ORIGINAL ARTICLE

Comparative Evaluation of Compressive Strength of Two Nano-Hybird Composites

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Abstract

Aim: The aim of this study was to evaluate and compare compressive strength of two nano-hybird composites so that clinicians may choose the best product in affordable range.

Materials and Methods: Two nano-hybrid composites i.e., Tetaric N Ceram by Ivoclor Ivadent, AG, Liechtenstein and Nexcomp by Meta Biomed, Korea were used. The prepared samples were of cylindrical shape (4mm diameter and 6mm height) and compressive strength was evaluated according to ISO 4049-2009. Data was statistically analyzed using t-test.

Results: Tetaric N Ceram had more compressive strength as compared to Nexcomp and there was statistically significant difference between them.

Conclusion: Both the tested composites had compressive strength within acceptable range and clinicians may choose the material depending upon patient affordability and clinical situation.

Keywords: Compressive strength, Nano-Hybrid Composites, Dental Material

Introduction:

Strength has significant influence on the selection of dental materials for posterior restorations. Better compressive strength of a restorative material is necessary to assure longevity of the dental restoration.[1] The long term prognosis of restorative materials is important because these are under constant stress of mastication and therefore such stress can cause fracture and failure of restoration.[2] Consequently, this leads to problems of periodontium and/or extraction of fractured tooth.[3] Different types of restorative materials such as dental amalgam, glass ionomer cements, resin based composites, etc. were developed in an attempt to have better mechanical and biological properties for restoration of lost tooth structure. Dental amalgam has been used since last 15 decades for the restoration of posterior teeth but it has several drawbacks including mercury toxicity and poor aesthetics.[4] Likewise, glass ionomer cements also have major concerns such has poor abrasion resistance, high solubility and low compressive strength.[5]

Dental composite restorations have been in use due to their excellent aesthetics.[6] The dental composites are improving day by day due to their chemical constituents, adhesive nature, conservative tooth preparation and preservation of aesthetics.[7, 8] These are material of choice for restoration of anterior teeth, however, for posterior restoration they should possess mechanical properties similar to the tooth.[9] In posterior restoration, among mechanical properties compressive strength is of prime importance due to high masticatory load. Many companies are trying to enhance its properties and efficacy for posterior restorations by increasing the filler content with smaller size to increase the strength and abrasion resistance against forces of mastication.[10] The new dental composites have high filler content, wide applications, and superior properties.[11]

The capability of any restorative material to resist mastication stresses influences the durability of restoration. The compressive strength is considered as performance criteria since, most mastication stresses are presented as pressure force test to assess resistance of material against chewing forces.[12] The aim of this study was to compare compressive strength of two commonly available dental composites in the market of Pakistan. As a result, dentists can easily select best and economical composite materials because there is vast difference in the prices of both of them.

Methodology:

Two nano-hybrid composites i.e., Tetaric N Ceram by Ivoclor Ivadent, AG, Liechtenstein and Nexcomp by Meta Biomed, Korea were used. Ethical approval was taken prior conducting study from the ethical committee of KMU. The compressive strength was evaluated by using cylindrical shaped (6mm height and 4 mm diameter) specimens.[13] Teflon mould was used to make 5 samples of each group. Samples were poured

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carefully in mould after placing it on glass slab. The samples were poured in the mould in single increment and cellulose acetate strip was used to cover the samples to prevent formation of inhibition layer of oxygen. The samples were than cured from both sides by using Rainbow LED light. After curing samples were removed from the mould and were polished under continuous water flow. Compressive Strength was measured according to ISO 4049-49. Universal Testing Machine with crosshead speed of 0.5 mm.min-1 was used. The compressive strength (σc) was measured after recording the highest compressive load (P) withstand by each sample.[14]

Results:

Tertaric N Ceram had more mean compressive strength as compared to Nexcomp and there was statistically significant difference between both. The details of results are given in table1 as well as in figure 1.

Table 1: Mean Compressive Strength along with Standard Deviation of commercial composites

Commercial Composite	Compressive Strength (MPa)
Tetaric N Ceram	204 ± 9.31
Nexcomp	149 ± 10.11

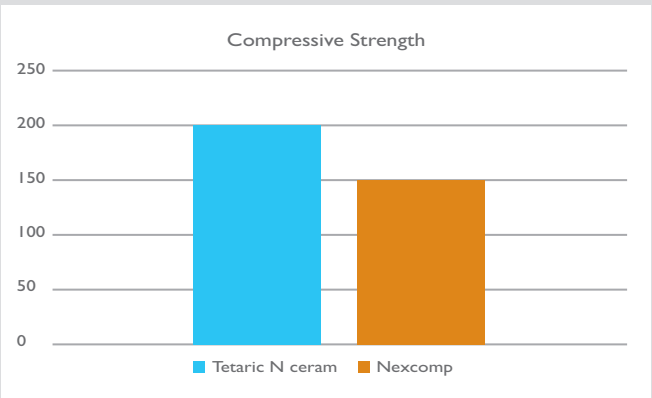

Figure 1: Mean Compressive Strength along with Standard Deviation of commercial composites

Discussion:

Evaluation of compressive strength is one of the important parameter to judge the mechanical properties of restorative resins. This evaluation is of significant importance for durability of restorative resins as most masticatory forces are compressive in nature.[15] Evolution in nanotechnology has highly affected the composition of restorative composite resins, as wide range of materials have been synthesized and introduced.[16] Nanocomposites were developed to integrate the benefits of both micro-filled and hybrid composites. These composites not only possess the better esthetics as needed for anterior restorations but also perform well in high masticatory load bearing posterior restorations.[17]

The maximum evaluated strength in posterior region is approximately 130 MPa.[18] In our study, both the composites had strength more than the evaluated strength needed for posterior region. There was significant difference between the evaluated compressive strength of both composites i.e. tetaric N ceram had more strength as compared to nexcomp. This may be due to the fact that tetaric N ceram has more filler load (80%) as compare to nexcomp (75%). Besides filler load, Tetaric N ceram has pre-polymerized fillers. The filler load and composition of fillers directly influence the mechanical properties of composite resins.

The results of nexcomp in our study were analogous to previous studies done by Shahawi and Elbatanony[19], Shahawi et. al[20] and Elbatanony et. al.[21] In case of tetaric N ceram, the results were not comparable to previous studies as Showkat et al[22] and Sadananda et al14 reported less strength and more strength as compared to our study respectively. This may be due to the fact that the results of mechanical properties are influenced by many factors such as sample preparation, intensity of curing light, distance between sample and curing light, load of the mechanical testing machine and materials from which moulds are made.[23]

In present study, the compressive strength was assessed according to the given acceptable method. The obtained results depict that both of these nano-hybrid composites can be used in anterior and posterior region. The clinical expected scenario may be different from reported results, as this test was done under ideal laboratory conditions.

Conclusion:

The tested composites had compressive strength within acceptable range, yet there was statistically significant difference between them. As there is wide difference between prices of both of these composites, so the dentists may choose the composite depending upon patient's affordability and need.

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Author Contributions

1. Nayab Amin – Conceptualization and critical analysis
2. Usama Siddiqui – Paper Writing and experimentation
3. Mohammad Saleem – Content Reviewing
4. Sarmad Fayaz – Statistical Analysis
5. Khumara Roghani – Proof Reading