

Numerical Study of the Behavior of a Zirconia Dental Prosthesis with Prior Defect

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Abstract

The biomechanics field continues with its progress and will not cease to grow due to ongoing research in this area to find better solutions to problems. It is in this context that this work aims to simulate the mechanical behavior of a dental prosthesis made from zirconia. The proposal of zirconia as a material for dental prosthesis is the main aim of this paper. Indeed, Zirconia as a bioceramic material presents many advantages, and especially good biocompatibility and high resistance of wear. On the other hand the disadvantage of this material is its fragility i.e. it has weak strength against cracking. So, in this paper we considered a dental prosthesis assumed to be implanted to an adult person. In order to study the crack initiation we considered a defect in this prosthesis. Using the conditions of blocking and loading by Abaqus simulating tool, we obtained the results revealing the possibility of using zirconia as a material for dental prosthesis.

Keywords: dental, zirconia, simulation, masticator

1. Introduction

Dental prostheses according to their types can be made of one of the following materials:

- Acrylic resins which are thermoplastic polymers.
- Ceramics, including zirconia, alumina and porcelain, are used in the manufacture of adjoining dental prostheses, crowns and bridges.
- Metals often used for posterior teeth include precious metals (gold, silver, etc.) and non-precious metals (nickel, chromium, cobalt, etc.) (Aiche et al. 1984, LeJoyeux 1978)

The zirconia is known by a set of properties making it a candidate material to be used in the biological human environment. Some of the important properties are cited as the following:

- Compressive strength close to 6000 MPa
- Purity up to 95.6%