (-: high risk of bias; +: low risk of bias).

Author	Random sequence generation	Allocation concealment	Blinding	Incomplete outcome data	Selective reporting	Other bias
Dahlin, et al.	-	-	-	-	-	+
Zhou, et al.	-	-	-	-	-	+
Quaranta, et al.	-	-	-	-	-	+
Mohamed, et al.	-	-	-	-	-	+
Penarrocha-Diago, et al.	-	-	-	-	-	+
Chan, et al.	-	-	-	-	-	+
Sarmast, et al.	-	-	-	-	-	+
Soldatos, et al.	-	-	-	-	-	+

an absorbable membrane. Healing was uneventful and significant radiographic resolution of the lesions was observed. Six months follow-up.

- Sarmast et al. (31) (2017, case report): Surgical and mechanical debridement was performed on 1 dental implant, irrigation with 0.9% sodium chloride and chemical debridement using EDTA/chlorhexidine 2%, tetracycline. GBR with freeze-dried bone allograft (FDBA) 50/50 and an absorbable membrane. Healing was characterized by absence of symptoms and radiographic bone filling. One year follow-up.
- Soldatos et al. (32) (2018, case report): Surgical and mechanical debridement was performed on 1 dental implant, with implant surface decontaminated by means of an air-abrasive device with amino acid glycine powder and Er,Cr:YSGG laser (wavelength of 2,780 nm) at 1.5 W/25 Hz. GBR performed with FDBA and a collagen membrane. Resulted in complete remission of symptomatology and radiographic bone fill. Thirty-three months follow-up.

Discussion

Retrograde peri-implantitis aetiology is still controversial and this leads to a large underestimation of the pathology (17).

In the past 20 years, various surgical techniques have been used and further studies with a longitudinal design are needed to identify a proper clinical management (31). Treatment for RPI depends both on clinical presentation and radiological findings: diagnosis range between 1 week and 4 years after implant placement (33, 34). If there is a radiolucent area around the apex of the implant, not present immediately after surgery, without pain, a strict follow-up of the lesion is recommended, without other treatment (35). If patient develops pain or radiolucency increases in size, medical and surgical treatment is indicated (35, 36). Therapeutic modalities usually range from just prescribing an antibiotic therapy to the patient with/without endodontic treatment of the adjacent tooth, resection of the apical part of the dental implant, endodontic re-treatment and apicoectomy of the adjacent tooth to surgical/chemical debridement of the apical part of the implant with/without guided bone regeneration (GBR) procedures (36).

This systematic review included only case series and case reports, which are considered to be of the lowest scientific evidence, with absence of higher quality studies. Another limitation is represented by the limited follow-up available, with only one study with long-term evaluation (>5 years), and by the very low amount of dental implants included (n=36).

Peri-implant diseases are well documented conditions in literature, with a still unclear etiology (37, 38), however the available scientific evidence on retrograde peri-implantitis is very limited, with only case reports or case series present in literature (35). Based on the findings of this review, surgical and mechanical debridement of the apical part of the implant associated with GBR with allograft and absorbable membrane was the surgical treatment option most used. Several chemical agents were used to decontaminate the implant surface, with irrigation by means of physiologic saline solution and chlorhexidine as the most performed. Only one article reported data on apex resection of the implant affected by RPI.

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References

1. De Angelis F, Papi P, Mencio F, Rosella D, Di Carlo S, Pompa G. Implant survival and success rates in patients with risk factors: results from a long-term retrospective study with a 10 to 18 years follow-up. Eur Rev Med Pharmacol Sci. 2017; 21:433-7.

2. Rossi F, Lang NP, Ricci E, Ferraioli L, Baldi N, Botticelli D. Long-term follow-up of single crowns supported by short, moderately rough implants-A prospective 10-year cohort study. Clin Oral Implants Res. 2018;29: 1212-9.
3. Papi P, Di Carlo S, Mencio F, Rosella D, De Angelis F, Pompa G. Dental Implants Placed in Patients with Mechanical Risk Factors: A Long-term Follow-up Retrospective Study. J Int Soc Prev Community Dent. 2017;7:S48-S51.
4. Hämmerle CHF, Cordaro L, Alccayhuaman KAA, Botticelli D, Esposito M, Colomina LE, et al. Biomechanical aspects: Summary and consensus statements of group 4. The 5th EAO Consensus Conference 2018. Clin Oral Implants Res. 2018;29 Suppl 18:326-31.
5. Heitz-Mayfield LJ, Aaboe M, Araujo M, Carrión JB, Cavalcanti R, Cionca N, et al. Group 4 ITI Consensus Report: Risks and biologic complications associated with implant dentistry. Clin Oral Implants Res. 2018;29 Suppl 16:351-8.
6. Mencio F, De Angelis F, Papi P, Rosella D, Pompa G, Di Carlo S. A randomized clinical trial about presence of pathogenic microflora and risk of peri-implantitis: comparison of two different types of implant-abutment connections. Eur Rev Med Pharmacol Sci. 2017;21:1443-51.
7. Barbieri M, Mencio F, Papi P, Rosella D, Di Carlo S, Valente T, et al. Corrosion behavior of dental implants immersed into human saliva: preliminary results of an in vitro study. Eur Rev Med Pharmacol Sci. 2017;21:3543-8.
8. Peñarrocha-Diago M, Peñarrocha-Diago M, Blaya-Tárraga JA. State of the art and clinical recommendations in periapical implant lesions. 9th Mozo-Grau Ticare Conference in Quintanilla, Spain. J Clin Exp Dent. 2017 1;9: e471-3.
9. McAllister BS, Masters D, Meffert RM. Treatment of implants demonstrating periapical radiolucencies. Pract Periodontics Aesthet Dent. 1992;4: 37-41.
10. Ayangco L, Sheridan PJ. Development and treatment of retrograde peri-implantitis involving a site with a history of failed endodontic and apicoectomy procedures: a series of reports. Int J Oral Maxillofac Implants. 2001: 3: 412-7.
11. Bretz WA, Matuck AN, De Oliveira G, Moretti AJ. Treatment of retrograde peri-implantitis: clinical report. Implant Dent 1997: 4: 287-90.
12. Flanagan D. Apical (retrograde) peri-implantitis: a case report of an active lesion. J Oral Implantol 2002: 2: 92-6.
13. Bain CA, Moy PK. The association between the failure of dental implants and cigarette smoking. Int J Oral Maxillofac Implants. 1993;8: 609-15.
14. Zhou W, Han C, Li D, Li Y, Song Y, Zhao Y. Endodontic treatment of teeth induces retrograde peri-implantitis. Clin Oral Implants Res. 2009;20: 1326-32.
15. Park SH, Sorensen WP, Wang HL. Management and prevention of retrograde peri-implant infection from retained root tips: two case reports. Int J Periodontics Restorative Dent. 2004;24:422-33.
16. Penarrocha-Diago M, Boronat-Lopez A, García-Mira B. Inflammatory implant periapical lesion: etiology, diagnosis, and treatment— presentation of 7 cases. J Oral Maxillofac Surg. 2009;67: 168-73.
17. Temmerman A, Lefever D, Teughels W, Balshi TJ, Balshi SF, Quirynen M. Etiology and treatment of periapical lesions around dental implants. Periodontol 2000. 2014;66: 247-54.
18. Brisman DL, Brisman AS, Moses MS. Implant failures associated with asymptomatic endodontically treated teeth. J Am Dent Assoc. 2001;132: 191-5.
19. Esposito M, Hirsch J, Lekholm U, Thomsen P. Differential diagnosis and treatment strategies for biologic complications and failing oral implants: a review of the literature. Int J Oral Maxillofac Implants. 1999;14: 473-90.
20. Chaffee NR, Lowden K, Tiffee JC, Cooper LF. Periapical abscess formation and resolution adjacent to dental implants: a clinical report. J Prosthet Dent. 2001;85: 109-12.
21. Oh TJ, Yoon J, Wang HL. Management of the implant periapical lesion: a case report. Implant Dent 2003: 1: 41–6.
22. Piattelli A, Scarano A, Balleri P, Favero GA. Clinical and histologic evaluation of an active "implant periapical lesion": a case report. Int J Oral Maxillofac Implants 1998: 5: 713–6.
23. Penarrocha-Diago M, Maestre-Ferrin L, Cervera-Ballester J, Penarrocha-Oltra D. Implant periapical lesion: diagnosis and treatment. Med Oral Patol Oral Cir Bucal. 2012: 38: 527–32.
24. Murad MH, Sultan S, Haffar S, Bazerbachi F. Methodological quality and synthesis of case series and case reports BMJ Evidence-Based Medicine. 2018;23:60-3.
25. Dahlin C, Nikfarid H, Alsén B, Kashani H. Apical peri- implantitis: Possible predisposing factors, case reports, and surgical treatment suggestions. Clin Implant Dent Relat Res. 2009;11: 222-7.
26. Zhou Y, Cheng Z, Wu M, Hong Z, Gu Z. Trepanation and curettage treatment for acute implant periapical lesions. Int J Oral Maxillofac Surg. 2012;41: 171-5.
27. Quaranta A, Andreana S, Pompa G, Procaccini M. Active implant peri-apical lesion: A case report treated via guided bone regeneration with a 5-year clinical and radiographic follow-up. J Oral Implantol. 2014;40: 313- 9.
28. Mohamed JB, Alam MN, Singh G, Chandrasekaran SC. The management of retrograde peri-implantitis: A case report. J Clin Diagn Res 2012;6: 1600-2.
29. Penarrocha-Diago M, Maestre-Ferr ın L, Penarrocha- Oltra D, Canullo L, Piattelli A, Penarrocha-Diago M. Inflammatory implant periapical lesion prior to osseointegration: A case series study. Int J Oral Maxillo- fac Implants. 2013;28: 158-162.
30. Chan HL, Wang HL, Bashutski JD, Edwards PC, Fu JH, Oh TJ. Retrograde peri-implantitis: A case report introducing an approach to its management. J Periodontol. 2011;82: 1080-8
31. Sarmast ND, Wang HH, Sajadi AS, Angelov N, Dorn SO. Classification and Clinical Management of Retrograde Peri-implantitis Associated with Apical Periodontitis: A Proposed Classification System and Case Report. J Endod. 2017;43: 1921-4.
32. Soldatos N, Romanos GE, Michaiel M, Sajadi A, Angelov N, Weltman R. Management of Retrograde Peri-Implantitis Using an Air-Abrasive Device, Er,Cr:YSGG Laser, and Guided Bone Regeneration. Case Rep Dent. 2018 Apr 15;2018: 7283240.
33. Kutlu HB, Genc T, Tozum TF. Treatment of refractory apical peri-implantitis: a case report. J Oral Implantol. 2016;42: 104–9.
34. Waasdorp J, Reynolds M. Nonsurgical treatment of retrograde peri-implantitis: a case report. Int J Oral Maxillofac Implants. 2010;25: 831–3.
35. Sarmast ND, Wang HH, Soldatos NK, Angelov N, Dorn S, Yukna R, et al. A Novel Treatment Decision Tree and Literature Review of Retrograde Peri-Implantitis. J Periodontol. 2016;87:1458-67.
36. Ramanauskaite A, Juodzbalys G, Tözüm TF. Apical/Retrograde Periimplantitis/Implant Periapical Lesion: Etiology, Risk Factors, and Treatment Options: A Systematic Review. Implant Dent. 2016;25: 684-97.
37. Papi P, Di Carlo S, Rosella D, De Angelis F, Capogreco M, Pompa G. Peri-implantitis and extracellular matrix antibodies: A case-control study. Eur J Dent. 2017;11: 340-4.
38. Mencio F, Papi P, Di Carlo S, Pompa G. Salivary bacterial leakage into implant-abutment connections: preliminary results of an in vitro study. Eur Rev Med Pharmacol Sci. 2016;20: 2476-83.