Analysis of the Peri-implant Soft Tissues in Contact with Zirconia Abutments: An Evidence-based Literature Review

Rodrigo Antonio de Medeiros, Aljomar José Vechiato-Filho, Eduardo Piza Pellizzer, Jose Vitor Quinelli Mazaro, Daniela Micheline dos Santos, Marcelo Coelho Goiato

ABSTRACT

Aim: The aim of this study is to evaluate through a literature review, the soft tissue response in contact with zirconia abutments, including case reports comparing prosthetics rehabilitations with zirconia and titanium abutments upto 3 years of follow-up as well as the factors that should be considered on implant’s abutment selection.

Background: Metallic abutments can provide grayish color when in contact with thin soft tissues which may lead the implant prosthetic treatment to failure. In this context, the abutments of zirconia stand out because there is an excellent linking between esthetics and the health of peri-implant soft tissues.

Materials and methods: A consult of the published researches was made on the PubMed database from 2000 to September 2012. The including criteria were: literature reviews, clinical studies and case reports in English that focused on the response of the soft tissue in contact with zirconia implant abutments. The studies that were not in English and did not match the tackled issue were excluded.

Results: A total of 32 articles were found. According to the search strategy, just 16 articles were selected for this review. Three studies affirmed that zirconia abutments have an excellent soft tissue response; one study showed increased gingival recession with zirconia abutments and nine studies do not stand out any difference on biological behavior between titanium and zirconia abutments. Three studies affirmed that zirconia abutments provide natural gingival appearance, anatomic contour and greater esthetics.

Conclusion: The use of zirconia abutments is recommended for anterior regions because of their greater optical properties and esthetic results and more studies should be performed and analyzed longitudinally regarding their biological response.

Clinical significance: The zirconia abutments have been established to be essential in order to achieve great esthetic results in cases of thin peri-implant soft tissues and in regions where the three-dimensional placement of implants is more superficial.

Keywords: Dental implants, Gingiva, Esthetics, Review.


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evaluate, through a literature review, the response of peri-implant soft tissue in contact with zirconia abutments, including comparisons among three case reports of implant-supported single crowns with titanium and zirconia abutments, as well as the factors that must be considered when selecting these components.

MATERIALS AND METHODS
A search about the tackled subject of was performed on PubMed database from 2000 to September 2012. The following keywords were singly used: ‘zirconia abutment and soft tissue reaction’, ‘zirconia abutment and biological complications’, ‘zirconia abutment and soft tissue complications’, ‘zirconia abutment and soft tissue inflammation’, ‘dental implant and ceramic abutment and biological complications’, ‘zirconia abutment and esthetic and all-ceramic crown’. The including criteria were: literature reviews, clinical studies and case reports that evaluated the response of the peri-implant soft tissue in contact with zirconia abutment. The studies that were not in English and did not match the proposed subject were excluded. Titles and abstracts, and full-texts when necessary, were read by two reviewers. The results obtained were analyzed, crossed and discussed for the reviewing.

RESULTS
By using the keyword, a total of 32 articles were found. From this initial result, just 16 articles fit into the search strategy and were used to this current study. The studies were tabulated and classified according to the degree of scientific evidence (Table 1).

DISCUSSION
In 2004, Glauser et al13 reported in their study that the ceramic abutments were introduced in implant dentistry in 1993, with the purpose of enhancing esthetic results of implant-supported single crowns in anterior areas, since the titanium abutments may cause a grayish aspect in peri-implant soft tissue, affecting clinical appearance of the implant-supported restoration.

In the same year, Doring et al6 affirmed that the interaction between the implant fixed reconstructions and the surrounding soft tissue is a crucial factor that should be considered to obtain clinical success. According to these authors, zirconia abutments promote less bacterial adherence in comparison with titanium abutments, preventing gingival inflammation.

However, Tan et al14 observed the esthetic result produced by exchanging titanium and zirconia abutments in an implant-supported single crown. In this study, the ceramic component showed a subtle difference in the final clinical appearance. Thus, according to Sailer et al,1 among the relevant esthetic parameters on abutment selection, the smile line, gingival biotype, three-dimensional (3D) implant placement, color of the adjacent tooth, costs and patient expectations should be considered (Figs 1A to D).

Wakin et al in 2008,8 affirmed that for patients with high smile line, the zirconia abutments have better esthetic result and may re-establish more naturally the silhouette, color and health aspect of the peri-implant soft tissues in comparison with titanium abutments (Figs 2A to C). This fact can be attributed to the minimum influence on color shade of the component when in contact with the gingiva. But, in the same year, Linkevicius et al3 made a systematic review similar to the anterior study, concluding that there was no difference between zirconia and titanium abutments in the tissue anatomy, as can be observed on two illustrated cases of implant-supported single crowns (Figs 3A to D).

For the authors, there are few works that focused on the clinical performance of tissue around zirconia abutments. Thus, more studies about this component are necessary, as it is considered an important factor for the long-term success of implant treatment.

Corroborating with this affirmatives, in 2009, Sailer et al8 and Zembic et al10 compared the tissues response around zirconia and titanium abutments, during 1 and 3 years, respectively. For these authors, both components showed the same results in all the analyzed aspects.

In 2010, Nothdurft et al2 published in their study that the bacterial ingress, masticatory forces and prosthetic manipulation may affect the gingival integrity. The authors evaluated the peri-implant health around ceramic abutments with 1 year of follow-up. Most of the tissues did not show any trace of inflammation, presenting themselves with healthy appearance because less microorganisms adherence on abutments surface. However, van Brakel et al9 made a microbiological analyses and found no difference in the primary colonization for both zirconia and titanium abutments. This fact can be explained by the similarity on the surface characteristics of these materials, suggesting a histological study in order to stand out subtle differences on the response of peri-implant soft tissue.

In 2011, Lewis et al15 studied through a systematic literature review the importance of the abutment’s material biocompatibility with the surrounding gingiva. These authors found evidences of better biological outcome when the peri-implant soft tissues are in contact with zirconia abutments, but they suggested that more longitudinal studies are necessary to affirm this conclusion. In order to
Table 1: Articles screened according to the search strategy

<table>
<thead>
<tr>
<th>Authors</th>
<th>Type of study</th>
<th>Scientific evidence degree</th>
<th>Purpose of study</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glauser et al, 2004</td>
<td>Prospective study 6</td>
<td>To analyze the presence of peri-implant soft tissue inflammation in esthetic areas with zirconia (Zr) abutments</td>
<td>No significant differences for the parameters analyzed</td>
<td></td>
</tr>
<tr>
<td>Doring et al, 2004</td>
<td>Retrospective study 6</td>
<td>To evaluate the clinical outcome of Ankylos system, up to 8 years of follow-up with titanium (Ti) or Zr abutments</td>
<td>Both abutments presented good clinical performance with no biological alterations</td>
<td></td>
</tr>
<tr>
<td>Tan et al, 2004</td>
<td>Case report 7</td>
<td>To evaluate the esthetic outcome with Ti and Zr abutments</td>
<td>Satisfactory esthetic outcome for both abutments</td>
<td></td>
</tr>
<tr>
<td>Sailer et al, 2007</td>
<td>Case report 7</td>
<td>To compare the esthetic outcome of Zr and Ti abutments</td>
<td>The authors recommend the use of Zr abutments for anterior zones</td>
<td></td>
</tr>
<tr>
<td>Waktin et al, 2008</td>
<td>Case report 7</td>
<td>To evaluate esthetic outcome of replacing Ti for Zr abutment</td>
<td>Improvement of gingival appearance</td>
<td></td>
</tr>
<tr>
<td>Linkevicius et al, 2008</td>
<td>Systematic review 1</td>
<td>To evaluate the soft tissue stability of ceramic abutments comparing with other metallic alloys</td>
<td>There is no evidence that proves the better response of Ti abutments compared with other materials</td>
<td></td>
</tr>
<tr>
<td>Sailer, 2009</td>
<td>Prospective study 6</td>
<td>To evaluate if Zr abutments have the same success rates than Ti abutments</td>
<td>There was no difference about the soft tissue response</td>
<td></td>
</tr>
<tr>
<td>Zembic, 2009</td>
<td>Prospective study 6</td>
<td>To evaluate if Zr abutments have the same biological response than Ti abutments</td>
<td>No difference was found between the types of components</td>
<td></td>
</tr>
<tr>
<td>Sailer et al, 2009</td>
<td>Systematic review 1</td>
<td>To verify the survival and complications of Zr and Ti abutments</td>
<td>There are no evidences to provide differences on technical and biological aspects</td>
<td></td>
</tr>
<tr>
<td>Nothdurft et al, 2010</td>
<td>Clinical study 7</td>
<td>To analyze if Zr abutments may be indicated to posterior zones</td>
<td>Peri-implant soft tissues had health appearance and free from inflammatory reaction</td>
<td></td>
</tr>
<tr>
<td>Van Brakel et al, 2010</td>
<td>In vivo study 7</td>
<td>To compare the microorganisms ingress and soft tissue health on Zr and Ti abutments</td>
<td>No alterations on the peri-implant soft tissue</td>
<td></td>
</tr>
<tr>
<td>Lewis and Klineberg, 2011</td>
<td>Literature review 7</td>
<td>To review the literature about cases with single crowns, considering the abutment type and the surrounding tissues</td>
<td>Zr, Ti and gold abutments had excellent biological response</td>
<td></td>
</tr>
<tr>
<td>Ekfeldt et al, 2011</td>
<td>Retrospective study 6</td>
<td>To evaluate the clinical outcomes of personalized Zr abutments</td>
<td>The abutments show good biological and functional response</td>
<td></td>
</tr>
<tr>
<td>Salihoglu et al, 2011</td>
<td>In vivo study 7</td>
<td>To compare the bacterial adherence on Zr and Ti abutments</td>
<td>No difference was found between the types of components</td>
<td></td>
</tr>
<tr>
<td>Van Brakel et al, 2012</td>
<td>In vivo study 7</td>
<td>To compare through histological data the health of the peri-implant soft tissues between Zr and Ti abutments</td>
<td>There is no difference on the biological response</td>
<td></td>
</tr>
<tr>
<td>Hosseini et al, 2012</td>
<td>Prospective study 6</td>
<td>To identify the outcome variables of all-ceramic and metal-ceramic implant-supported single crown</td>
<td>Greater recession of all-ceramic restorations</td>
<td></td>
</tr>
</tbody>
</table>

complement this study, Ekfeldt et al\textsuperscript{11} evaluated the plaque accumulation, probing pocket depths and bleeding on probing of zirconia abutments for 5 years, concluding that these abutments have an excellent response on the evaluated biological parameters.

For Salihoglu et al\textsuperscript{9}, the plaque accumulation on these components is directly linked with the success of implant treatment. This group of authors executed a microbiological analysis of the peri-implant soft tissues of ceramic and titanium abutments, finding that there was no difference in the microorganism colonization for both types of abutments.

In 2012, van Brakel et al\textsuperscript{16} made a histological study previously mentioned, with the purpose of assessing the inflammatory reaction of the soft tissues around zirconia and titanium abutments. In this study, there was no significant difference on qualitative histological features between the two types of abutments tested and both showed health gingival appearance. Similarly, Housseini et al\textsuperscript{7} did
Figs 1A to D: (A) and (B) show the reduced thickness of the gingival biotype; indicating the use of zirconia abutment. In order to avoid the gray aspect of the surrounding tissue, the use of titanium abutments in implant-supported single crowns is recommended just in areas with thicker gingival biotypes, as showed on (C) and (D).

Figs 2A to C: (A) and (B) the excellent esthetic outcome is observed. Along 3 years of follow-up (C), the peri-implant soft tissue presented no clinical alterations and the color, silhouette and natural aspect of the gingiva were preserved.

not find any mismatch on the soft tissues response around zirconia and titanium abutments of implant-supported single crowns. But, they observed significantly more complications in all-ceramic restorations than metaloceramic crowns, concerning marginal adaptation of abutment-crowns interface, what can promote greater bacterial adherence and consequently more tissues inflammation reactions.

Sailer et al\textsuperscript{12} published a systematic review presenting the same rates of biological complications for zirconia and titanium abutments, but the ceramic component showed twice the rate of gingival recession, being 8.9 and 3.8\%. 
respectively. These results can be attributed to the frequent use of ceramic abutments in the esthetic zone as well as the higher risk of recession of this area when compared with thicker gingival biotypes of posterior regions.

CONCLUSION

There is not a conscience in the literature about the response of peri-implant soft tissue in contact with zirconia abutments. However, in order to achieve greater esthetics outcomes, zirconia abutments are recommended for areas with thin soft tissues and in regions where the 3D placement of implants is more superficial.

CLINICAL SIGNIFICANCE

Zirconia abutments indicate to have a great response in terms of peri-implant soft tissue response. Also, these abutments have been established to be essential in order to achieve great esthetic results in cases of thin peri-implant soft tissues and in regions where the 3D placement of implants is more superficial.

REFERENCES


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